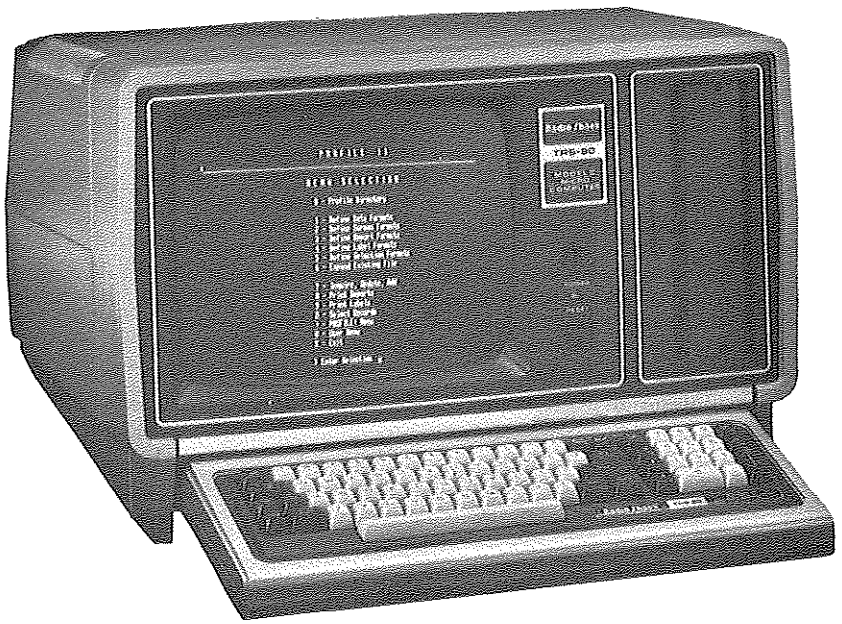
Radio Shack®

Service Manual

TRS-80®

Model II Video Shrink Kit



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TRS-80®Video Shrink Kit

Service Manual

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Contents

Introduction

The Video Shrink Board is designed to prevent momentary video screen shrinkage caused by voltage fluctuations resulting from system component actuation. It is supplied in kit form for easy installation into existing TRS-80 Model II Microcomputer systems.

The board is installed in series with the power supply leads to the video circuit, utilizing an existing in-line connector to provide connection points for the board.

1/ Installation

Installation of this board involves some disassembly and reassembly of components mounted on the Power Supply assembly. Access to the Power Supply assembly is achieved by removing the top cover of the TRS-80 Model II. See the disassembly instructions contained in Section II of the Model II Technical Reference Manual. (Radio Shack Catalog Number 26-4921).

Contained in the installation kit are all the required parts noted below:

- Printed circuit board
- Mounting straps (2)
- Screws, washers and nuts (2 each) for mounting Straps to Model II
- Screws and nuts (2 each) for mounting Video Shrink Board to Straps

Existing screws, which mount the Power Supply board to the support bracket, must be removed (see Figure 1). These screws are attached to the power supply support bracket through threaded spacers. The screws which are to be replaced are noted in Figure 1. The new screws are metric screws 16 mm long. Screw length is critical! The screw installed toward the front of the Model II will interfere with an existing circuit board if too long a screw is used. Be sure the screws are installed as shown.

Follow this procedure to install the board:

1. Remove from the Power Supply board (see Figure 1) the two screws which are to be replaced.
2. Replace screws removed in Step 1 with the metric screws contained in the kit.

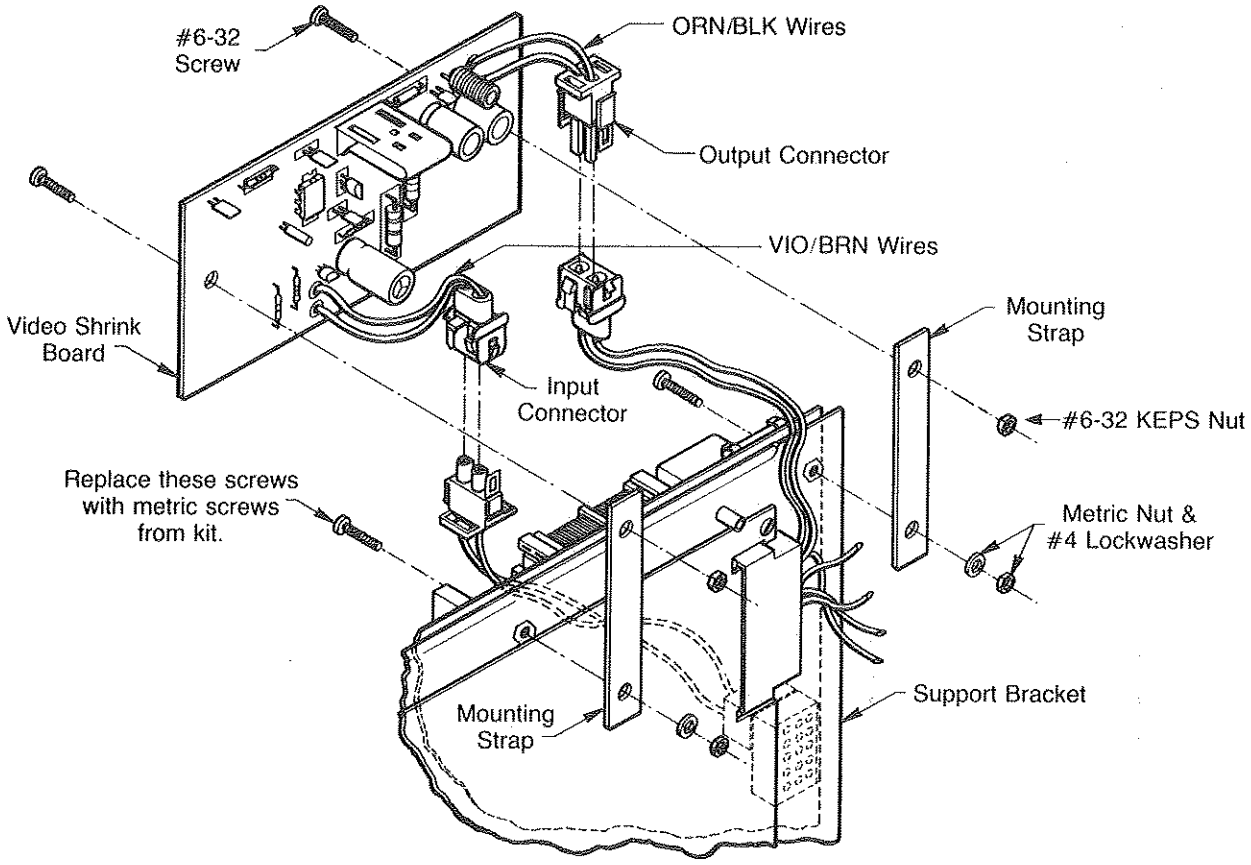


Figure 1. Installing the Video Shrink Board

3. Install a metric screw into the spacer toward the front of the Model II. As the screw emerges from the spacer, install first the strap, then a lockwasher and nut onto the screw. If this is not done, you may not be able to start the nut on after the screw is threaded completely into the spacer. Make sure screw is tightly threaded into the spacer.

4. Install the other screw into the rear spacer. Install the other mounting strap on the screw. Secure the strap with a lockwasher and nut.

5. Install the Video Shrink Board with the component side to the right side of the Model II as shown in Figure 1, using #6-32 screws and nuts.

6. Tighten the nuts mounting the two straps, using a pair of long nose pliers.

7. Disconnect the output line connector from the Power Supply board (orange and black wires) and reconnect it to the input connector of the Video Shrink board. This is the connector toward the front of the Model II.

8. Connect the other half of the connector noted in Step 7 (connector with violet and brown wires) to the output of the Video Shrink board (connector which exits the Video Shrink board toward rear of Model II).

9. Adjust the voltage output of the board (see Section 3 - Troubleshooting.

10. Reinstall the Model II cover.

2/ Theory of Operation

The circuitry contained on the Video Shrink board uses an NE5561 Switched Mode Power Supply Controller IC in a non-isolated boost converter operating from the 12 VDC CRT power line. The circuit is designed to actually produce a voltage equal to or slightly greater than its input voltage. The circuit can actually regulate its output voltage to less than the input voltage due to voltage drops in the inductor L1 and diode CR1. Normally, the output voltage should be set to 12.2 VDC or just slightly higher than the input voltage but not any higher than 12.6 VDC.

The operation of the Video Shrink board is as follows. Q3 is used as a combination slow start and duty cycle limit transistor. When the power is first applied to the circuit, C3 is in a discharged state and begins to charge up toward the divider voltage of 1.68 VDC set by R6 and R9 and the IC reference voltage of 8.2 VDC at Pin 2 of U1. The transistor Q3 will then clamp the Error Amp Output on Pin 4 of U1 to a voltage approximately .6 volt higher than the divider voltage. This voltage at Pin 4 of U1 controls the duty cycle, letting it gradually approach its normal operating range.

Output regulation starts at the error amplifier with the gain set by the following components: R1, C2, C1, R13, R11, and R12. The resistors R11-13 set up a voltage divider that will compare the output voltage to the U1's internal 3.76 VDC reference. The resistor R1 and capacitors C1 and C2 will allow maximum gain at DC and reduce the gain at higher frequencies to insure stability.

The output to Q2 base is a square wave of variable duty cycle as determined by load demand. The internal transistor is open collector and is pulled up by R4. Whenever the internal transistor is turned on, it shunts the base current away from Q2 and turns Q2 off. Conversely, when the internal transistor is off, R4 then biases Q2 on. The duty cycle is set by comparing the output of the error amplifier Pin 4 of U1 to a sawtooth waveform at Pin 5 of U1. The sawtooth waveform is generated by the charging up of capacitor C6, using R3 as the charging resistor. R3 is in turn connected to the regulated 8.2 VDC available at Pin 2 of U1. Figure 2 shows the effect of the error voltage on the output duty cycle.

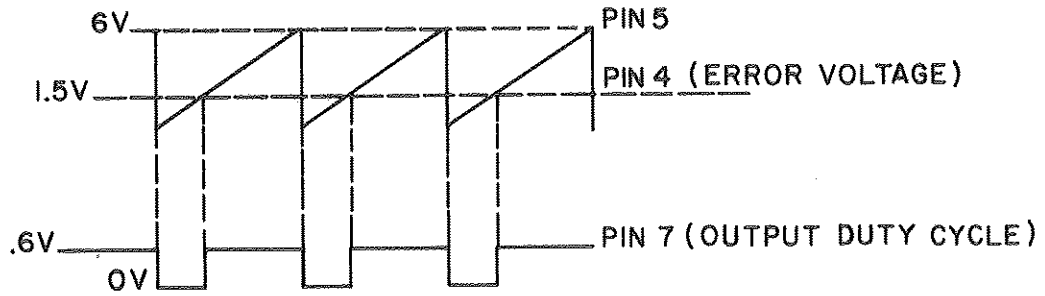


Figure 2. Error Voltage Waveform

Q1 will be turned on whenever the output of Pin 7 of U1 is low, due to the inverting action of transistor Q2. Whenever Pin 7 is high, the collector of Q2 is low, which shunts the base current away from Q1 and turns Q1 off. The sawtooth waveform should be approximately 32 kHz.

Pin 6 of U1 operated an overcurrent protection feature that will reset the output on Pin 7 if the instantaneous voltage on Pin 6 exceeds the internal reference voltage of .48V. R10 then will determine the peak current, with R7 and C7 providing some filtering of the switching transients which will also appear across R10. The overcurrent protect circuit operates on a pulse to pulse basis, returning to normal as soon as the voltage at Pin 6 falls below .48V.

The switching operation is as follows: Q1 turns on, causing magnetizing current to begin increasing in L2, the switching inductor. After initial startup, C8 becomes charged to the output and, with Q1 on, diode CR1 is reverse biased and does not conduct during the ON time of Q1. Thus the output capacitor C8 sustains the load current during this portion of the switching cycle. When Q1 turns OFF, the magnetic field energy previously stored in L2 is discharged through CR1 which is now forward biased. The output capacitor C8 is incrementally charged, restoring its depleted voltage. The inductor during this time has one end clamped to the input voltage and therefore increases the output voltage by charging up C8. The amount of time that Q1 is turned on determines the amount of energy stored in L2 which, in turn, determines the output voltage at C8. Inductor L1 and capacitor C9 form a low pass filter which eliminates most of the transients from the output. Resistor R2 and capacitor C4 form a snubber network across the Schottky rectifier CR1.

3/ Troubleshooting

If for some reason the power supply fails, the most obvious symptom will be that the CRT will still shrink and that the output voltage will be .4 to .6 VDC lower than the input voltage. If you think that the IC U1 has failed, check for the following signal levels. If any of these levels are not correct, replace the IC.

1. Pin 2: 8.2 VDC
2. Pin 5: triangular waveform (see Figure 2)
3. Pin 7: negative output pulse of low duty cycle varying from .6 VDC down to approximately 0.0 VDC.

1. Symptom: The CRT still shrinks whenever the Disk Drives are activated.

   Remedy: The output voltage is set to less than the input voltage -- readjust R12.

   Remedy: The power supply is not working -- check Q1, CR1, and U1.

2. Symptom: The output voltage is about .4 to .6 VDC less than the input voltage and R12 has no effect.

   Remedy: The power supply is not working -- check Q1, CR1, and U1.

There is only one adjustment on this board, the trimmer resistor R12. This resistor adjusts the switcher output voltage to the desired voltage. To set R12, first measure the input voltage as follows:

1. Place the positive meter probe at R4.
2. Place the negative meter probe at GND.
3. Record the measurement.

Next, check the output voltage. As long as the output voltage is greater than the input voltage, the power supply is functioning normally. The output voltage should be set

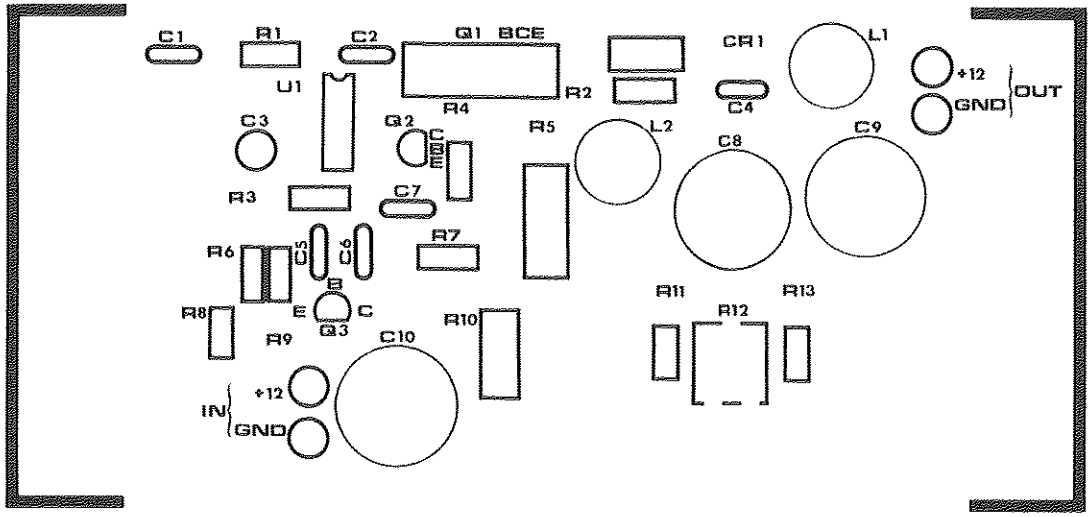
at the factory at 12.2 VDC. However, if the input voltage is higher than 12.2 VDC, it will be necessary to readjust the power supply for a slightly higher voltage. At no time should the output voltage be adjusted to more than 12.6 VDC. The output voltage can be measured as follows:

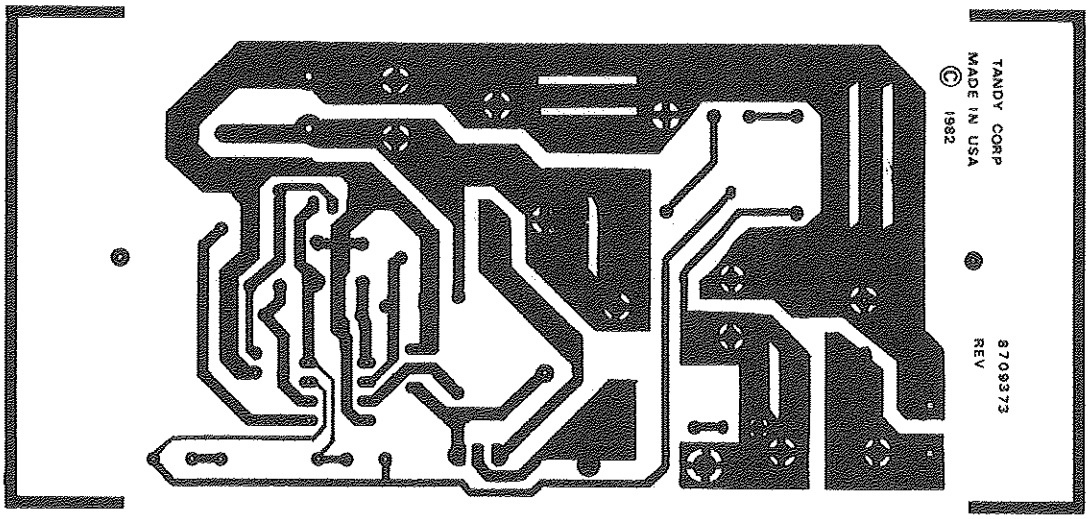
1. Move the positive lead to C9 +.

2. Leave the negative meter lead at GND.

3. Adjust R12 for 12.2 VDC or just slightly higher than the input voltage, but less than 12.6 VDC.

4/ Printed Circuit Board





5/ Parts List

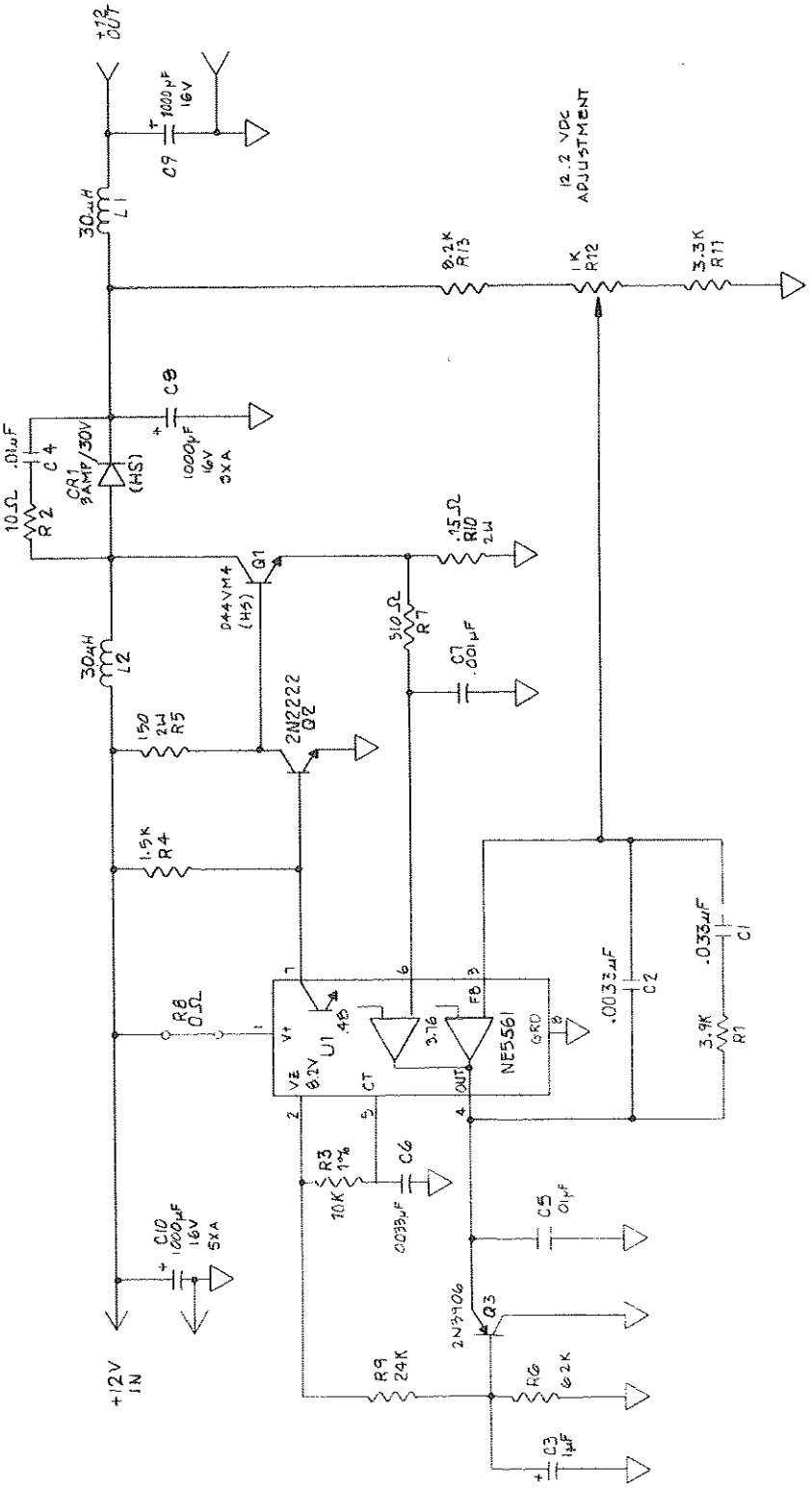
Qty	Sym	Description	Part No.
1		PCB, Single-sided	8709373
1	R1	Res, 3.9k ohm, 1/4W, 5%, CF	8207239
1	R2	Res, 10 ohm, 1/4W, 5%, CF	8207010
1	R3	Res, 10k ohm, RN55D, 1%, MF	8200310
1	R4	Res, 1.5k ohm, 1/4W, 5%, CF	8207215
1	R5	Res, 150 ohm, 2W, 10%, WW or MO	8247115
1	R6	Res, 6.2k ohm, 1/4W, 5%, CF	8207262
1	R7	Res, 510 ohm, 1/4W, 5%, CF	8207151
1	R8	Res, Zero Ohm Jumper	8290000
1	R9	Res, 24k ohm, 1/4W, 5%, CF	8207324
1	R10	Res, 0.15 ohm, 1 or 2W, 5%, WW	8247001
1	R11	Res, 3.3k ohm, 1/4W, 5%, CF	8207233
1	R12	Potentiometer, 1k ohm, 20%, Cond Plas	8279211
1	R13	Res, 8.2k ohm, 1/4W, 5%, CF	8207282
1	C1	Cap, .033 uf, 63V, Stkd Flm M Poly	8393334
2	C2,6	Cap, .0033 uf, 63V, Stkd Flm M Poly	8392334
1	C3	Cap, 1 uf, 35V, 20%, ER	8325014
2	C4,5	Cap, .01 uf, 63V, Stkd Flm M Poly	8393103
1	C7	Cap, .001 uf, 63V, Stkd Flm M Poly	8392103
3	C8-10	Cap, 1000 uf, 16V, 105C, 20%, Low ESR	8325104
1	Q1	Transistor, D44VM4 NPN 8A, 40V, 40W BCE	8110044
1	Q2	Transistor, (2N)2222 NPN EBC	8110222
1	Q3	Transistor, (2N)3906 PNP EBC	8100906
1	CR1	Diode, 30PIV, Schottky 3 Amp	8160330
1	U1	IC, NE5561, Switching Regulator	8050561
2	L1,2	Inductor, 30 uH, Tor, 5A DCR=.021 ohm	8419008
1		Heatsink	8549019
2		Bracket, Mounting	8729176
1	IN	Connector Plug with 3" (18 Ga) Tin Lds	8709378
1	OUT	Connector Cap with 3" (18 Ga) Tin Lds	8709379

On some models, C8-10 may be substituted with a 2200 uf, 16V, 105C, 20% Low ESR capacitor

5/ Parts List (con't)

Qty	Sym	Description	Part No.
2		Screw, Bracket Mounting Metric	8569173
2		Washer, #4 Lock, for Metric Screw	8589021
2		Nut, Bracket Mounting	8579031
2		Screw, Circuit Board Mounting, #6-32	8569003
2		Nut, Circuit Board Mounting, #6-32 KEPS	8579004

6/ Schematic


+12V OUT
1000µF 16V
C9
30µH L1
12.2 VDC ADJUSTMENT
8.2K R13
1K R12
3.3K R11
CR1 3AMP/30V (HS)
C8 1000µF 16V 5XA
.01µF C4
10Ω R2
.15Ω R10 2W
Q1 D44VM4 (HS)
510Ω R7
C7 .001µF
30µH L2
150 2W R5
2N2222 Q2
1.5K R4
R8 0Ω
U1 NE5561
.0033µF C2
.033µF C1
3.9K R1
R3 10K 1%
C6 .0033µF
C5 .01µF
C10 1000µF 16V 5XA
2N3906 Q3
R9 20K
R6 6.2K
C3 1µF
+12V IN

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