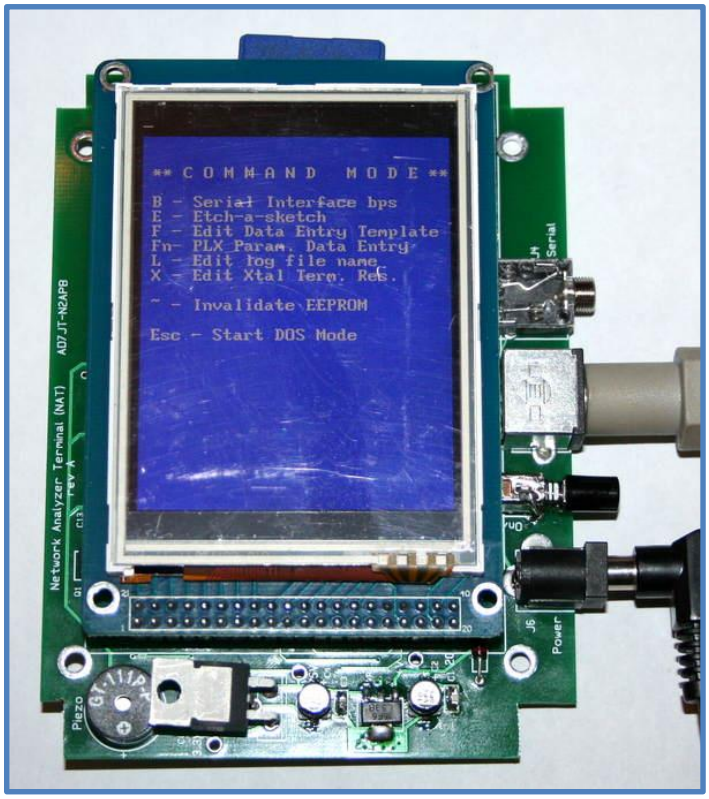
Network Analyzer Terminal

NAT KIT
Assembly Guide

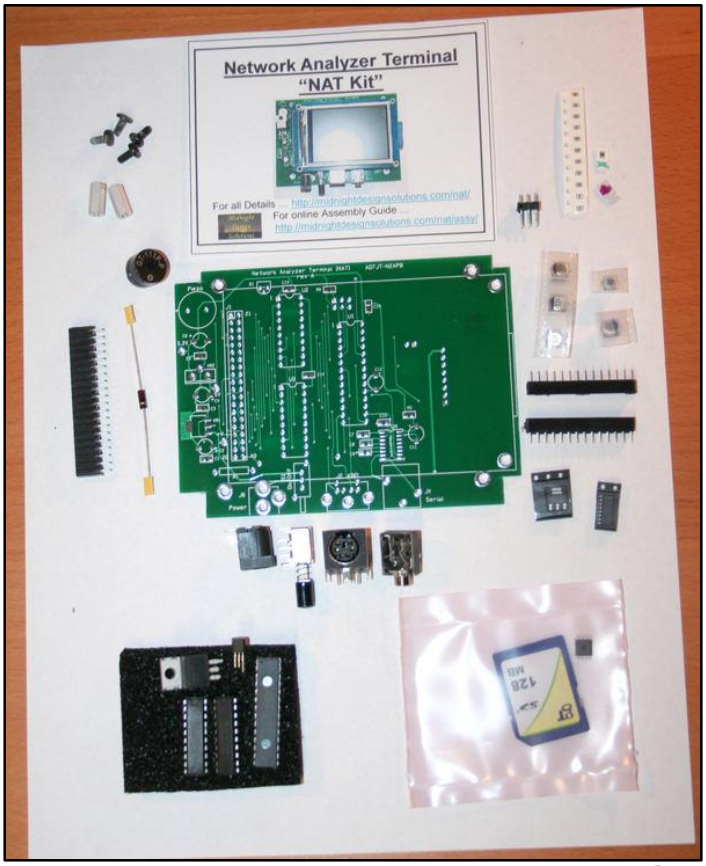


Dec 2014

1.) Overview

This is how the NAT Kit comes to you.
PCB and components in the lower section.

Optional enclosure and display (inside) in the upper section.



Here are all the pcb-mounted parts .

Most semiconductors are in the black foam pad, And the anti-static bag in lower right contains the SD Card and EEPROM memory chip.

2.) Parts List (page 1 of 4)

These four pages are a “photo parts list”, showing all parts supplied in the NAT Kit.

You should go through this carefully to ensure that you have all parts and can identify them by Designator.

Designator	QTY	Description	Source	P/N	
C1, C3, C5, C7, C8, C9, C10, C13, C14, C15	10	CAP CER 0.1UF 50V 10% X7R 0805	Digi-Key	399-1170-1-ND	
C11	1	CAP ALUM 2.2UF 35V 20% SMD	Digi-Key	PCE4295CT-ND	
C2, C4, C6	3	CAP ALUM 10UF 35V 20% SMD	Digi-Key	PCE4022CT-ND	
C12	1	CAP ALUM 22UF 35V 20% SMD	Digi-Key	PCE3953CT-ND	
J1	1	CONN RECEPT .100 DUAL STR 40POS	Digi-Key	929975E-01-20-ND	
J2	1	Jack, miniDIN, 6-pin	Mouser	161-2206	
J3	1	IC socket, DIP, 28-position	Mouser	517-4828-6000-CP	
J4	1	Jack, stereo, 3.5mm	Mouser	161-MJ352-EX	
J6	1	Jack, coaxial, 2.1mm	Mouser	163-7620-E	

Parts List (page 2 of 4)

P1	1	Pinheader, 2x3-position, 0.1" spacing	Mouser	517-836-01-36	
Piezo	1	Piezo speaker, miniature	Digi-Key	433-1020-ND	
Q1	1	MOSFET N-CH 60V 200MA TO-92	Digi-Key	2N7000_D26ZCT-ND	
R6	1	RES 1.0K OHM 1/8W 5% 0805 SMD (MAGENTA)	Digi-Key	311-1.0KARCT-ND	
R2	1	RES 10 OHM 1/8W 5% 0805 (GREEN)	Digi-Key	RMCF0805JT10R0CT-ND	
R1	1	RES 22 OHM 1/4W 5% AXIAL	Digi-Key	OD220JE-ND	
S1	1	Switch, SPDT, pushbutton	Mouser	107-MS-B1PL-13	
U2, U3	2	Integrated Circuit, SN74AHC373N, microcontroller, octal latch, DIP, 28-pin	Digi-Key	SN74AHC373N	
U1	1	Integrated Circuit, dsPIC33FJ128MC802, DIP, 28-pin	Digi-Key	DSPIC33FJ128MC802-I/SP-ND	

Parts List (page 3 of 4)

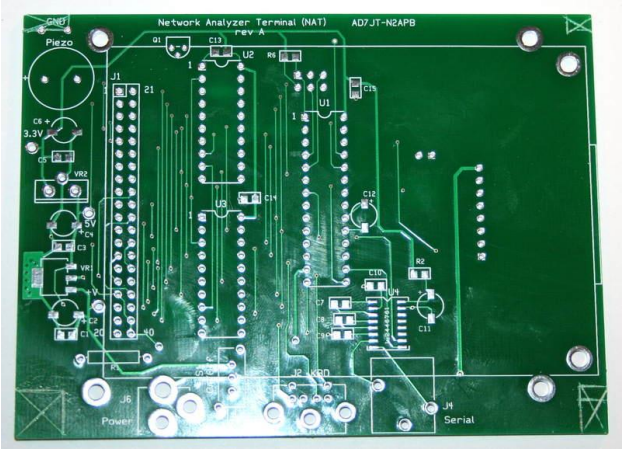
U5	1	Integrated Circuit, EEPROM 256KBIT 10MHZ 8SOIC (mount on QVGA)	Digi-Key	CAT25256XIOS-ND	
VR1	1	Voltage regulator, LM2940-5V, SOT223	Digi-Key	LM2940IMP-5.0/NOPBCT-ND	
VR2	1	Voltage regulator, 2937ET-3.3V	Digi-Key	LM2937ET-3.3/NOPB-ND	
		MISC			
Screws	4	Machine screw, pan slotted, #4-40x3/16" (BLACK)	Small Parts	MX-0440-03B	
Spacers	2	Spacers 7/16 LGNTH 4-40 Aluminum	Mouser	761-2056-440-AL-7	
SC Card	1	SD Card, 128 MB	eBay	oempcworld	
PCB	1	PC Board, 4.47"x3.31", 2-sided, soldermasked	MyRO PCB	(Custom)	
		OPTIONAL			
ENCLOSURE	1	Enclosure, Hammond 1591XXGSBK, black plastic, 4.82"x3.78"x1.5"	Mouser	546-1591XXGSBK	

Parts List (page 4 of 4)

Standoffs	4	7/16" nylon, 2-56			
Lower screws	4	5/8" screw, 2-56			
Upper screws	4	3/16" screw, 2-56			
Nut	4	2-56 nut			
Rubber Feet	4	Rubber feet			
QVGA	1	LCD, 3.2" TFT LCD Module+Touch Panel+PCB SD Socket	eBay		

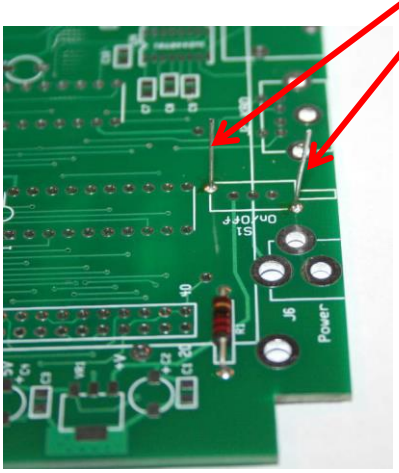
3.) PC Board Assembly

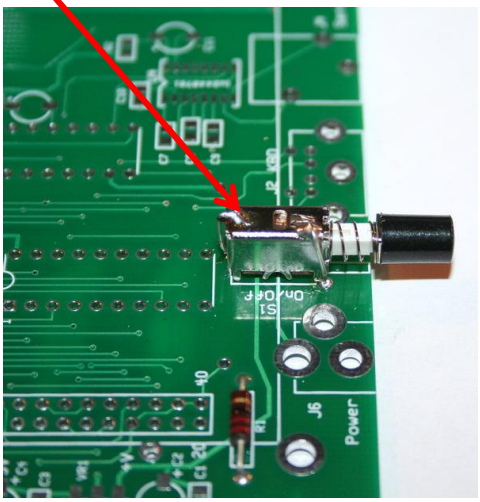
The pc board will either come with the notches in the four corners marked (as shown) for cutout for fitting into the recommended enclosure, or the notches will already be made.



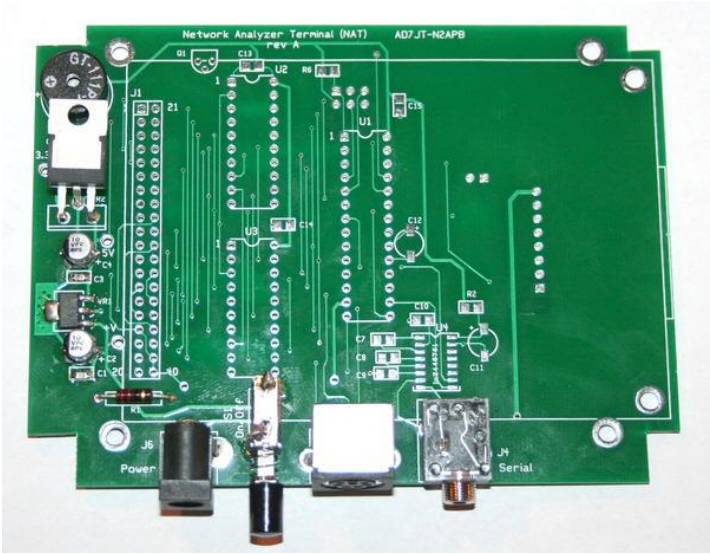
Per usual, there were several “minor errors” in the pcb layout. The first was for the switch S1 mounting holes. Try as you may, the only way to insert S1 such that its mounting tabs match the holes in the board would be from the bottom … which would work fine, but the switch would be lower in the side panel than the other components.

The better solution is to put in your own mounting wires to hold the switch body in place! First attach the 22-ohm axial resistor R1 as shown below on the left, and solder the two snipped-off leads into the mounting holes for S1. Then snip off the two mounting tabs from the body of S1, solder S1 in place using its three leads, and then solder those two extra wires to the body of switch S1. Voila! You now have S1 mounted firmly in place where it should be.



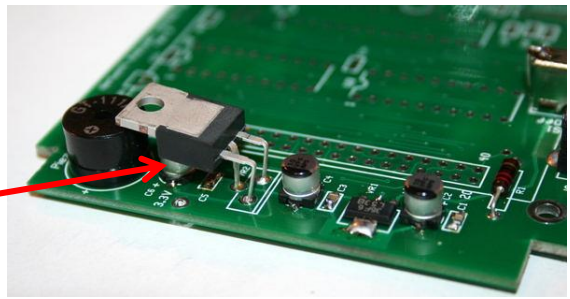


Go ahead and put the parts associated with the 5V and 3.3V voltage regulators, along with the other larger components along the board edges … as shown below.



When installing the electrolytic capacitors in the silver cans, be sure to observe polarity. The negative side of these parts are marked with a black stripe, and the positive pad on the pcb is marked with a + sign.

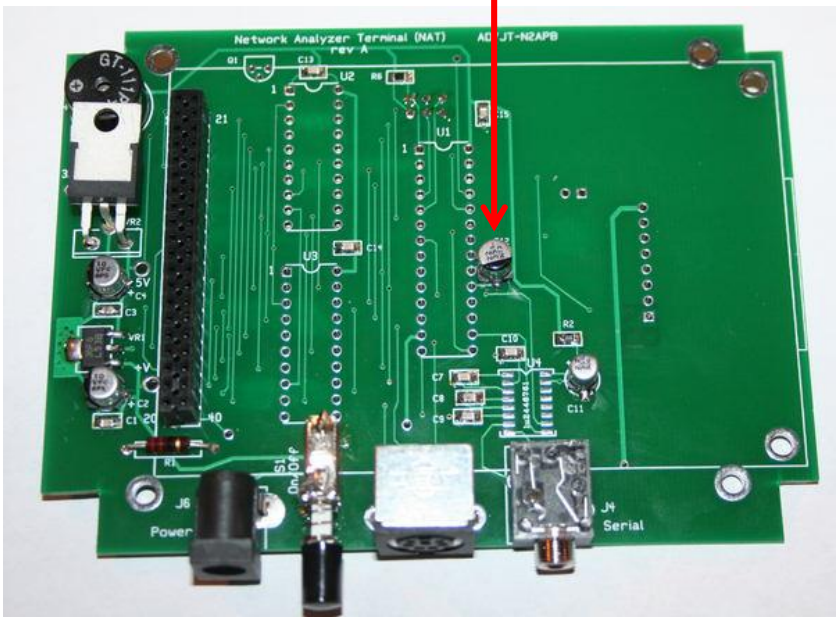
Bend the leads of the 3.3v regulator VR2 as shown, such that its bod sits atop capacitor C6.



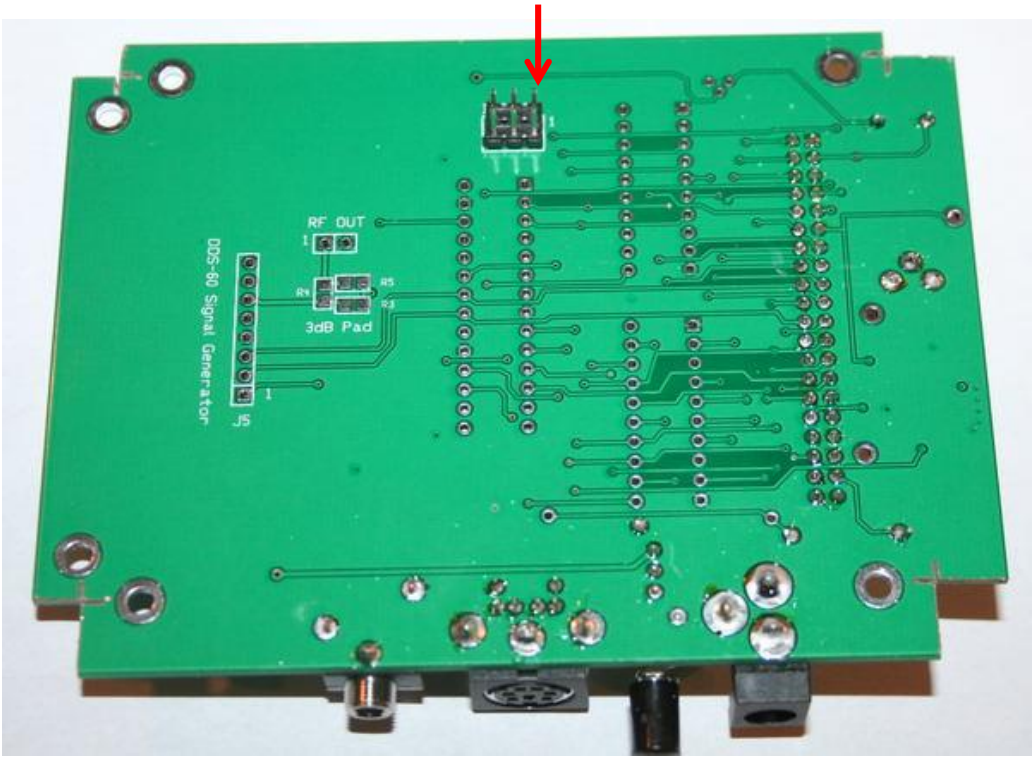
At this point you should plug in a 12V DC power supply to power connector J6. With power switch S1 pushed in, you should measure 5V and 3.3V at the test point pads marked accordingly on the left side of the board.

Do not proceed until you have verified that the voltage regulator circuits are doing their jobs.

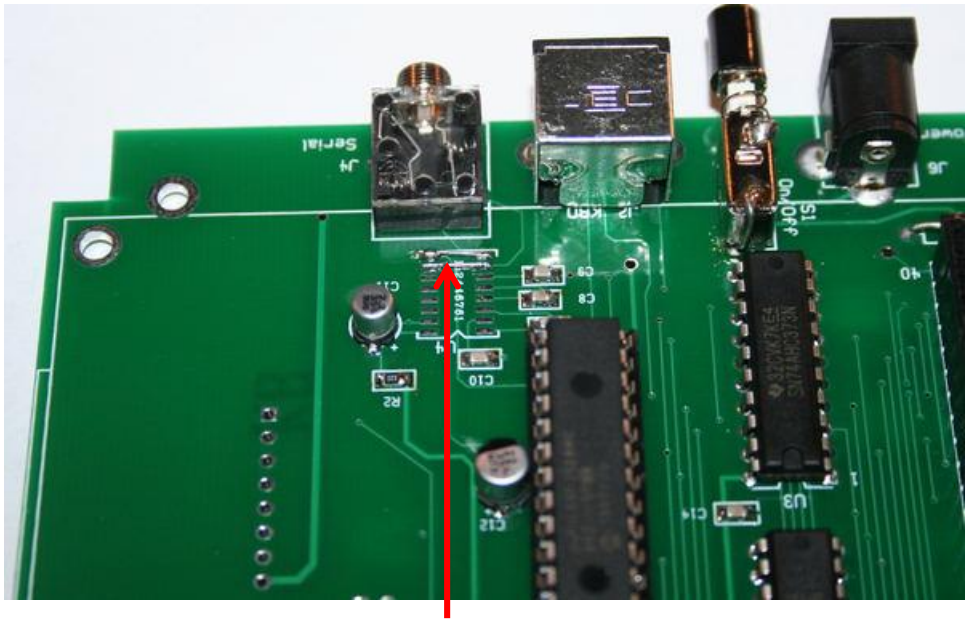
Go ahead next to attach the parts as shown below. When installing the 22uF electrolytic “silver can” try biasing it a little to the right when soldering it in place . This will give the 28-pin IC socket enough room right next to the cap.



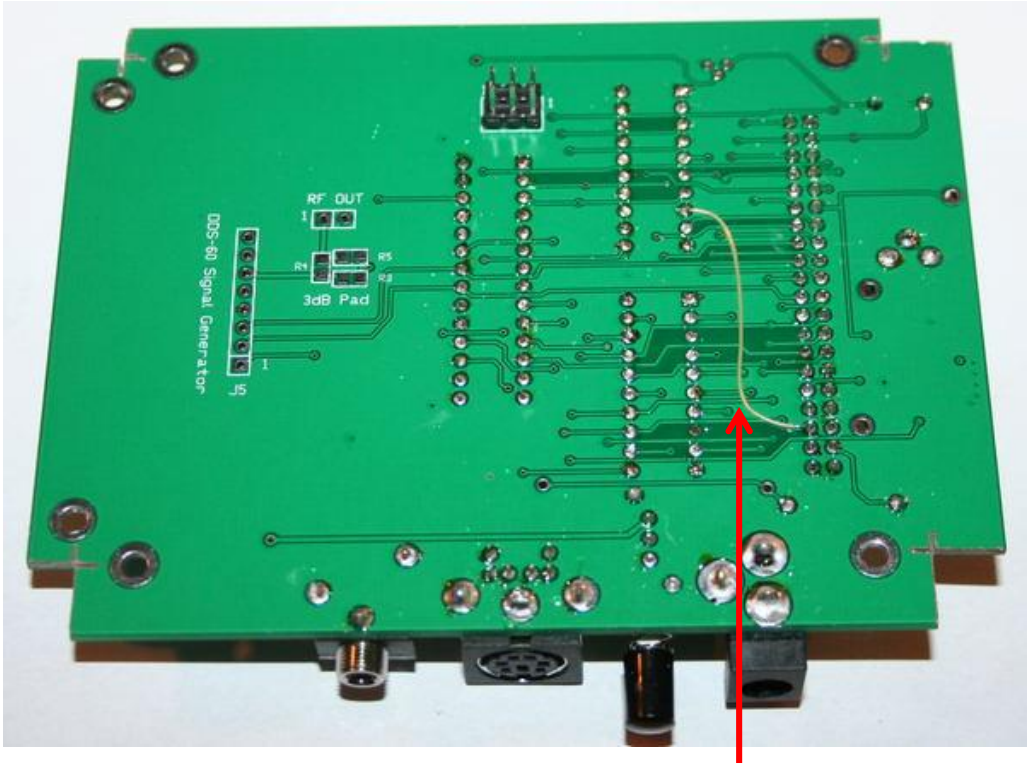
The one part (for now) that gets mounted on the bottom side of the board is the 2x3 position pinheader P1. It is essential to mount this part on the bottom in order for the pin numbering to be correct when connecting a programming pod to the board if/when you need to reprogram the microcontroller downstream.



You may now attach the 28-pin IC socket for the microcontroller U1. The wrong IC socket was ordered (wide-spaced instead of narrow), but this was remedied by cutting off each side, resulting in two 14-pin strip sockets. It is easiest to place the strips on U1 ("high-edged" sides outward), and then insert the U1+sockets to the U1 position in the pcb and solder in place.



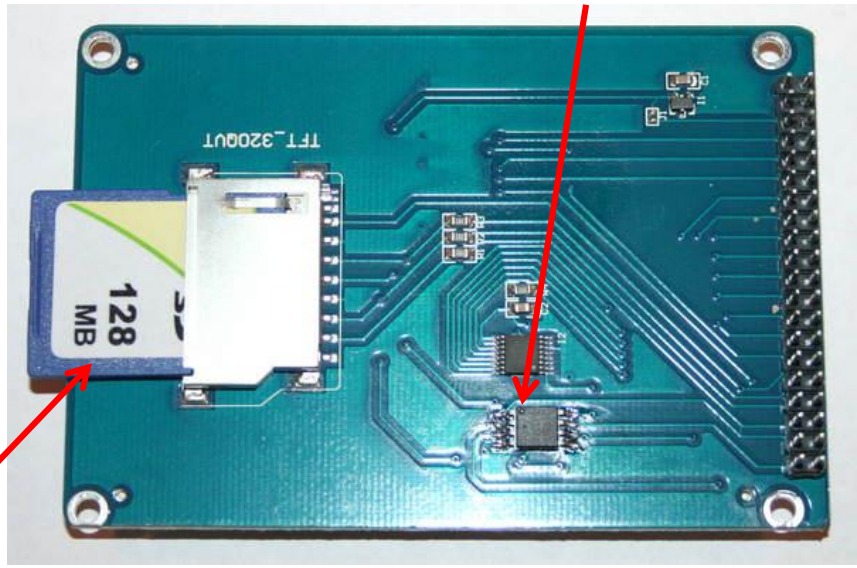
At this point, for ultimate use with the PHSNA measurement system, to just place jumpers across the U4 TxD and RxD pin pairs, as shown above. You can get the optional U4 IC later if you want RS-232 serial port voltage level translation.



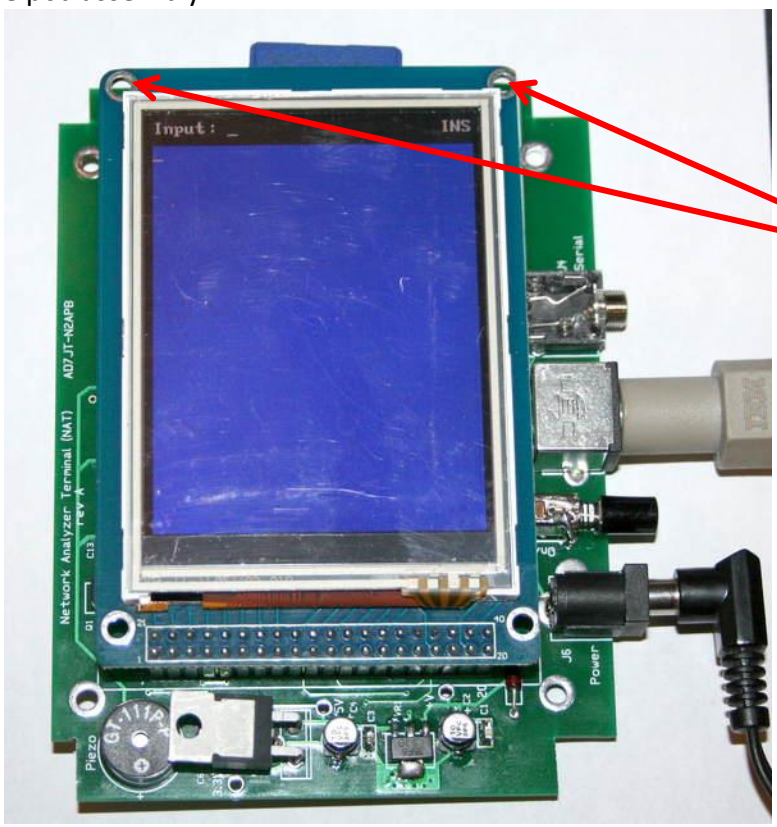
The other inevitable pcb error is actually a trace omission. You can fix that easily by adding a jumper wire as shown above.

The last step with the board assembly is to attach the EEPROM memory chip U5 (located in the pink antistatic bag with the SD Card) to the bottom of the display module, as show below. Be sure to observe pin 1 orientation.

Push the SD Card into the holder on the bottom of the display module, as shown here.



Now just carefully push the display module's 40-pin connector into the mating receptacle on the pcb assembly …



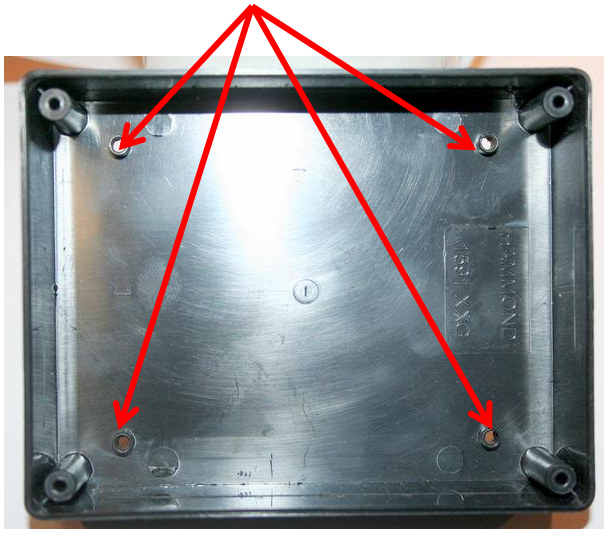
… and secure the far end of the display to the pcb using the two aluminum standoffs and four 4-40 screws.

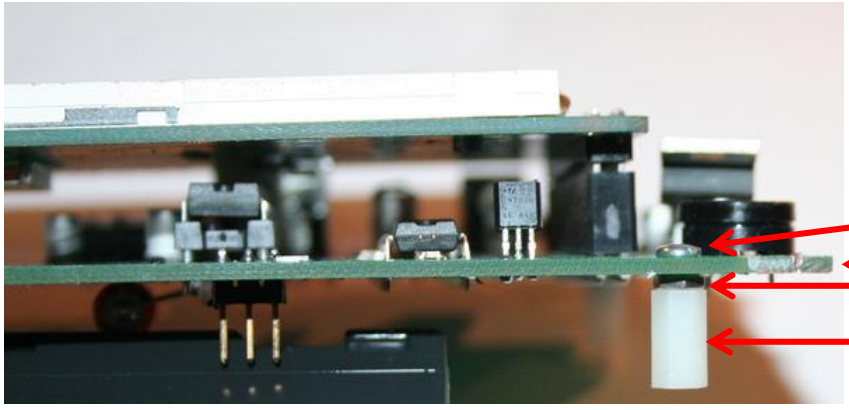
NOTE: At this point you should peel off the protective plastic on the surface of the display, leaving a nice , smooth, shiny and clean (for a while) display surface.

NAT PCB ASSEMBLY COMPLETE!

4.) Enclosure Preparation

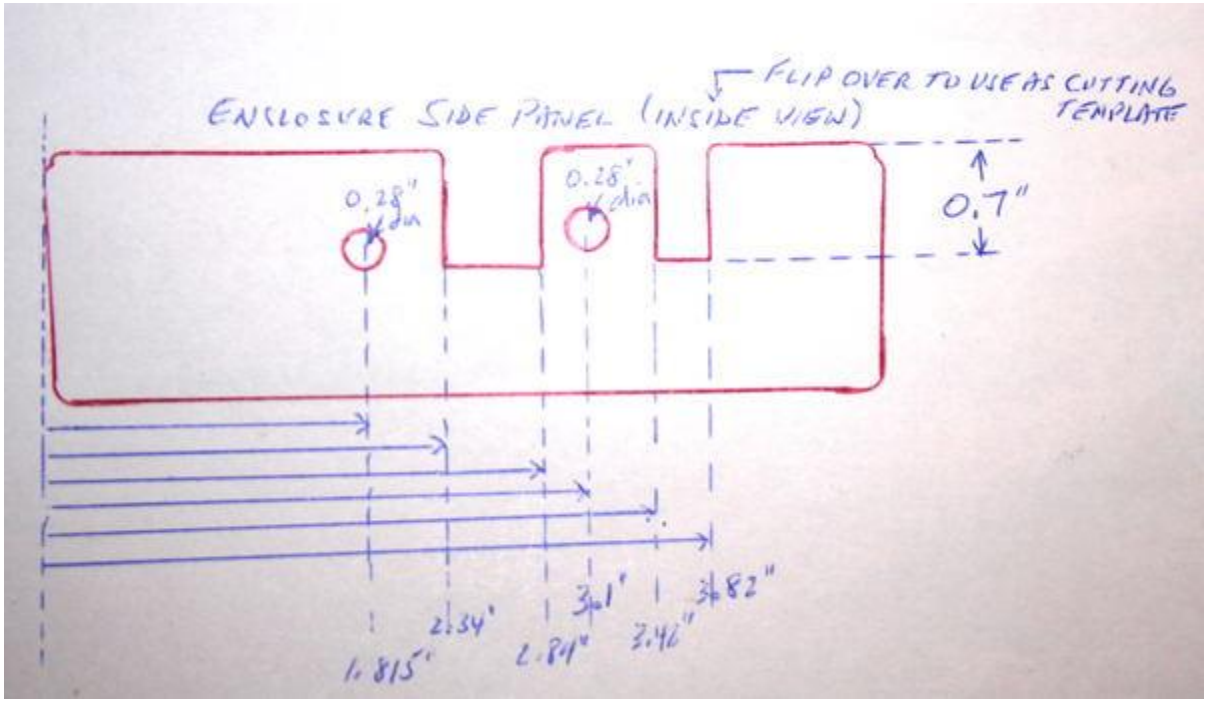
The bottom-inside of the enclosure has four molded plastic pcb mounting standoffs. Using a 1/8” drill bit, enlarge the holes in each standoff, and continue drilling right on through the bottom. The pcb mounting screws will go through these holes.





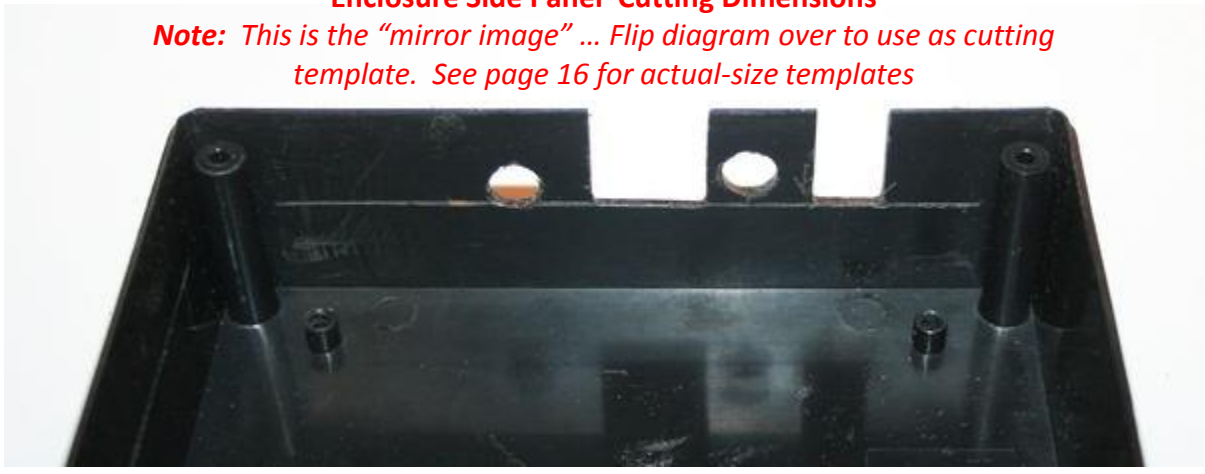
In the four corners of the pc board, mount the board standoff hardware as shown. The stack-up is:

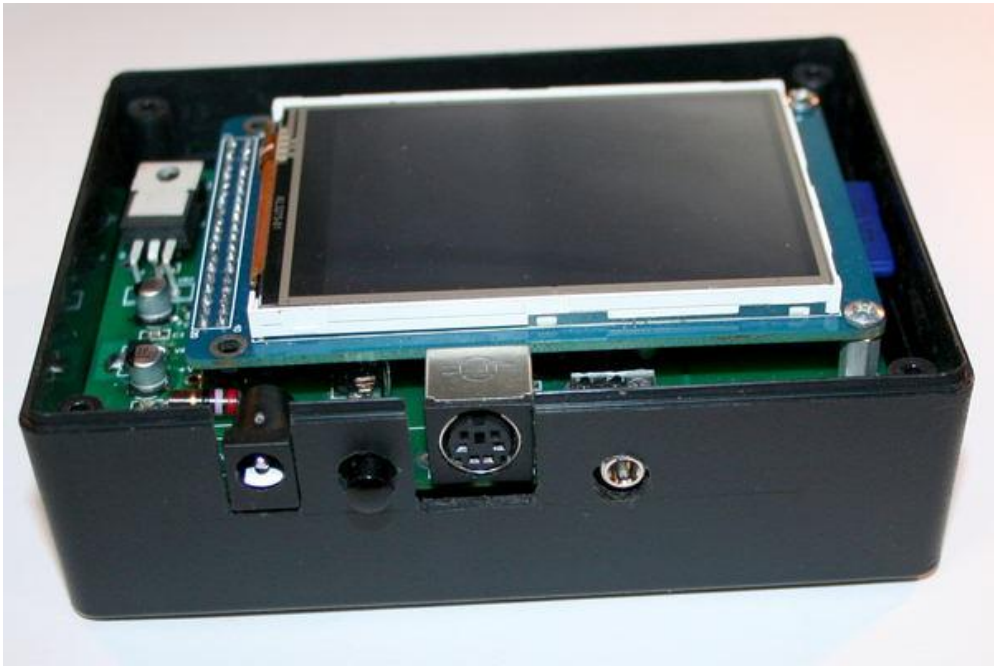
- 2-56 screw
- pcb
- 2-56 nut
- nylon standoff



Enclosure Side Panel Cutting Dimensions

Note: *This is the "mirror image" … Flip diagram over to use as cutting template.* *See page 16 for actual-size templates*



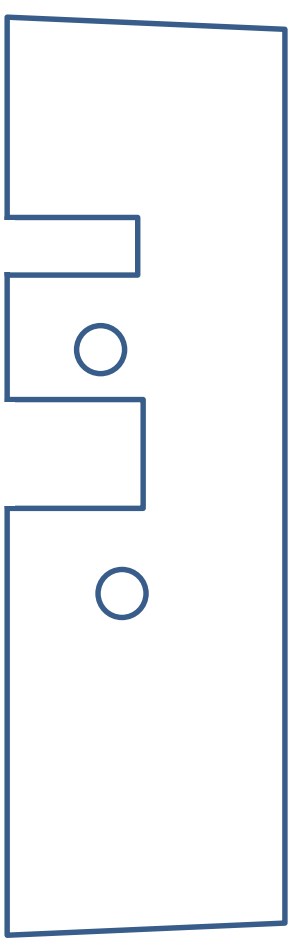


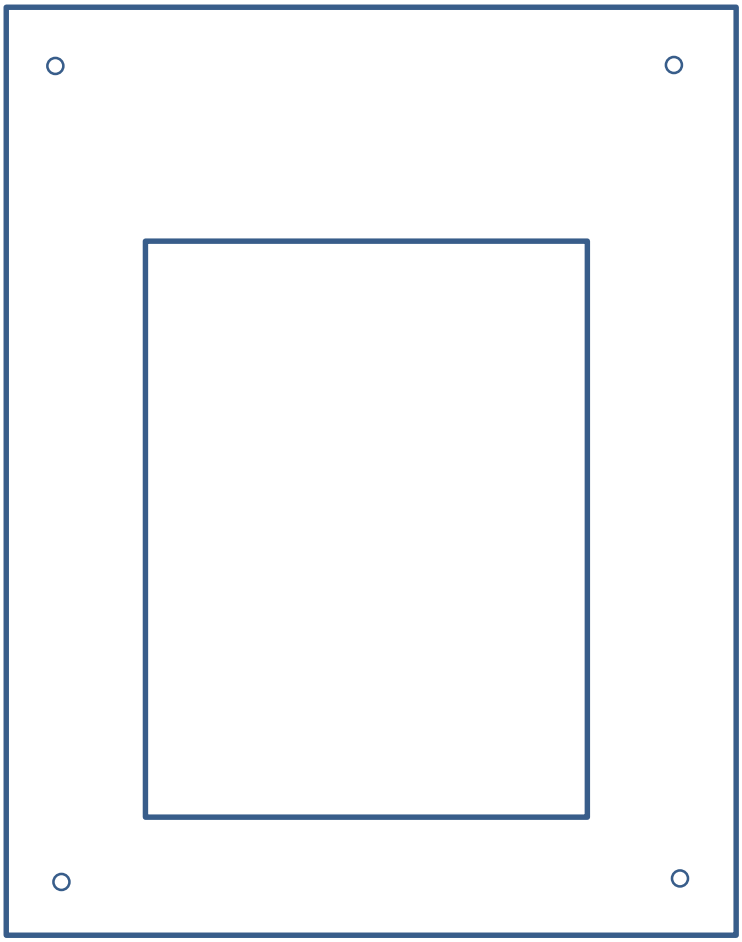
Add four rubber feet to bottom side of enclosure.

NAT pc board sitting neatly inside the prepared enclosure.

Templates for side and top panel cutouts.

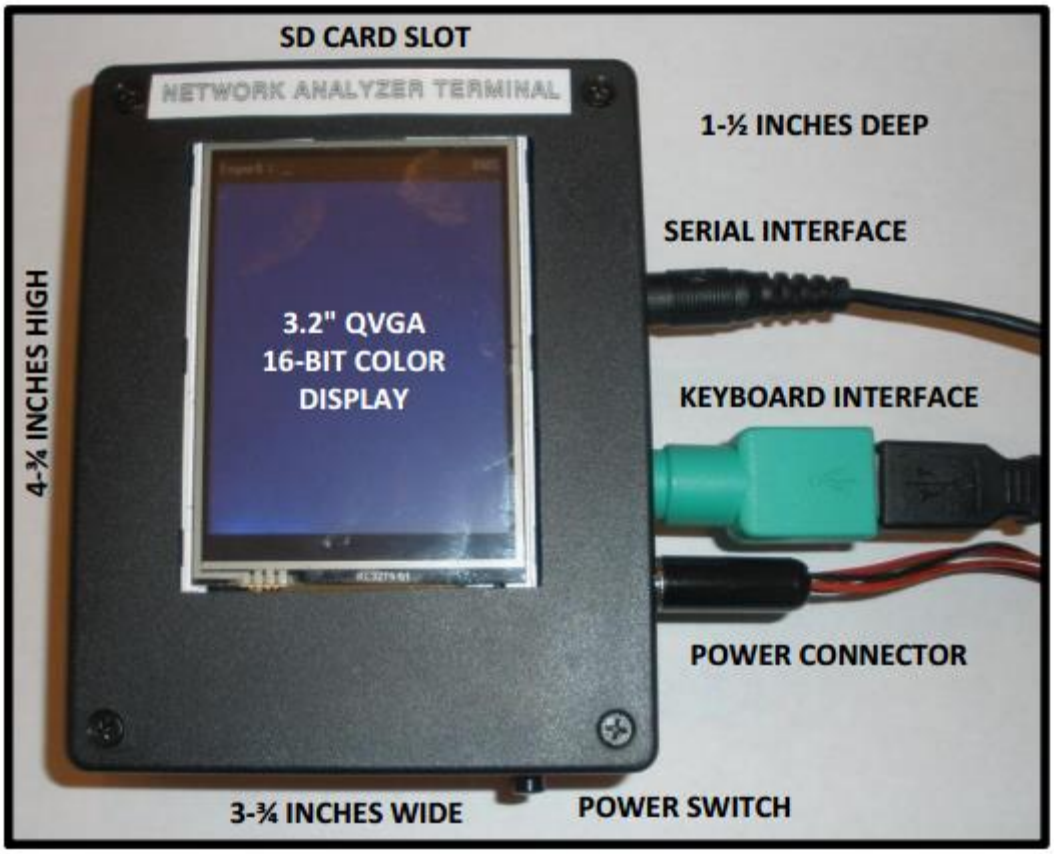
These are shown actual size IN THE PDF MANUAL … From this PDF document, just print this page, cut close to side and tape to the enclosure. Use as a guide when drilling/cutting the soft plastic.

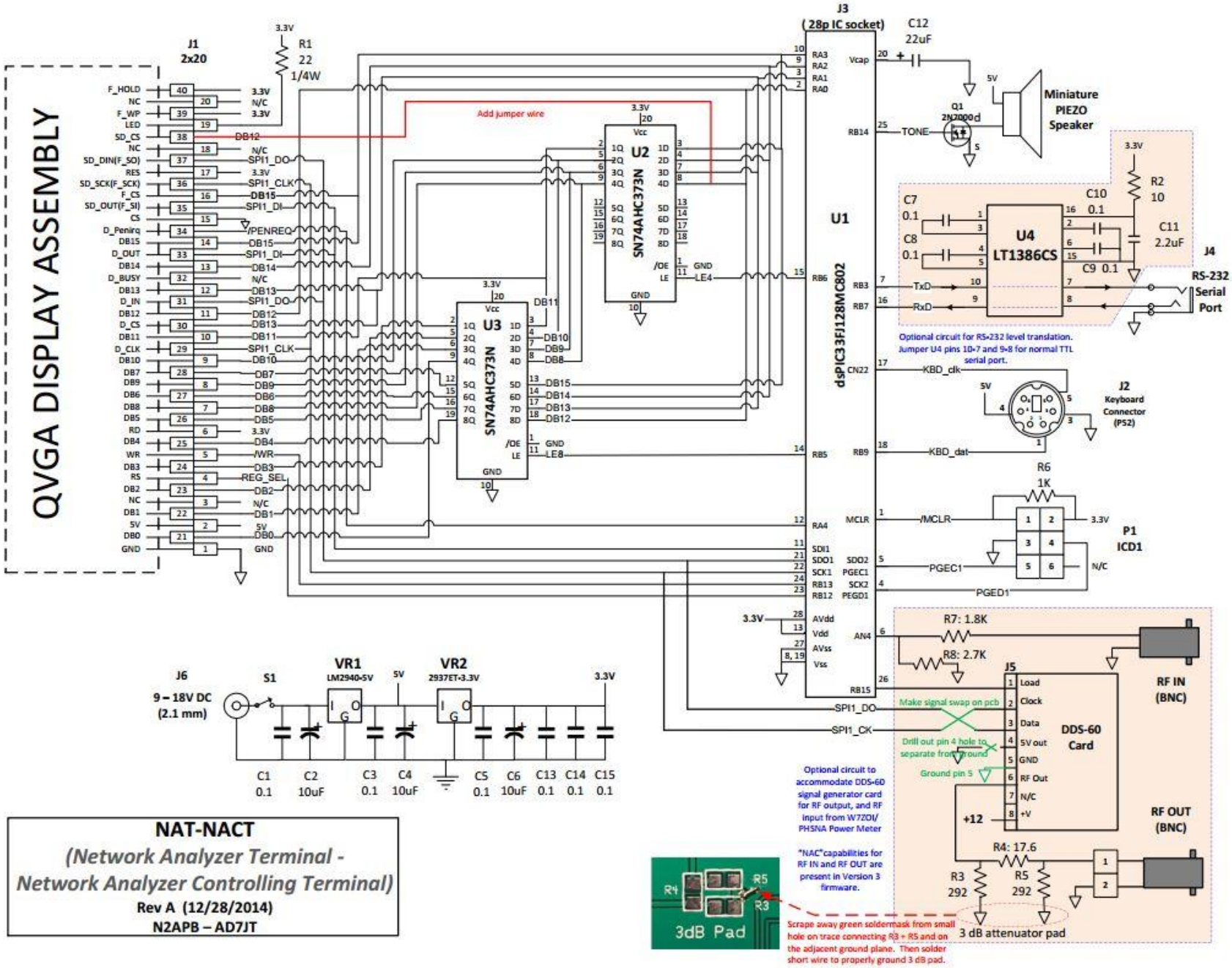




Completed NAT + Enclosure

We'll soon have an overlay graphic that can be customized, cut out, laminated and affixed to the front panel, serving as a nice label and "bezel" to neaten up the edges of the display hole.




QVGA DISPLAY ASSEMBLY
J1
2x20
J3
(28p IC socket)
U1
dsPIC33FJ128MC802
U2
SN74AHC373N
U3
SN74AHC373N
U4
LT1386CS
C12
22uF
R1
22
1/4W
Add jumper wire
Miniature
PIEZO
Speaker
Q1
2N7000
TONE
R2
10
C7
0.1
C8
0.1
C10
0.1
C9
0.1
C11
2.2uF
J4
RS-232
Serial
Port
TxD
RxD
Optional circuit for RS-232 level translation.
Jumper U4 pins 10-7 and 9-8 for normal TTL
serial port.
KBD_clk
KBD_dat
J2
Keyboard
Connector
(PS2)
R6
1K
/MCLR
P1
ICD1
PGEC1
PGED1
R7: 1.8K
R8: 2.7K
RF IN
(BNC)
RF OUT
(BNC)
J5
DDS-60
Card
Load
Clock
Data
5V out
GND
RF Out
N/C
+V
+12
Make signal swap on pcb
Drill out pin 4 hole to
separate from ground
Ground pin 5
SPI1_DO
SPI1_CK
Optional circuit to
accommodate DDS-60
signal generator card
for RF output, and RF
input from W7ZOI/
PHSNA Power Meter
NAC capabilities for
RF IN and RF OUT are
present in Version 3
firmware.
R4: 17.6
R3
292
R5
292
3 dB attenuator pad
3dB Pad
Scrape away green soldermask from small
hole on trace connecting R3 + R5 and on
the adjacent ground plane. Then solder
short wire to properly ground 3 dB pad.
J6
9 – 18V DC
(2.1 mm)
S1
VR1
LM2940-5V
VR2
2937ET-3.3V
C1
0.1
C2
10uF
C3
0.1
C4
10uF
C5
0.1
C6
10uF
C13
0.1
C14
0.1
C15
0.1
NAT-NACT
(Network Analyzer Terminal -
Network Analyzer Controlling Terminal)
Rev A (12/28/2014)
N2APB – AD7JT