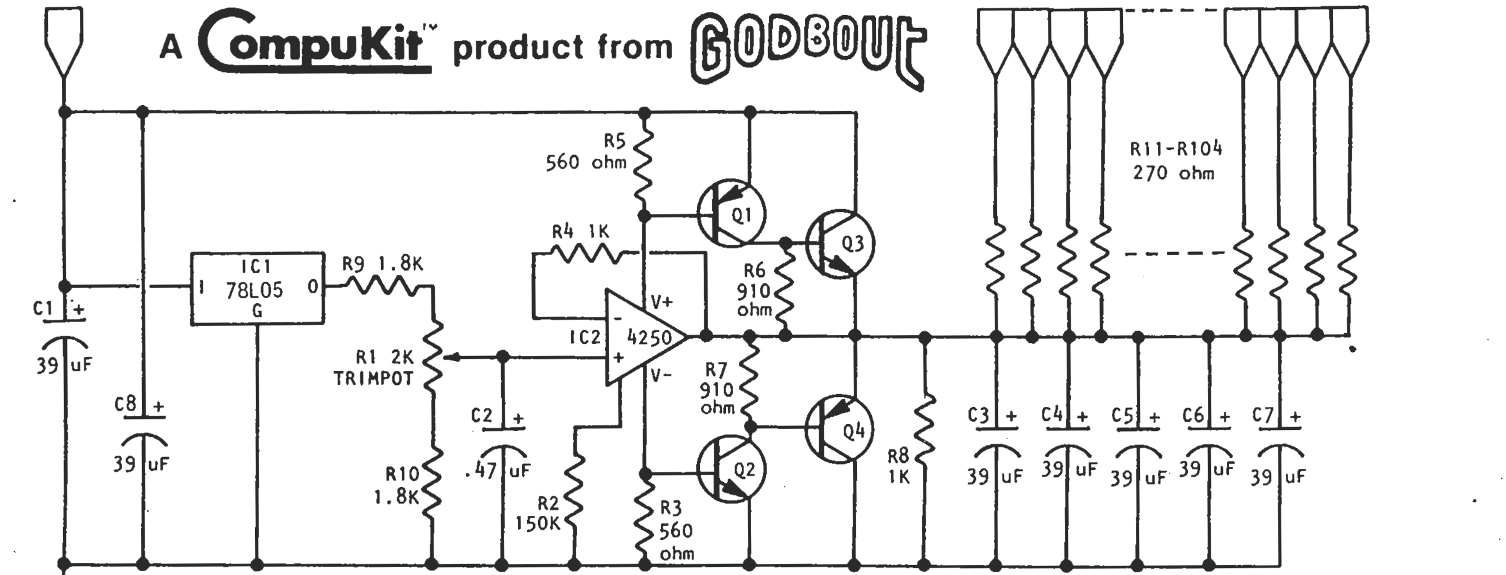
A CompuKit™ product from GODBOUT



SOLDERING TECHNIQUES Solder masked boards are similar to standard PC boards but are screened with a solder resistant coating on the foil side. This mask is screened over the entire board, except where there are solder connections to be made. Thus, solder does not run down a trace but adheres to the junction of the exposed board and exposed lead. Because of this, soldering requires a bit of care; trying to force lots of solder on to this type of joint will make it ball up around the lead. On the other hand, since solder does not comfortably hold to or flow over the resist, the chances of getting a bridge between tight, adjacent traces are decidedly minimized.

When soldering with a solder masked board, we recommend keeping the component leads straight up at all times, not bent over as with other types of boards (see figure 1). To prevent components from falling out when you flip the board over to solder, flip the board over on to a table, book, or other flat surface, which pushes the parts agains the component side of the board.

When soldering, bring the iron tip in at an angle, against the board pad and component lead; then feed in a tiny bit of solder at opposite ends of the lead (see figure 2). This makes for a good joint with no excess solder. Use of any type of solder other than rosin core solder invalidates the warranty.

CALIBRATION To bring up the board, remove any peripheral cards and attach either +8V filtered but unregulated or +5V regulated to the positive supply terminal of the active terminator board. If you are using a regulated +5V supply, leave IC1 out of the circuit and short the input and output pads together so that R9 connects directly to the +5V regulated supply. Then, measure the voltage across C3 or C4 with a voltmeter or DC reading scope; set trimpot R1 so that your meter reads 2.6V. The active terminator circuitry is now properly calibrated.

ACTIVE TERMINATION THEORY The standard TTL termination is a 2.6V reference, composed of a 360 and 390 ohm resistor in series across the power supply; the TTL line terminates at the junction of these two resistors. This type of passive termination allows for proper sourcing and sinking of the TTL line, and keeps the impedance of the line to a minimum to minimize pickup of noise and crosstalk. Each one of these passive terminations, however, also draws about 6.7 mA from the power supply. So, terminating 94 lines in this manner means a standby current drain through the terminators of well over half an Amp! These passive terminations don't just put a strain on your power supply, they waste energy and create heat inside your computer's cabinet. I don't think we have to go much further to realize that passive termination is not such a good way to do things, although it is better than no termination at all.

The active terminator takes advantage of the fact that there is an equivalent active structure, based around a voltage source and isolating resistor, that can accomplish the same results (see figure 3). Current can either source or sink through the 270 ohm resistor, either dumping into or drawing from the voltage source. Terminating more lines simply means adding more 270 ohm resistors between the line and voltage source. As a result, the standby current is slashed to the standby current of the voltage source circuitry---about 15 or 20 mA, which is quite a saving of energy.

The current requirement goes up as lines require more sourcing or sinking, but here we are somewhat fortunate. At any given moment, on 94 lines there will be a fairly random mix of 1s and 0s from moment to moment---these tend to cancel out and thus reduce the current drive requirements of the voltage source. Nonetheless, although this keeps average current consumption down, there are instances when you might have an extreme momentary need for current. As a result, the voltage source has enough capacity built-in to take care of the most adverse cases.

The structure of the voltage source is fairly simple (see schematic); IC1 sets up a stable voltage reference independent of master supply variations. IC2, a micropower op amp, hooks up as a simple voltage regulator with Q1 - Q4 set up as current boosting devices to cover any large current demands. R1, the trimpot, adjusts the output voltage of the op amp---hence the terminator voltage--- to 2.6 Volts. Since the op amp is forced to run from a ±2.5V supply when the active terminator board is powered from a regulated +5V supply, you might expect some problems since that low a supply voltage range is marginal for most op amp types. However, the 4250 chosen for this application can work satisfactorily down to ±1.5V, so it is always working well within spec.

FIGURE 1

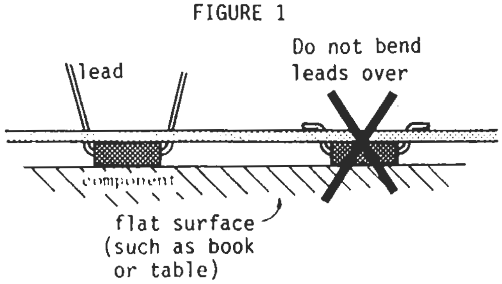


FIGURE 2

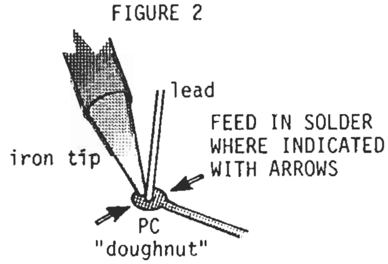
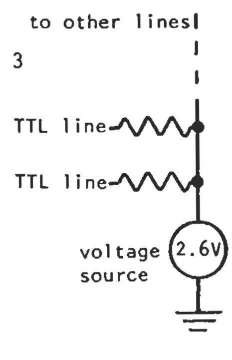


FIGURE 3



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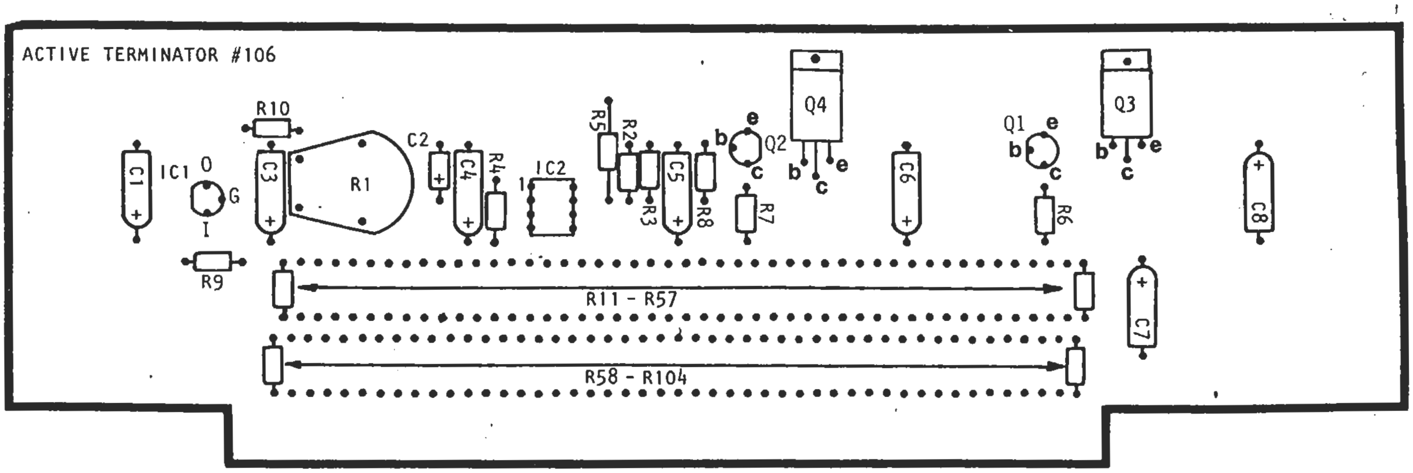
Active Terminator no. 106



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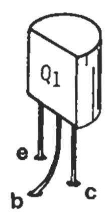

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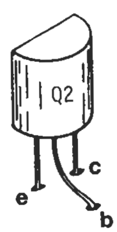

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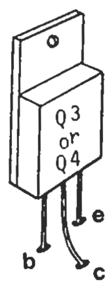


ORDER OF ASSEMBLY: READ THESE INSTRUCTIONS CAREFULLY AND TAKE YOUR TIME.

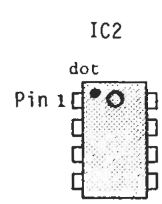
(1) CHECK ALL PARTS AGAINST THE PARTS LIST. (2) THIS BOARD USES A SOLDER MASK THAT VIRTUALLY MAKES SOLDER BRIDGES A THING OF THE PAST. HOWEVER SOLDER MASKED BOARDS REQUIRE A SPECIFIC STYLE OF SOLDERING, SO FLIP THIS SHEET OVER AND READ THE SECTION OF SOLDERING TECHNIQUES BEFORE PROCEEDING. (3) MOUNT RESISTORS R11-R57; FLIP THE BOARD OVER AS SHOWN UNDER SOLDERING TECHNIQUES, THEN SOLDER ALL LEADS AND CLIP OFF EXCESS LEAD LENGTH. (4) MOUNT RESISTORS R58-R104; FLIP THE BOARD OVER, THEN SOLDER ALL LEADS AND CLIP EXCESS LEAD LENGTH AS IN PREVIOUS STEP. (5) MOUNT AND SOLDER ALL OTHER RESISTORS <u>EXCEPT</u> THE 2K TRIMPOT IN A MANNER SIMILAR TO THE LAST TWO STEPS. (6) INSTALL THE CAPACITORS ON THE BOARD, CAREFULLY OBSERVING POLARITY. WE RECOMMEND MOUNTING THE CAPACITORS SO THAT THEIR VALUES FACE UPWARD AND ARE EASILY READABLE. AFTER CHECKING POLARITY SOLDER IN PLACE. (7) MOUNT AND SOLDER R1, THE 2K TRIMPOT, IN PLACE. (8) INSERT IC1, THE THREE TERMINAL REGULATOR. TO PREVENT POSSIBLE HEAT DAMAGE SOLDER IT CAREFULLY AND QUICKLY. (9) INSTALL THE 8-PIN MINIDIP SOCKET FOR IC2, SOLDER. MAKE SURE PIN 1 IS CORRECTLY IDENTIFIED AND THE IC CORRECTLY ORIENTED, INSERT IC2, SEE INSERT 4. (10) INSTALL AND SOLDER TRANSISTORS Q1 AND Q2, ORIENTING THE LEADS AS SHOWN IN INSERTS 1 AND 2. (11) MOUNT THE HEAT SINKS OF THE TWO POWER TRANSISTORS IN ACCORDANCE WITH INSERT 5, USING THE TWO NUT/BOLT SETS FROM YOUR KIT. THEN, INSTALL AND SOLDER Q3 AND Q4 IN PLACE AS SHOWN IN INSERT 3.

PLEASE NOTE: TRANSISTORS Q1-Q4 MUST BE PROPERLY ORIENTED FOR YOU KIT TO WORK PROPERLY. (12) FINALLY, EXAMINE YOUR WORK CAREFULLY. WHEN YOU ARE COMPLETELY SATISFIED THAT ALL IS WELL, TURN TO THE OTHER SIDE OF THIS SHEET FOR CORRECT CALIBRATION PROCEDURE.

<u>PARTS LIST, ACTIVE TERMINATOR BOARD</u>

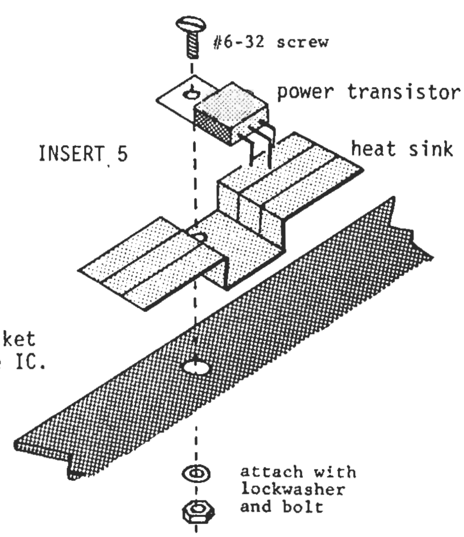
R1	2K trimpot
R2	150K resistor (brwn/gr/yel)
R3, R5	560 ohm resistor (gr/bl/brwn)
R4, R8	1K resistor (brwn/blk/red)
R6, R7	910 ohm resistor (wh/brwn/brwn)
R9, R10	1.8K resistor (brwn/gry/red)
R11-R104	270 ohm resistor (red/viol/brwn)
C1, C3-C8	39 uF tantalum capacitor
C2	0.47 uF tantalum capacitor
Q1	PNP transistor F137 (2N2907A)
Q2	NPN transistor 3560-2/PT134 (2N3904)
Q3	NPN power transistor (D44C4)
Q4	PNP power transistor (D45C4)
IC1	3 terminal regulator (78L05)
IC2	Micropower op amp (LM4250H)
(1)	Circuit board
(2)	THM6070 heat sinks
(2)	Nut and bolts for heat sinks
(1)	8-pin socket

INSERT 4



NOTE: Insert and solder socket <u>before</u> you insert the IC.

INSERT 5



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