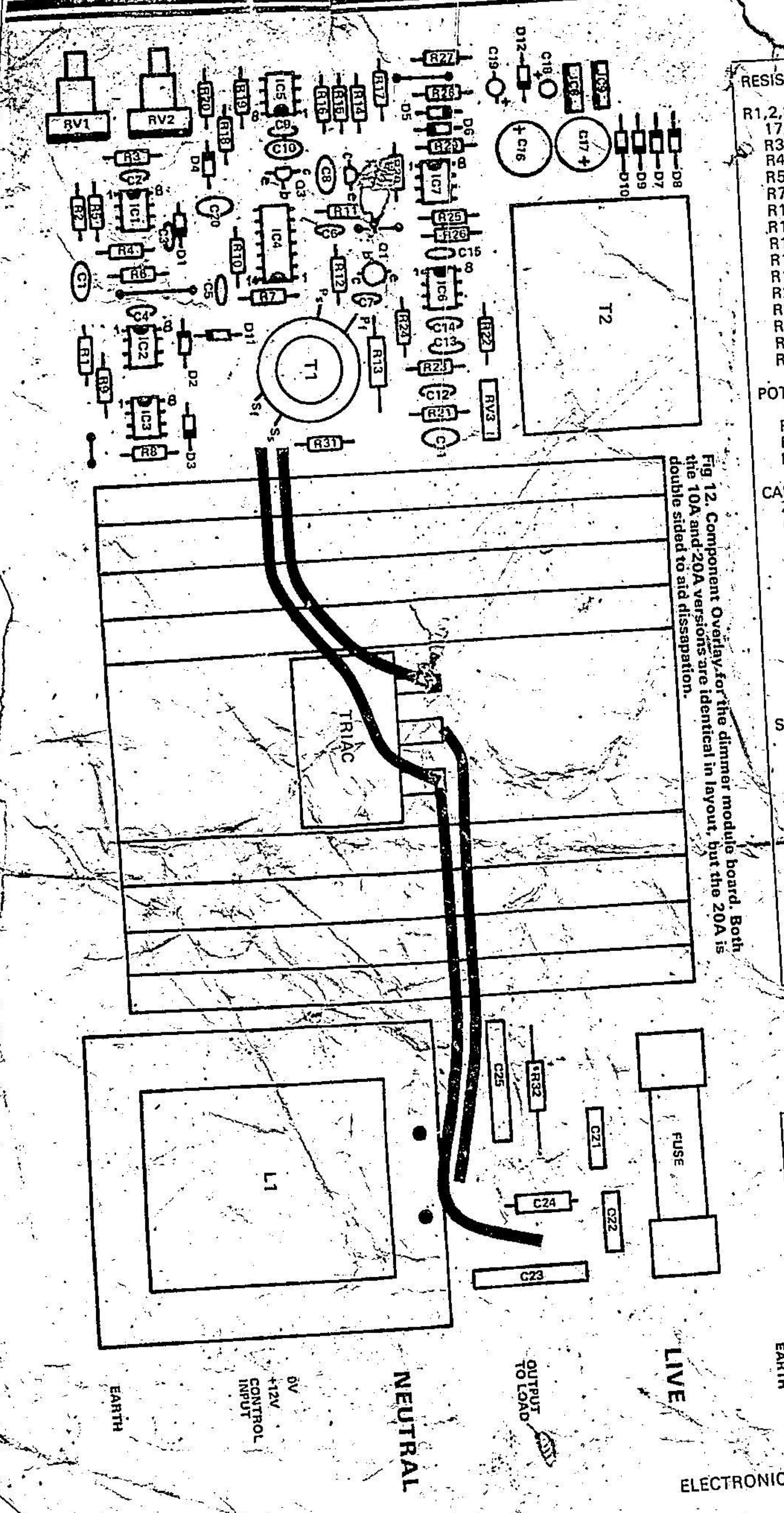



Fig 12. Component Overlay for the dimmer module board. Both the 10A and 20A versions are identical in layout, but the 20A is double sided to aid dissapation.

## TS LIST

RESISTORS all ¼W 5%

| | |
|---|---|
| R1,2,8,14,15, 17,19, 20,23-26, | 100k |
| R3,27,30 | 4M7 |
| R4 | 22k |
| R5,6 | 47k |
| R7,9,10 | 10k |
| R11 | 2k2 |
| R12 | 1k |
| R13 | 470R 1W |
| R16 | 2M2 |
| R18 | 15k |
| R21 | 4k7 |
| R22 | 220k |
| R28,29 | 3k3 |
| R31 | 10R |
| R32 | 47R 1W |

POTENTIOMETERS

| | |
|---|---|
| RV1 | 1M linear |
| RV2 | 100k linear |
| RV3 | 25k trimmer |

CAPACITORS

| | |
|---|---|
| C1,8,10,11,20 | 100n polyester |
| C2,4,9,15 | 33p ceramic |
| C3,7 | 10n polyester |
| C5 | 330p ceramic |
| C6 | 100p ceramic |
| C12,13 | 22n polyester |
| C14 | 33n polyester |
| C16,17 | 220u 25V |
| C18,19 | 10u 25V |
| C21,22,24 | 1n polyester |
| C23,25 | 33n 250V AC |

SEMICONDUCTORS

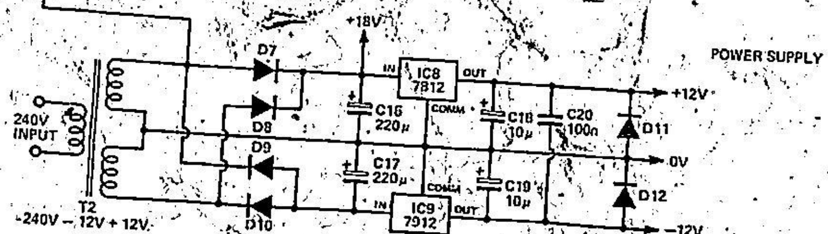
| | |
|---|---|
| IC1-3,5,6,7 | LM 301A |
| IC4 | 4011B |
| IC8 | 7812 |
| IC9 | 7912 |
| Q1 | 2N3643 |
| Q2,3 | BC 559 |
| TRIAC | BTW41/400 |
| D1-D6,11,12 | 1N 914 |
| D7-D10 | 1N 4001 |

MISCELLANEOUS

TI see text, T2 24V, 5VA, heatsink and choke and fuse 10A or 20A to suit, fuse holders.

## TABLE ONE

The pulse transformer T1 is the most difficult component in the project to find or produce. Tandy market a 4:1 device and this must be first choice. If this, and all other, commercial units prove elusive — try winding it yourself onto an ferrite ring of about 2in outside diameter, using 50 turns and 12 turns for the windings to obtain the required ratio. Some experimentation may be needed here in order to get the triac to fire properly, and we do not recommend you try this unless you have wound coils previously.



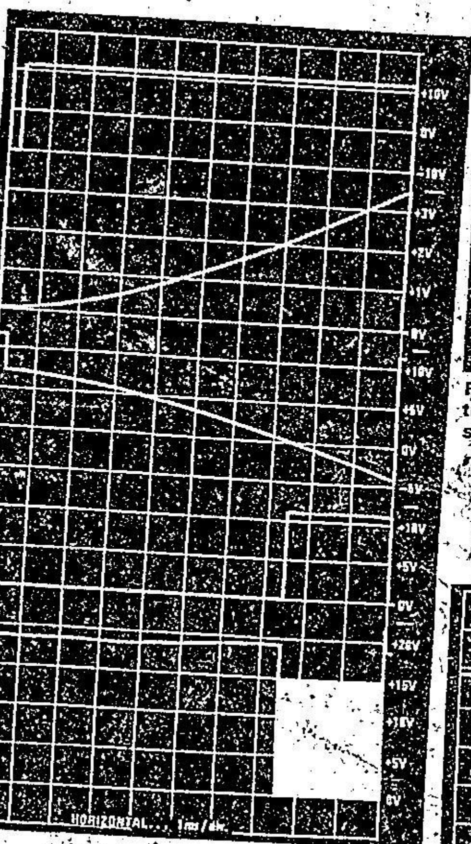



Fig 9. Waveforms shown are: Sync pulse (output IC7), curve generator (output IC5), mixer output (output IC2), oscillator output (IC4), transformer drive (Q1).

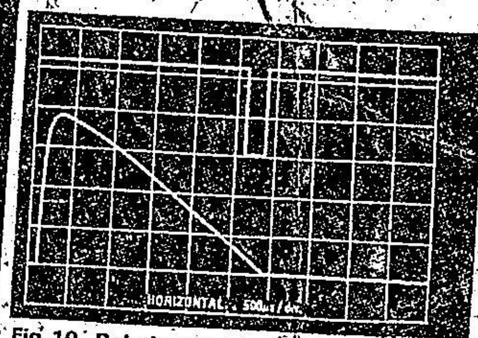


Fig 10. Relationship between the end of half cycle and the sync pulse.

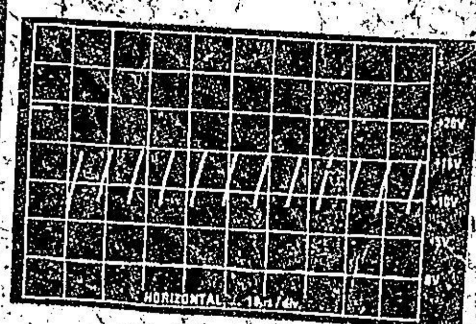


Fig 11. An expanded view of the drive waveform showing Q1 collector voltage.

# HOW IT WORKS ~DIMMER MODULE

To help explain the operation the circuit can be broken into seven sections.

**1. Power supply**
This is a simple full wave rectifier which gives about ± 18 V after being filtered by C16 and C17. Using 3 terminal regulators this is reduced to ± 12 volts which is needed for the circuitry.

**2. Control tone filter and sync generator**
As the name implies this removes the control tones that the supply authority superimposes on the mains voltage. These are normally about 1050 Hz and can cause problems by upsetting synchronization of dimmers. The filter is a low pass type comprising IC6 and associated components. As filters always alter the phase relationship this is corrected using phase shift networks C11/R21 and C12/R22. Potentiometer RV3 is used to ensure the phase shift is zero (at 50 Hz) with normal component variations. If the output of IC6 is between +0.6 volts and −0.6 volts, neither D5 nor D6 will be forward biased sufficiently to change the input voltages to IC7 so its output will be −10 volts. As the output voltage of IC6 is a 'clean' 50 Hz sine wave of about 6 volts amplitude this will only occur at a small region about the zero crossing point. At all other times the output of IC7 will be + 10 volts. The result is a negative pulse about 250 μs wide at the zero crossing point of the 50 Hz.

**3. Curve generator**
This produces the output shown in Fig. 6. When the sync pulse occurs, transistors Q2 and Q3 discharge capacitors C8 and C10. Immediately on release of the sync pulse the output of IC5 begins to ramp up slowly due to R16 charging C10. However, while initially the voltage across R14 is zero and therefore does not affect the charging of C10, as C8 begins to charge due to R15 its effect becomes more and more dramatic. A curve is necessary as it gives a better input/output voltage relationship but the curve must be reproduceable hence the circuit used.

**4. [illegible]t buffer**
T[illegible]es two purposes; firstly, it allows a megohm input impedance and secondly it detects when the input voltage falls below 0.1 volt and turns the dimmer output complet[illegible] off. This allows the minimum light cont[illegible] be turned up to give a better control [illegible] with the filaments just glowing, y[illegible] them off if the control voltage is re[illegible] zero.

If the voltage is above 0.1 volt, th[illegible] will lift the voltage on pins of IC1 [illegible] that of the input on pin 3. However [illegible] voltage falls below this level, the voltage [illegible] pin 2 will remain at about 0.1 volt due to R[illegible] and the output of IC1 will go to about −10 volts.

**5. Mixer-comparator**
IC2 mixes the input voltage, the output of the curve generator the sync pulse and the minimum adjustment potentiometers. This gives the waveform shown in Fig. 2 with the input voltage and the minimum adjustment only moving the curve up and down without altering the shape. When the output of IC2 falls below zero volts the output of IC3 goes from −10 V to +10 volt with D3 and R8/9 providing about 1 volt of positive feedback. The voltage has to rise to above 1 V to force the output back to −10 volts. The diode is necessary to ensure that the voltage at the input of the oscillator IC4 remains within the supply voltage of the IC (+12 V, 0 V).

**6. Oscillator/triac drive**
A CMOS oscil[illegible] IC4 is used to drive Q1 which supplies the energy for the pulse transformer T1. The oscillator will only operate when the control inputs (pins 1 a[illegible] 13) are +10 V. The frequency is controlled by C5 and is set at about 150 kHz. Resistor R13 provides current limiting for the pulse transformer while R12 prevents the reverse voltage damaging Q1 if the load on the secondary load (the triac) becomes disconnected.

**7. Power stage**
This is simply a triac with a choke in series to prevent both RFI and 'filament rattle' and a fuse to protect against short circuits. Capacitors are also used as bypasses to help prevent RFI.