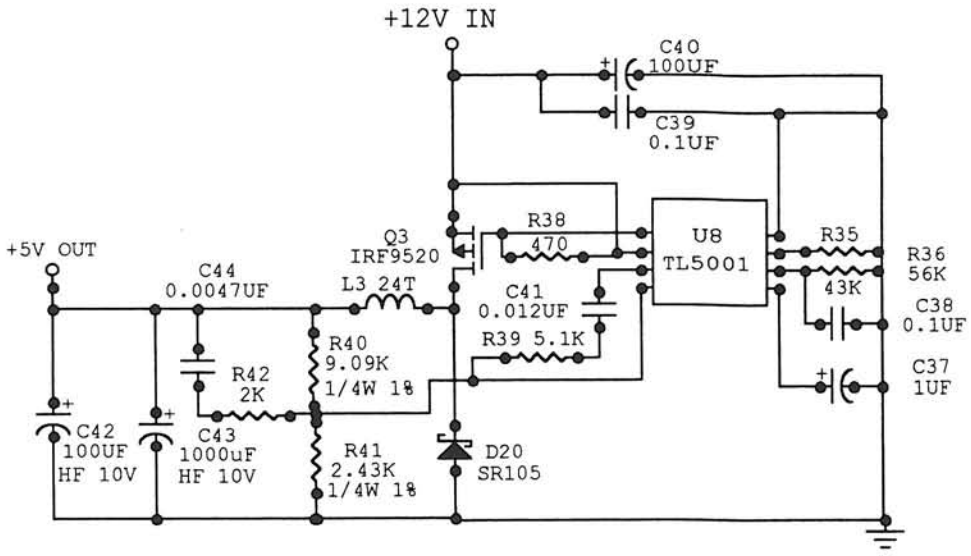
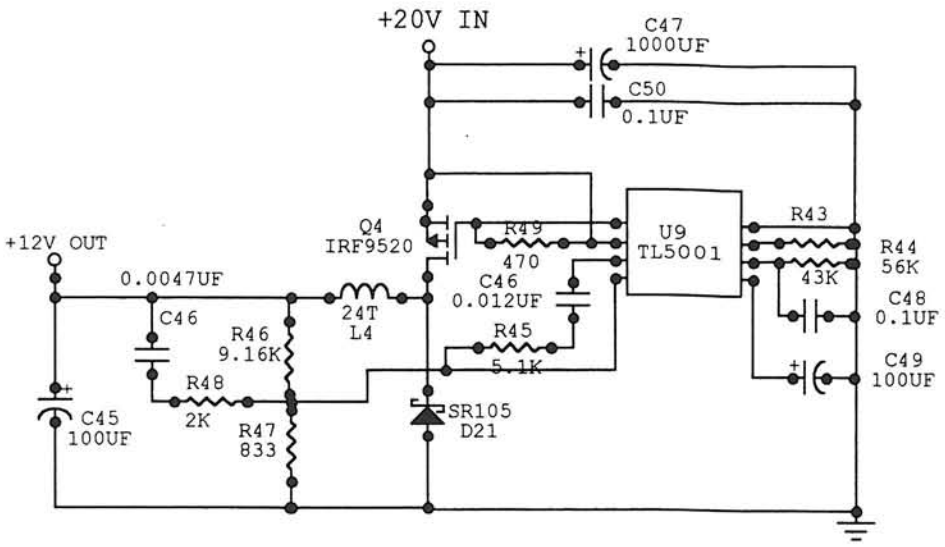
TR-6000 FIVE VOLT SWITCHING REGULATOR



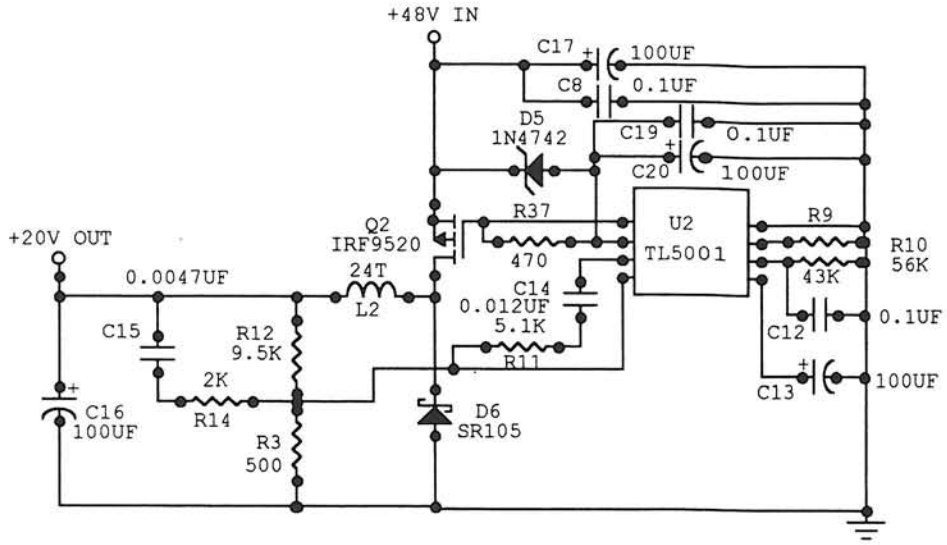
Pulse-width-modulation controller U8, switching transistor Q3, diode D20, inductor L3 and capacitor C43 comprise the main components of the regulator. The gate drive of Q3 is a square voltage pulse from U8, the width of which varies in relation to the feedback from the five volt output of the regulator. D20 is a schottky barrier rectifier diode which allows the continued flow of DC current during the interval when Q3 is off. When Q3 is on, D20 is biased off, and the current in L3 in excess of the load current charges C43. When Q3 switches off, D20 is biased on. The current in L3 starts to decrease, reversing the voltage across L3. C43 tends to maintain that voltage constant and the current in L3 decreases linearly until Q3 switches on again.

TR-6000 TWELVE VOLT SWITCHING REGULATOR



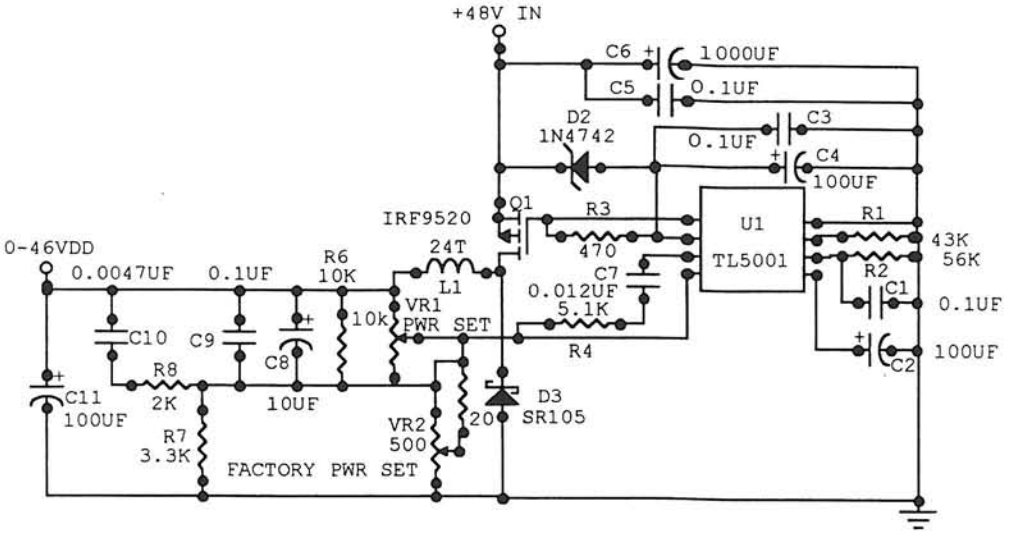
Pulse-width-modulation controller U9, switching transistor Q4, diode D21, inductor L4 and capacitor C45 comprise the main components of the regulator. The gate drive of Q4 is a square voltage pulse from U9, the width of which varies in relation to the feedback from the twelve volt output of the regulator. D21 is a schottky barrier rectifier diode which allows the continued flow of DC current during the interval when Q4 is off. When Q4 is on, D21 is biased off, and the current in L4 in excess of the load current charges C45. When Q4 switches off, D21 is biased on. The current in L4 starts to decrease, reversing the voltage across L4. C45 tends to maintain that voltage constant and the current in L4 decreases linearly until Q4 switches on again.

TR-6000 TWENTY VOLT SWITCHING REGULATOR



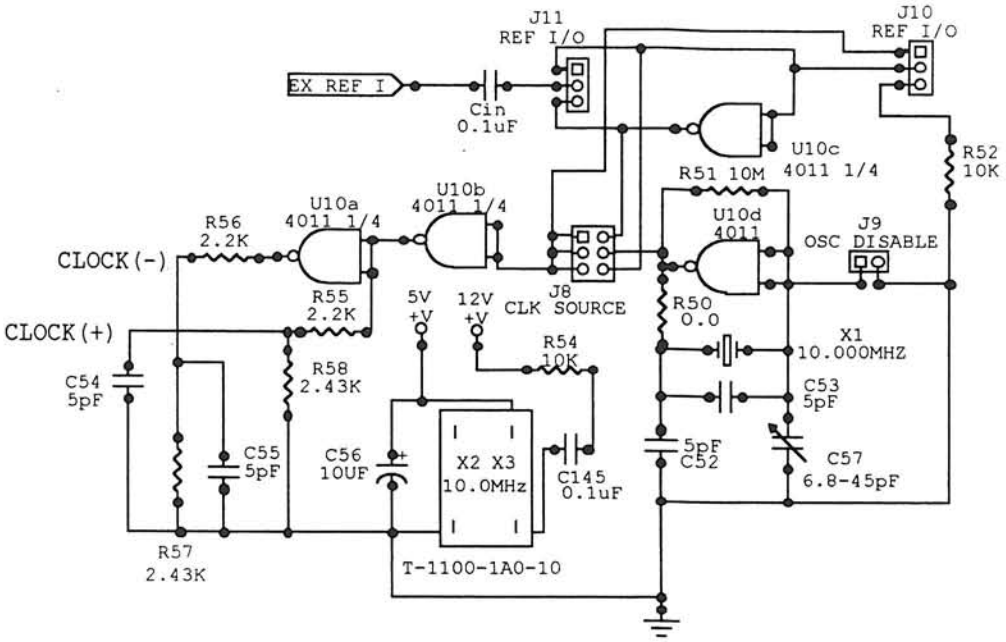
Pulse-width-modulation controller U2, switching transistor Q2, diode D6, inductor L2 and capacitor C16 comprise the main components of the regulator. The gate drive of Q2 is a square voltage pulse from U2, the width of which varies in relation to the feedback from the twenty volt output of the regulator. D6 is a schottky barrier rectifier diode which allows the continued flow of DC current during the interval when Q2 is off. When Q2 is on, D6 is biased off, and the current in L2 in excess of the load current charges C16. When Q2 switches off, D6 is biased on. The current in L2 starts to decrease, reversing the voltage across L2. C16 tends to maintain that voltage constant and the current in L2 decreases linearly until Q2 switches on again. Zener diode D5 is in series with the 48 volt input and drops twelve volts to reduce U2's VCC to 36 volts.

TR-6000 VARIABLE VOLTAGE SWITCHING REGULATOR



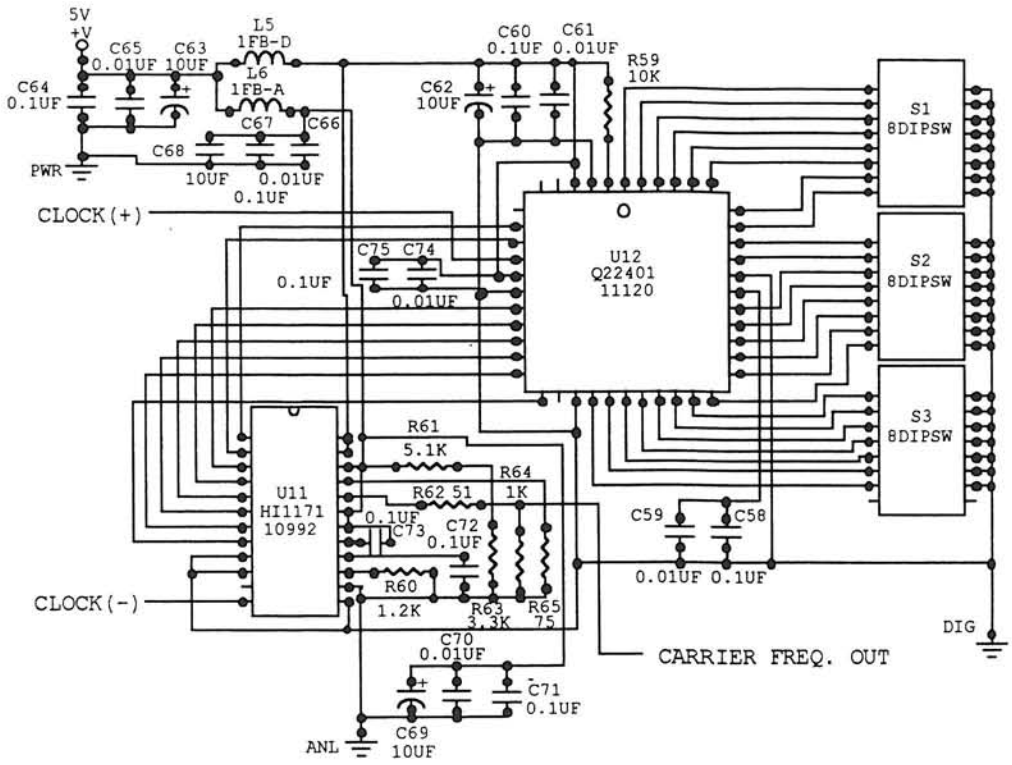
Pulse-width-modulation controller U1, switching transistor Q1, diode D3, inductor L1 and capacitor C11 comprise the main components of the regulator. The gate drive of Q1 is a square voltage pulse from U1, the width of which varies in relation to the adjustable feedback from the variable voltage output of the regulator. D3 is a schottky barrier rectifier diode which allows the continued flow of DC current during the interval when Q1 is off. When Q1 is on, D3 is biased off, and the current in L1 in excess of the load current charges C11. When Q1 switches off, D3 is biased on. The current in L1 starts to decrease, reversing the voltage across L1. C11 tends to maintain that voltage constant and the current in L1 decreases linearly until Q1 switches on again. Zener diode D2 is in series with the 48 volt input and drops twelve volts to reduce U1's VCC to 36 volts.

TR-6000 BI-PHASE REFERANCE OSCILLATOR CIRCUIT



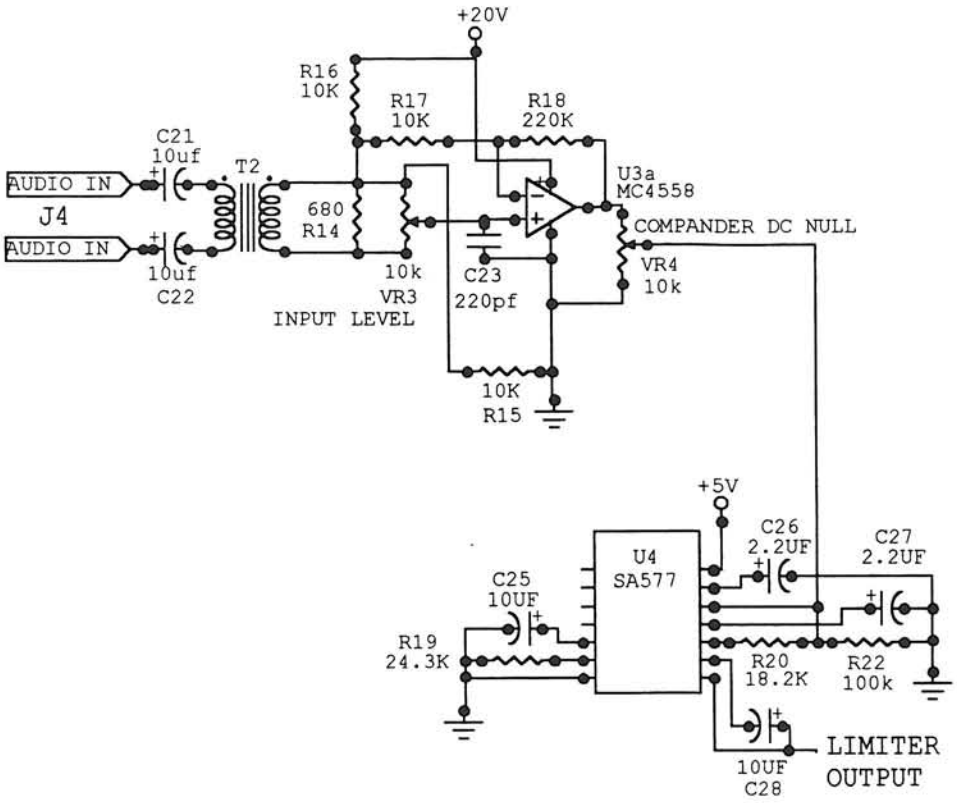
U10d and crystal X1 are configured as the standard inverter oscillator. The output is buffered and inverted by U10b producing the "Clock (+)" signal. Clock (+) is then inverted by U10a producing the "Clock (-)" signal. U10c is configured as an inverting buffer for X2 and X3 TCXO options and external GPS reference standards.

TR-6000 NUMERICALLY CONTROLLED OSCILLATOR CIRCUIT



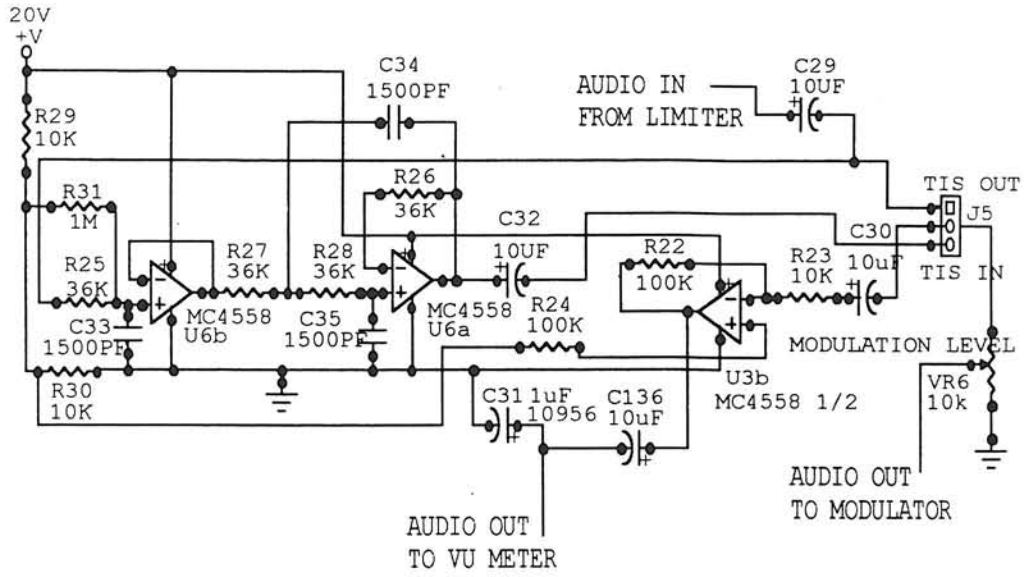
U12, a Q22401 direct digital synthesizer ASIC, along with U11, an eight bit D/A converter, generate the TR-6000 carrier frequency. DIP switches S1, S2 and S3 program the phase increment value for the desired carrier frequency. U12 generates the sine amplitude binary word output that is fed to U11's digital input. The sine amplitude value is converted into a sine waveform of the carrier frequency by U11.

TR-6000 AUDIO INPUT AMPLIFIER AND LIMITER CIRCUIT



U3a is configured as a transformer isolated non-inverting amplifier with a variable gain of zero to twenty two. The output of U3a feeds the input of U4, an SA577 unity gain level compandor. The compressor side of U4 is configured as a feed-forward hard limiter with a fast attack time (22mS) and slow release time(88mS). The expander side of U4 is not used in this circuit.

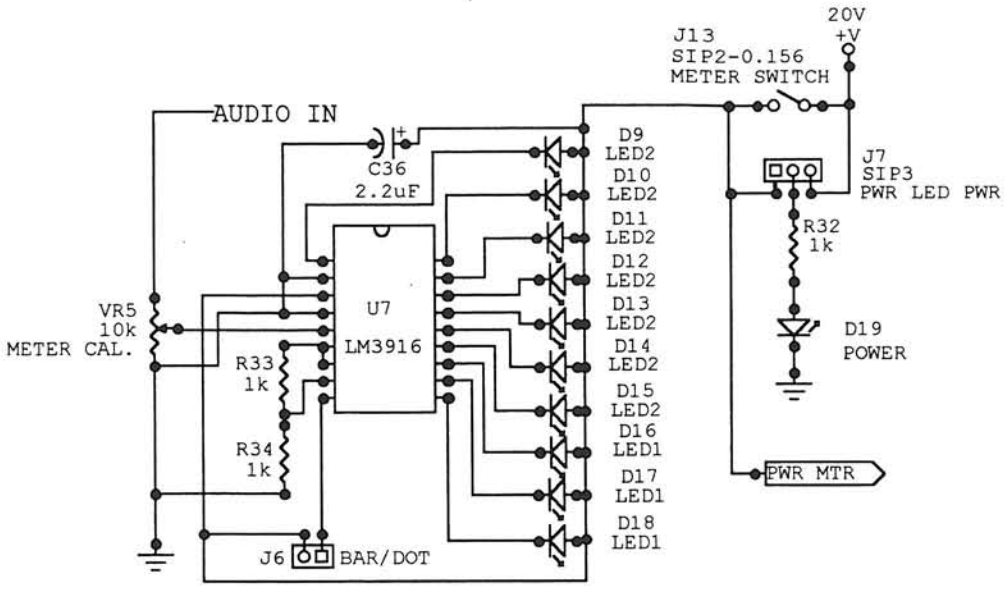
TR-6000 TIS AUDIO FILTER AND VU METER DRIVER CIRCUITS



U6 is configured as a third order voltage-controlled voltage source low-pass filter. Resistor R25 and capacitor C33 form the first pole with a cutoff frequency of 2947Hz. U6b provides unity gain. The second pole, resistor R27 and capacitor C34, and the third pole, resistor R28 and capacitor C35, along with U6a form a unity gain second order low-pass filter with a cutoff frequency also of 2947Hz. U6b and U6a are cascaded to provide the -60dB per Decade roll-off required by the FCC regulations.

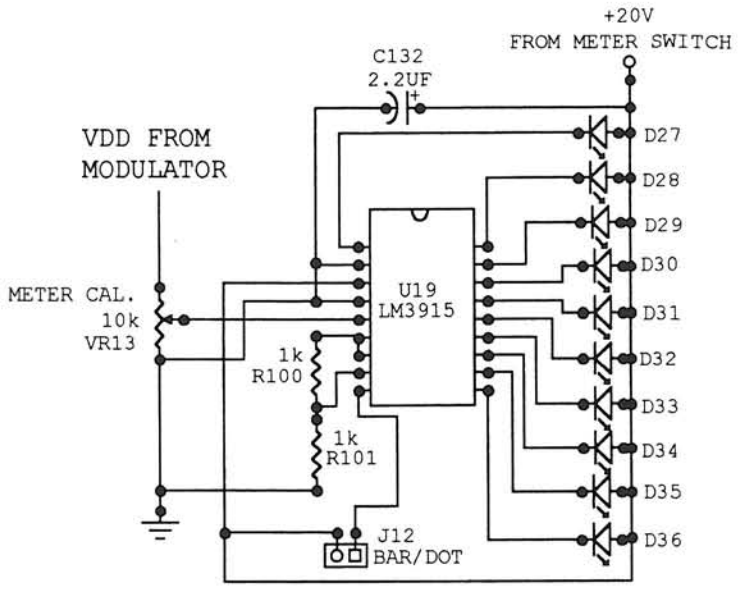
U3b is configured as a simple inverting amplifier with a gain of ten to provide isolation and adequate drive to the VU meter circuit.

TR-6000 AUDIO INPUT VU METER CIRCUIT



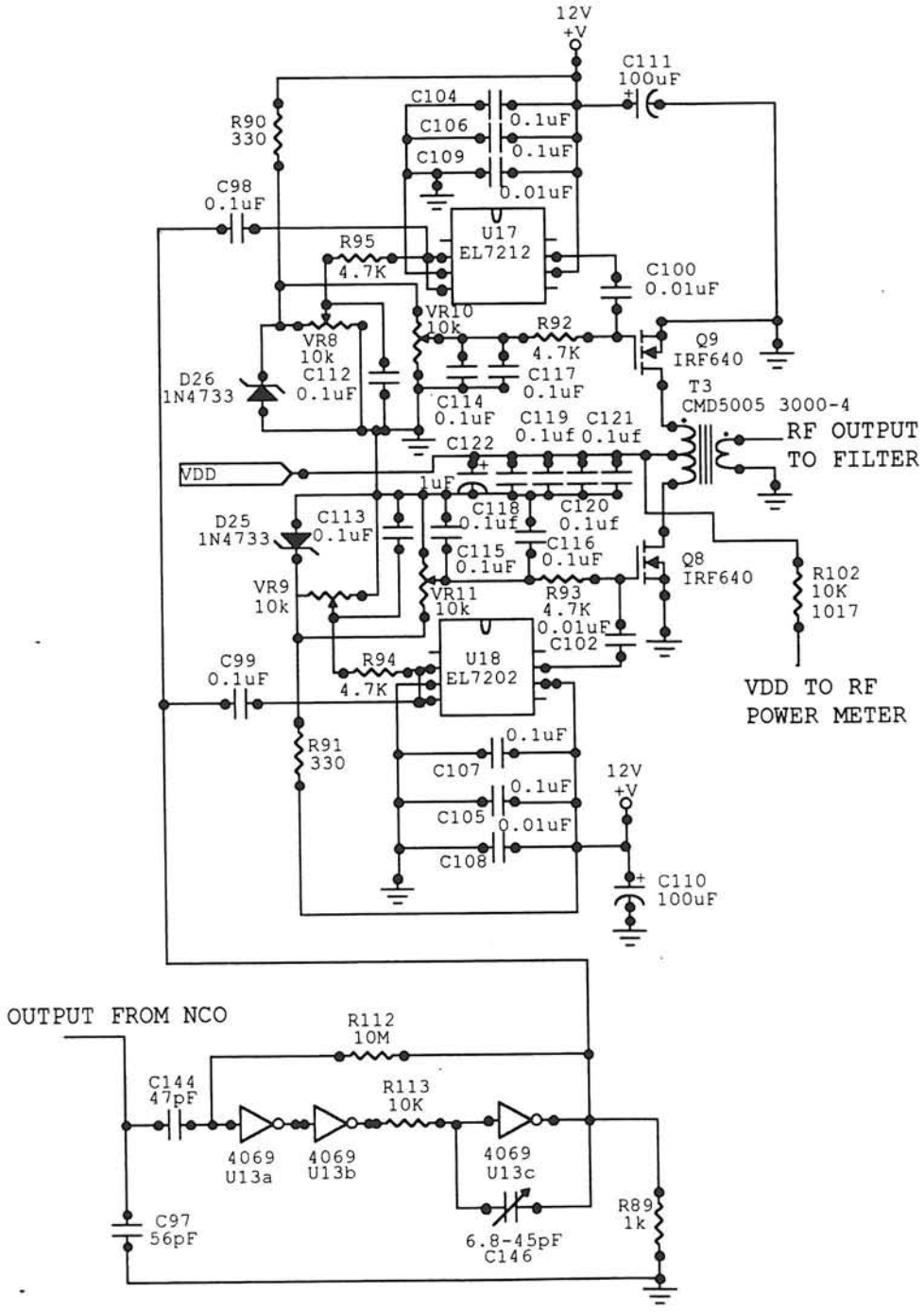
U7, an LM3916 VU responding dot/bar display driver, senses analog voltage levels present on pin five (modulation audio) and drives the ten LED's (D9 - D18) comprising the input audio VU meter display. Meter calibration is accomplished by potentiometer VR5, with LED D15 representing zero VU. LED D19 is the power present indicator.

TR-6000 RF OUTPUT POWER METER CIRCUIT



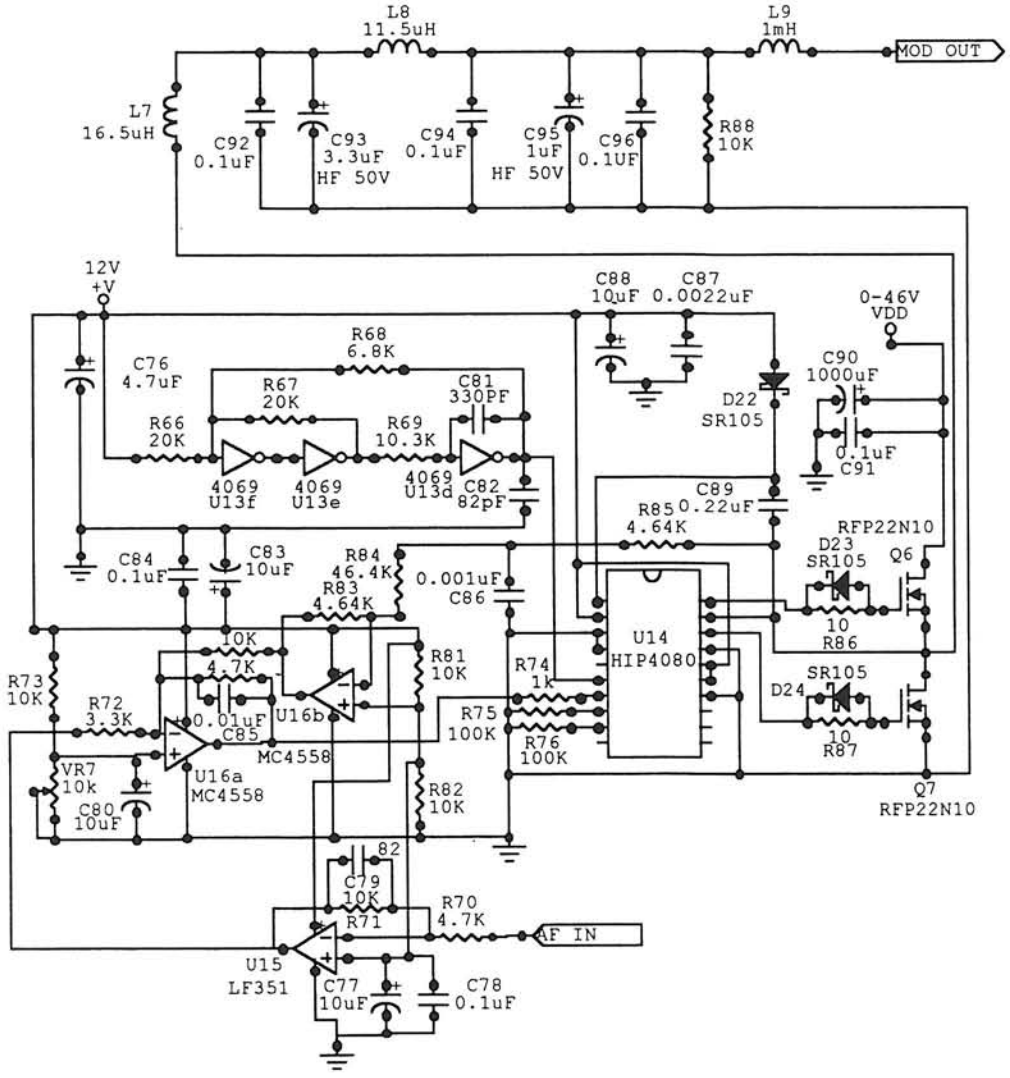
U19, an LM3915 logarithmic responding dot/bar display driver, senses analog voltage levels present on pin five (modulator VDD) and drives the ten LED's (D27 - D36) comprising the RF power output meter display. Meter calibration is accomplished by potentiometer VR13, with LED D34 representing 30 watts.

TR-6000 CLASS D RF POWER AMPLIFIER



The carrier frequency signal from the NCO D/A converter is amplified and converted into a triangle wave by U15a, U15b and U15c. This signal is fed to the matched driver IC's, U17 and U18. Zener diodes D25 and D26 are used as bias regulators for U17 and U18 (duty cycle adjustment) and for the final transistors Q8 and Q9 (forward bias). The gates of Q8 and Q9 are fed differentially from U17 and U18 respectively. The drains of Q8 and Q9 are connected to the primary of the output transformer T3 and are fed VDD through the center tap. The secondary side of T3 provides power to the output filter section.

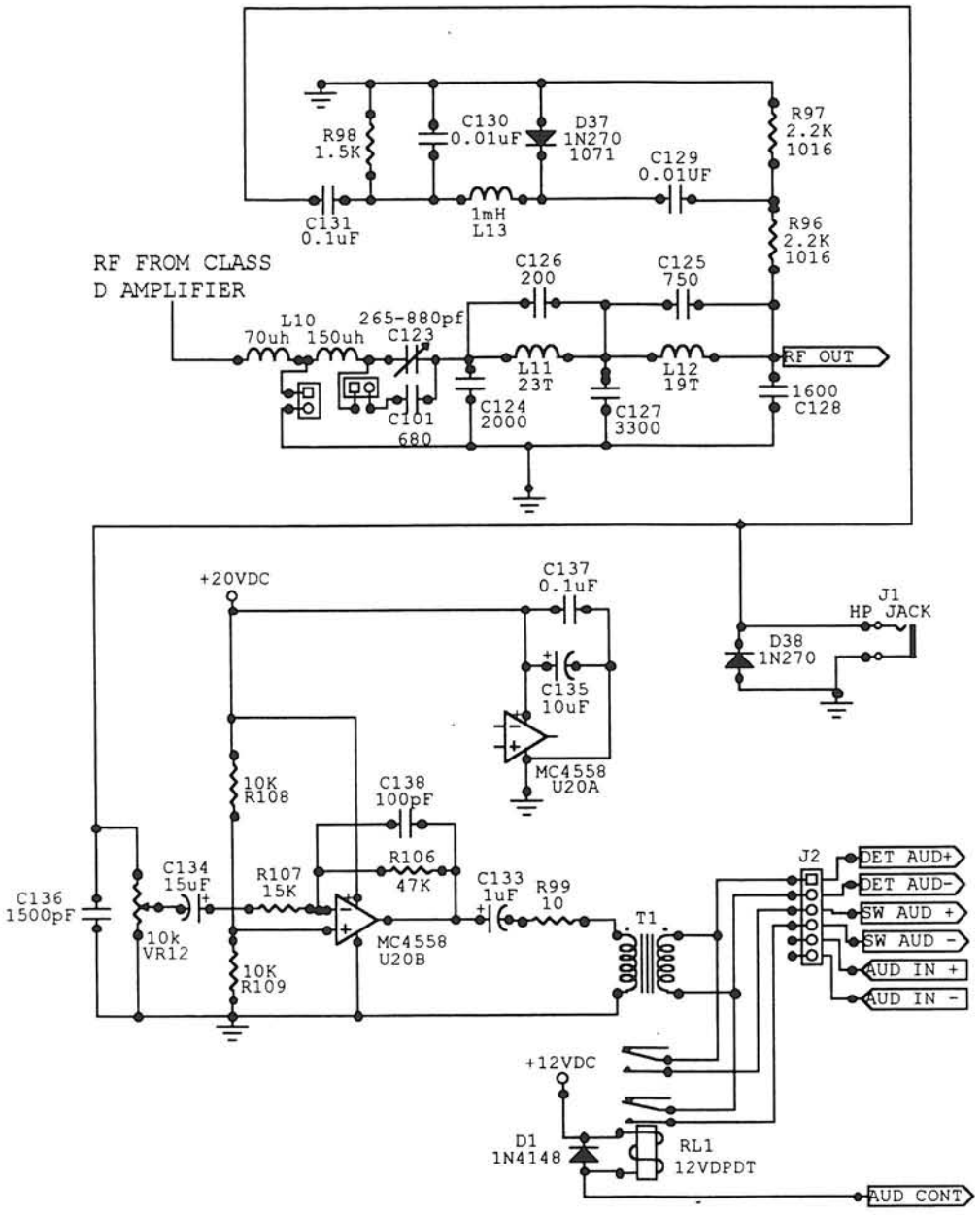
TR-6000 CLASS S AMPLITUDE MODULATOR CIRCUIT



U14, a Harris HIP4080A high frequency H bridge driver, along with transistors Q6 and Q7, operational amplifiers U15 and U16 and inverters U13d, U13e and U13f are the main components of the amplitude modulator. U13d, U13e and U13f are configured as a triangle wave generator for the U14 input comparator. U15 is configured as a simple inverting amplifier used to pre-amplify the audio input signal by a factor of 2.1. U16a and U16b comprise the feedback amplifier and input mixer. The feedback amplifier U16b has a gain of 0.1. The input audio and feedback signals are combined and fed to U14 by U16a. Only half of H bridge driver is utilized to drive the complementary voltage switching transistors Q6 and Q7. The output from Q6 and Q7 is then filtered by the low-pass filter formed by inductors L7 and L8 and capacitors C92, C93, C94, C95 and C96. Diode D22 and capacitor C89 form a bootstrap

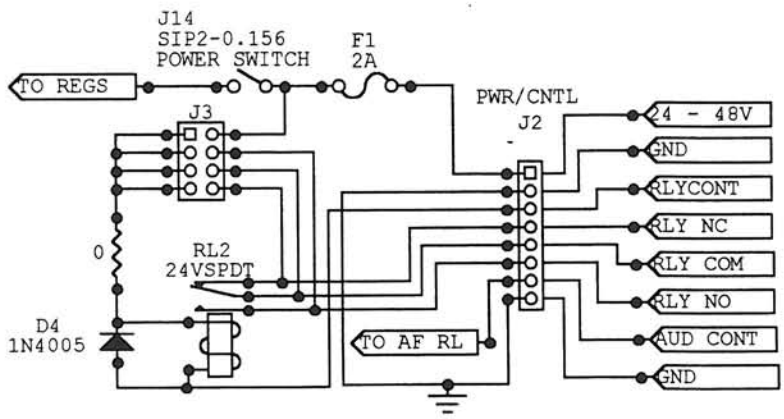
supply for the high side output gate drive. Diodes D23 and D24 shunt the gate resistors R86 and R87 respectively improving the switching performance of transistors Q6 and Q7.

TR-6000 RF OUTPUT FILTER AND DETECTOR CIRCUIT



The output of the class D RF power amplifier is fed to series tuned LC filter, comprised of inductor L10 and capacitors C123 and C101 and then to an elliptical low pass filter. The low pass filter consists of capacitors C124, C125, C126, C127 and C128 and inductors L11 and L12. Diodes D37 and D38 are envelope detectors for headphone and monitor audio. Operational amplifier U20b is configured as an inverting amplifier with an adjustable gain of zero to 3.1 to drive the monitor audio and switched monitor audio outputs. U20a is not used in this circuit. Diode D1 is the counter EMF diode for switched monitor audio relay RL1's coil.

TR-6000 POWER CONTROL RELAY



Relay RL2 is used for remote control of the transmitter input power supply. Header J3 allows the relay to be configured with jumpers so the relay coil can be energized by the main power input or any of the relay contacts. Diode D4 is the coil counter EMF diode.