

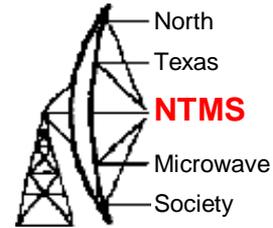
North Texas Microwave Society Jan 19-20 2024

Cowtown Hamfest agenda (approx. 1 hour sessions)

Friday	Saturday	Topic
5 pm	9 am	Getting started with Microwave radio – Kent WA5VJB
6 pm		Transverter setup and feedhorn align – Jim KM5PO
	10 am	Using a breadboard to test a project with demo
	11 am	How to solder surface mount devices (SMDs) with demo

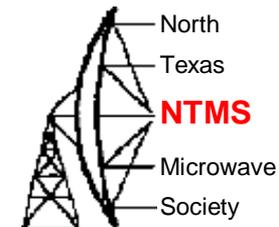
5pm: Microwaves are easy





6pm: Transverter/Dish setup

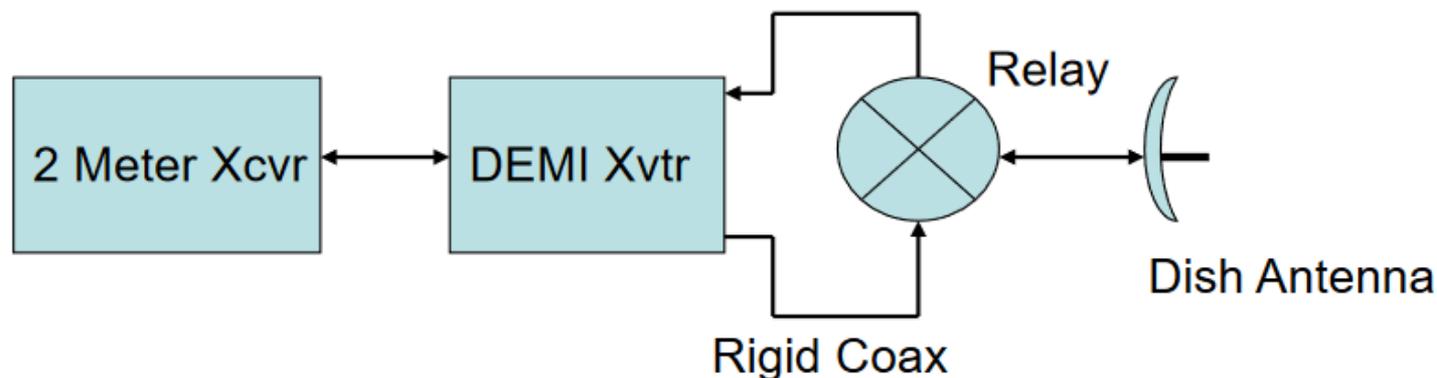




Gear on display

- DEMI 1296 MHz 25 watt transverter
- Q5 Signal DigiLO (dip switch programmable)
- Q5 Signal/KI5EMN custom DigiLO w/display
- DB6NT 2304 MHz 1 watt transverter
- DB6NT 10 GHz 200 mw transverter
- DB6NT 24 GHz 2 watt transverter
- DB6NT 8-13 GHz Local Oscillator
- Wavelab Homebuilt 24 GHz 2 watt transverter
- Texas Microwave 2 watt 10 GHz PA & bias supply
- Surplus SMA 18 GHz rated relays
- IF radios new & old: FT290, KX3, Icom 705

Basic Components



- **Down East Microwave 10 GHz Transverter Kit**
- **2 meter I/F transceiver**
- **Relay and rigid coax**
- **Dish or Horn antenna**

Transverter/Dish setup

DEMI Transverter Kit

Osc/multiplier

Pipe Cap Filters

DC Control Board

Top View

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DEMI Transverter Kit

144 MHz in/out

10 GHz in

10 GHz out (10 mW)

Surface mount construction

Bottom View

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Relays

SPDT 28 VDC
0-18 GHz - SMA

Transfer Relay
0-18 GHz - SMA

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Hardline Coax

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Dish Antenna

- 18 inch offset dish
- Readily available
- High gain typically 30 dB

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Low Noise Block Converter with integral Feedhorn (LNBF)

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Transverter/Dish setup

Designing the New Feed

www.ntms.org 10

WR90 Waveguide to Coax Transition

www.ntms.org 11

Building the Feed Horn

www.ntms.org 12

Solder it all together

www.ntms.org 13

New Horn and Waveguide Transition

www.ntms.org 14

Setting Correct Angle

www.ntms.org 15

Transverter/Dish setup

Adjustability

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Finding the Focal Point

Measure Dimensions

Vertical Length (mm)
Horizontal Length (mm)
Dish Depth (mm)
Max Depth to Bottom Length (mm)

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W1GHZ Online Microwave Antenna Book

<http://www.w1ghz.org/antbook/contents.htm>

Software Page:
Run HDL_ANT.exe
Select "Offset Dish Calculations"
Enter measured dish dimension data

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String and knot method to find phase center

RF
453 mm
256 mm
66.3 degrees tilt

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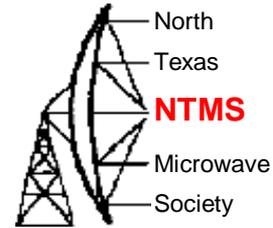
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10 GHz Portable Station

WWW.NTMS.ORG 22

Transverter/Dish setup





Sat 10 am: Breadboards!

W5HN

Breadboard features



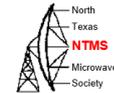
- Does not require soldering
- Build-up of parts is relatively fast
- Changing connections is easy
- Letting the smoke out is easy too
- Many projects such as basic DC
- Arduino and Raspberry Pi projects

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Breadboarding usage



- Prototyping
 - Testing all new design
 - Iterate between schematic/board
 - Verifying behavior
 - Other soldered circuit is broke?
- Making a temporary solution
 - You need something for a few days/weeks- laser transmitter (2017)

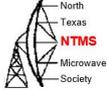
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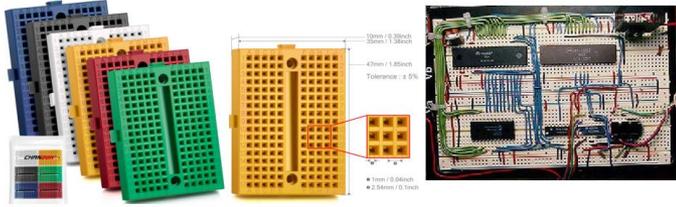
Types of breadboard

W5HN

Breadboarding basics

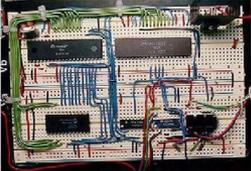


- All sizes, shapes and even colors
 - Bigger, Big, Small, Tiny
 - Most can be daisy chained



10mm / 0.394inch
30mm / 1.181inch
40mm / 1.575inch
Tolerance: ± 0.5%

2.54mm / 0.1inch

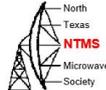


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Breadboarding basics



- Sketch a schematic by hand
- Test/improve the circuit on the breadboard
- Create schematic using tools for sharing
- Build a permanent circuit
 - Perfboard
- Export schematic for gerber, position, bom files. Use PCB manufacturer

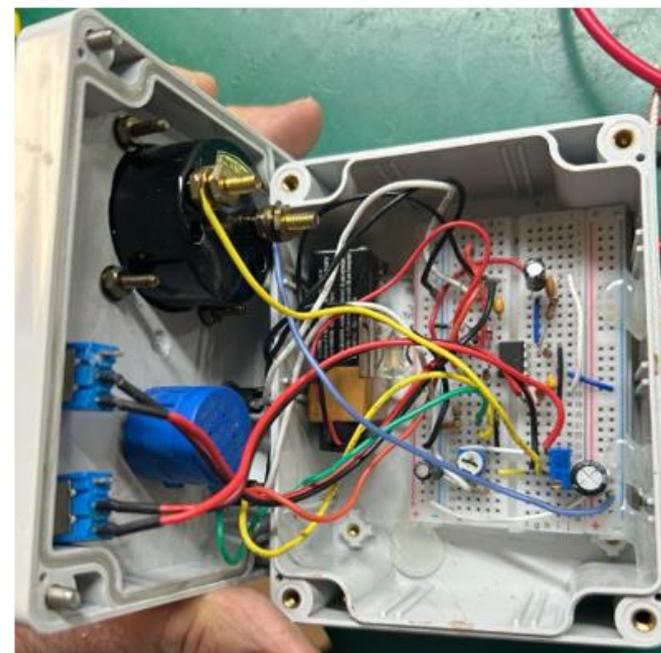


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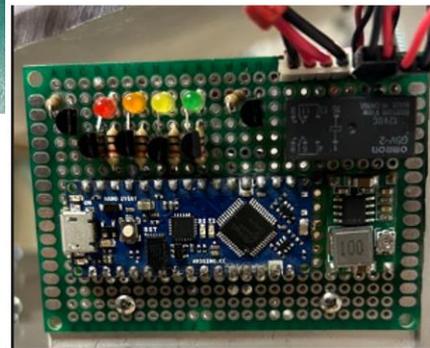
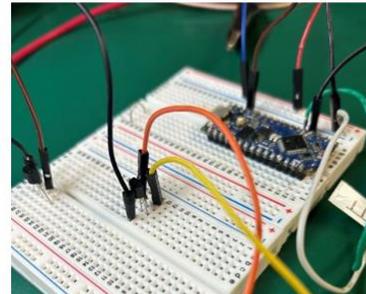
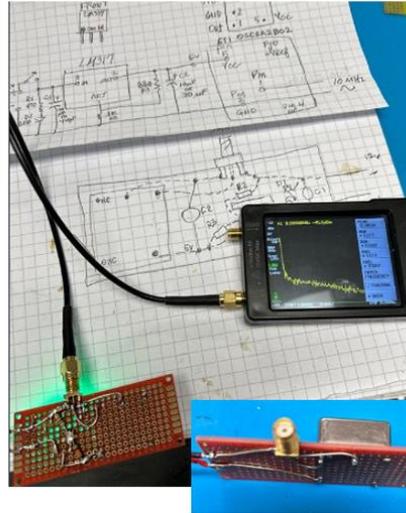
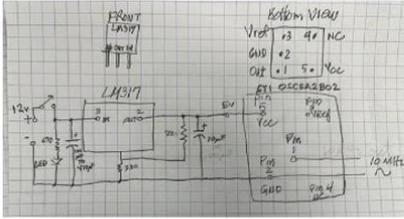
Use as is

- Audio meter



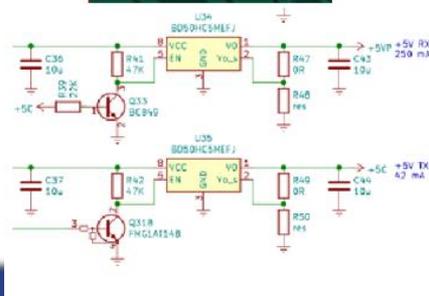
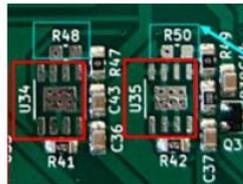
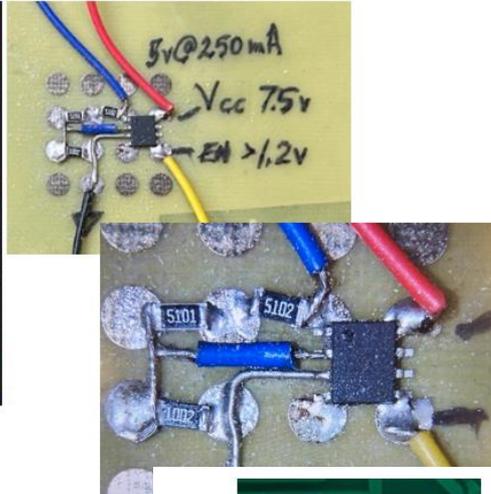
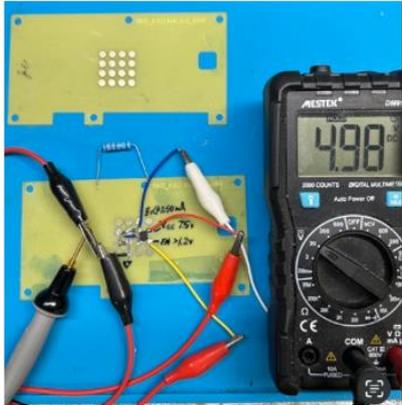
Prototype & build

- Sequencer MOSFET drive tests

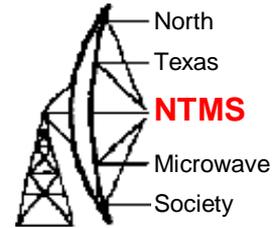


Prototype & build

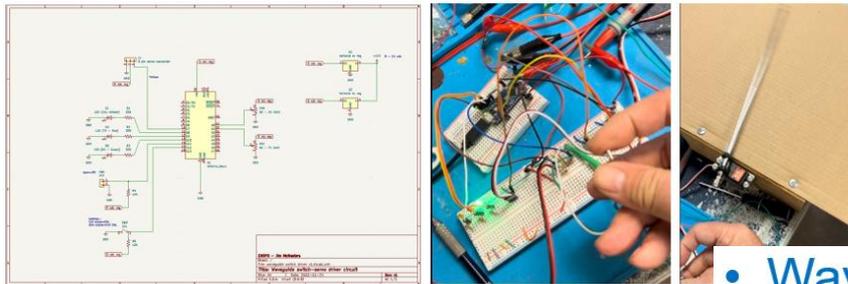
- Wavelab 24GHz board part replacement



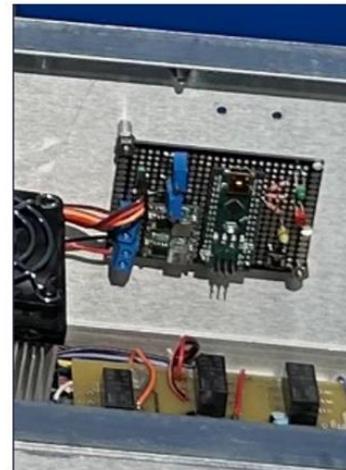
Prototype, troubleshoot & build



- Waveguide transfer switch controller

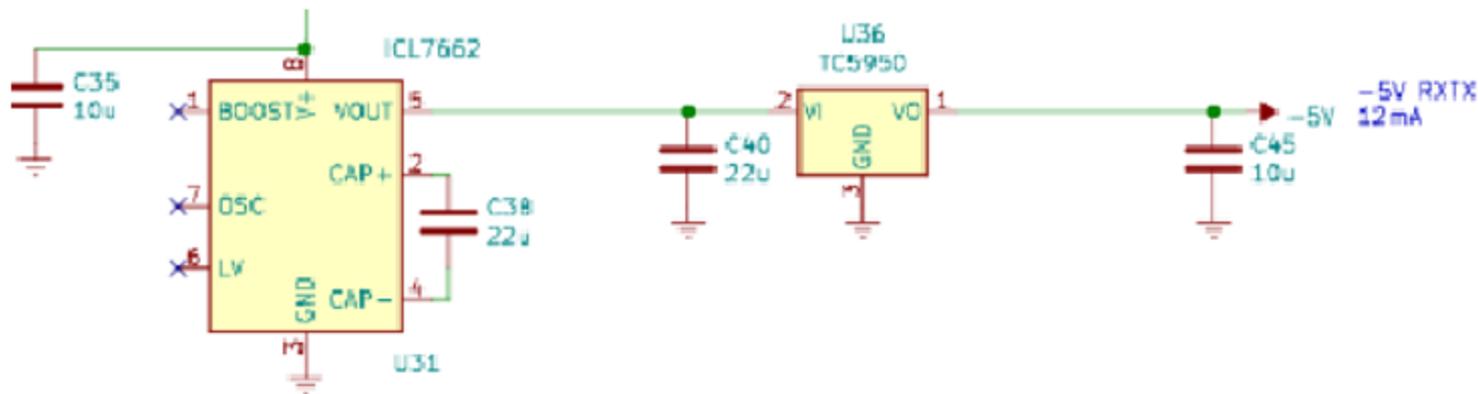


- Waveguide transfer switch controller



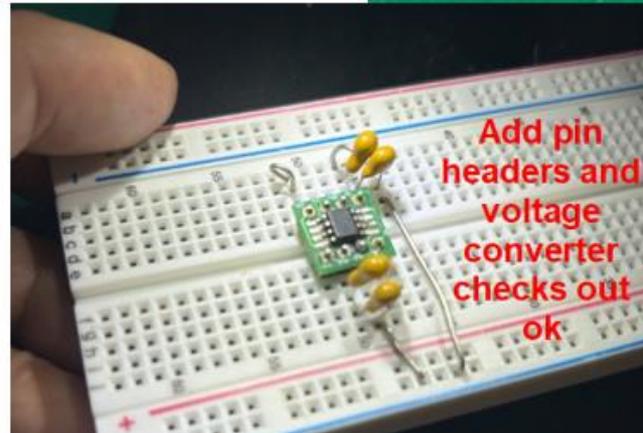
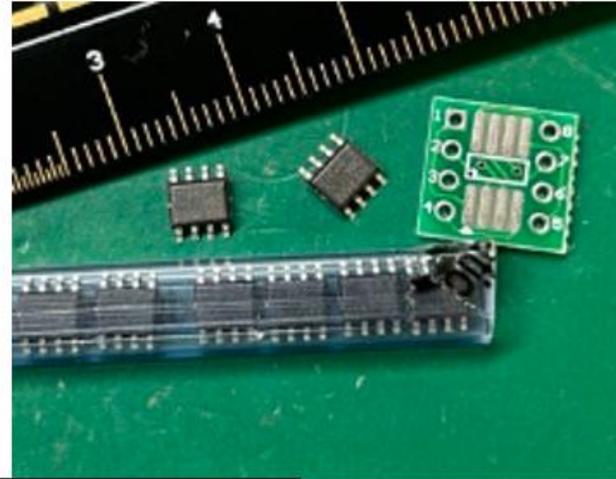
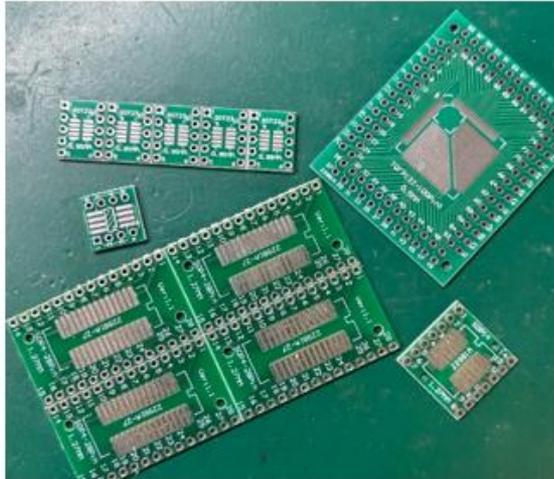
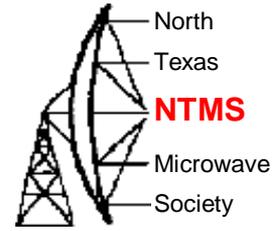
Prototype, troubleshoot & build

- Wavelab 24GHz board part failure?

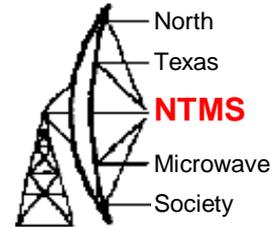


- Why does the part keep failing?
 - Test a new part from the batch..

Prototype, troubleshoot & build



Prototype, troubleshoot & build



Located a short to ground on -5 v line



Prototype, troubleshoot & build

- Let's add the (negative) voltage regulator



TC59

Low Dropout, Negative Output Voltage Regulator

Features

- Low Dropout Voltage
 - Typically 120mV @ 50mA; 380mV @ 100mA for -5.0V Output Part
- Tight Output Voltage Tolerance: $\pm 2\%$ Max
- Low Supply Current: 3.5 μ A, Typ
- Small Package: 3-Pin SOT-23A

Applications

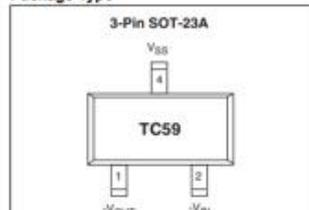
- Cellular Phones
- Battery Operated Systems
- Palmtops
- Portable Cameras

Device Selection Table

Part Number	Output Voltage	Package	Temperature Range
TC593002ECB	3.0V	3-Pin SOT-23A	-40°C to +85°C
TC595002ECB	5.0V	3-Pin SOT-23A	-40°C to +85°C

Other output voltages are available. Please contact Microchip Technology Inc. for details.

Package Type

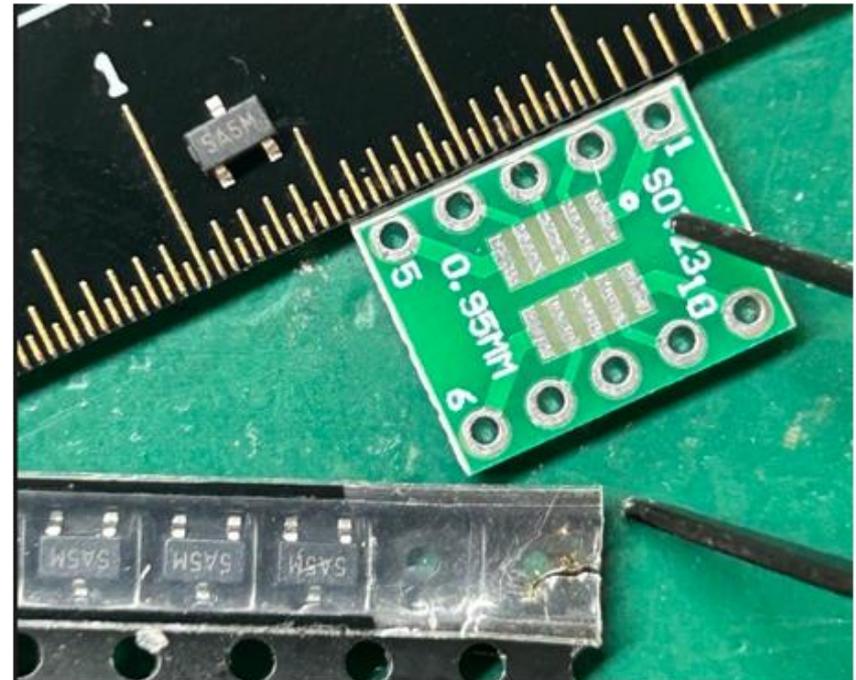
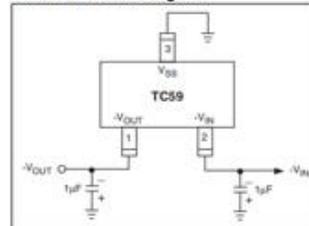


General Description

The TC59 is a low dropout, negative output voltage regulator designed specifically for battery-operated systems. Its full CMOS construction eliminates the wasted ground current typical of bipolar LDOs. This reduced supply current significantly extends battery life, particularly when the TC59 is operated in dropout.

Other TC59 key features include low supply current (typically 3.0 μ A) and low dropout operation (typically 120mV at 50mA). The TC59 is packaged in a small 3-Pin SOT-23A package.

Functional Block Diagram



11 am: How to solder SMD components

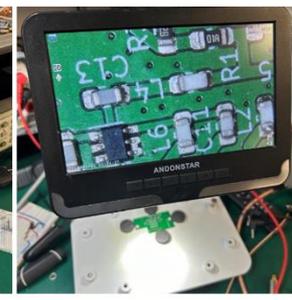
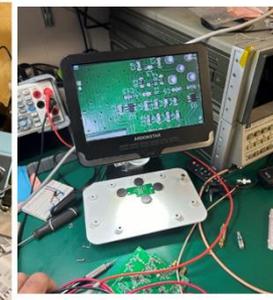
SMD soldering methods



- Multiple methods
- Manually solder with fine tip iron
 - Spread flux on to pads
 - Use thin solder on the roll .010"
 - tack one point - continue
 - <https://www.youtube.com/watch?v=EW9Y8rDm4kE&t=144s>
- Use solder paste applied manually or with stencil
- Manually flow paste with fine tip iron or
- Use hot plate and heat gun or
- Use oven to bake

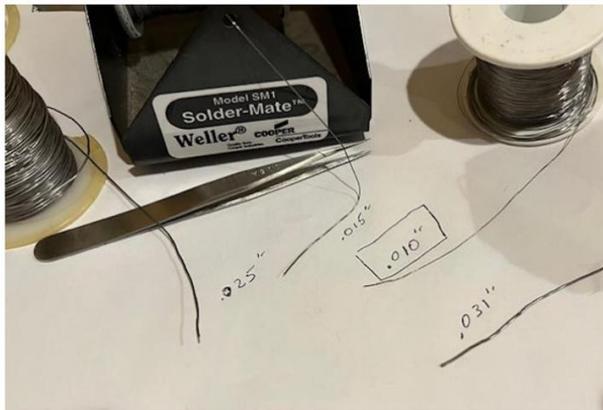


N5BRG Bob's microscope



- KM5PO Jim's scope. Can zoom x4
- Also use head mount magnifier

Solder & Wick



.015" Mouser #910-SMD2SW015100G



1.5 mm Mouser 910-SOLDERWICK1.5
2.0 mm Mouser 910-SOLDERWICK2.0

Solder flux & Clean Stick



15g Mouser 910-SMD291AX

Clean up

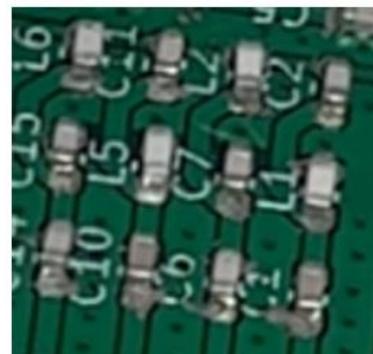


Hot plate & hot flow

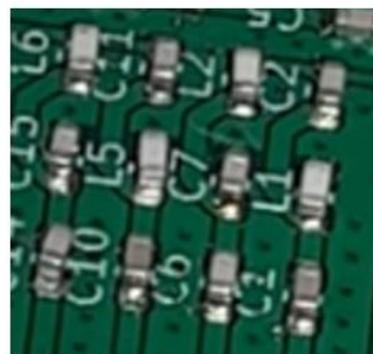
800F heat gun on 230F pre-heated plate



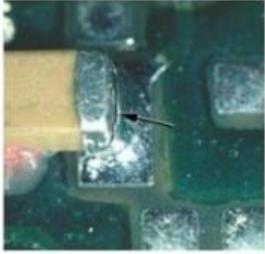
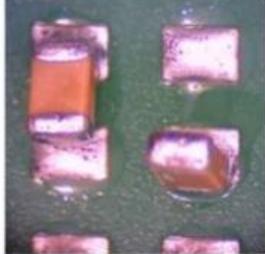
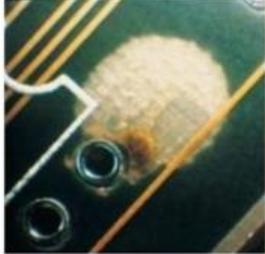
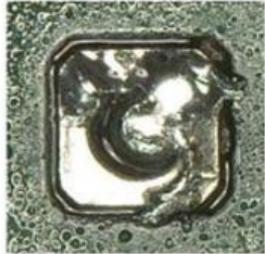
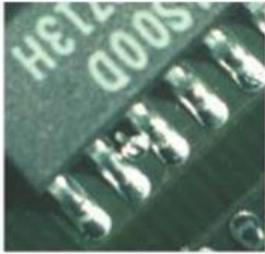
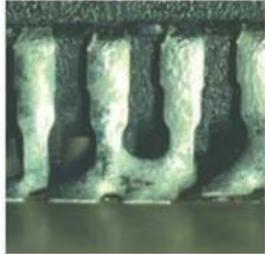
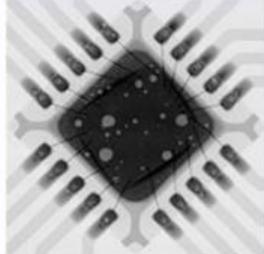
Before flow begins



After flow complete

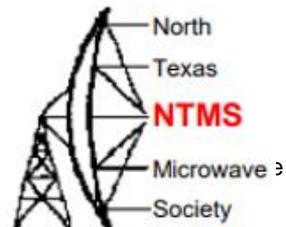


Use magnification and watch for Defects

Fractured solder	Tombstones	Delamination	Non-Wetting
			
Cold connection	Solder balls	Solder bridges	Voids
			

MSL Rating

Kapton Tape

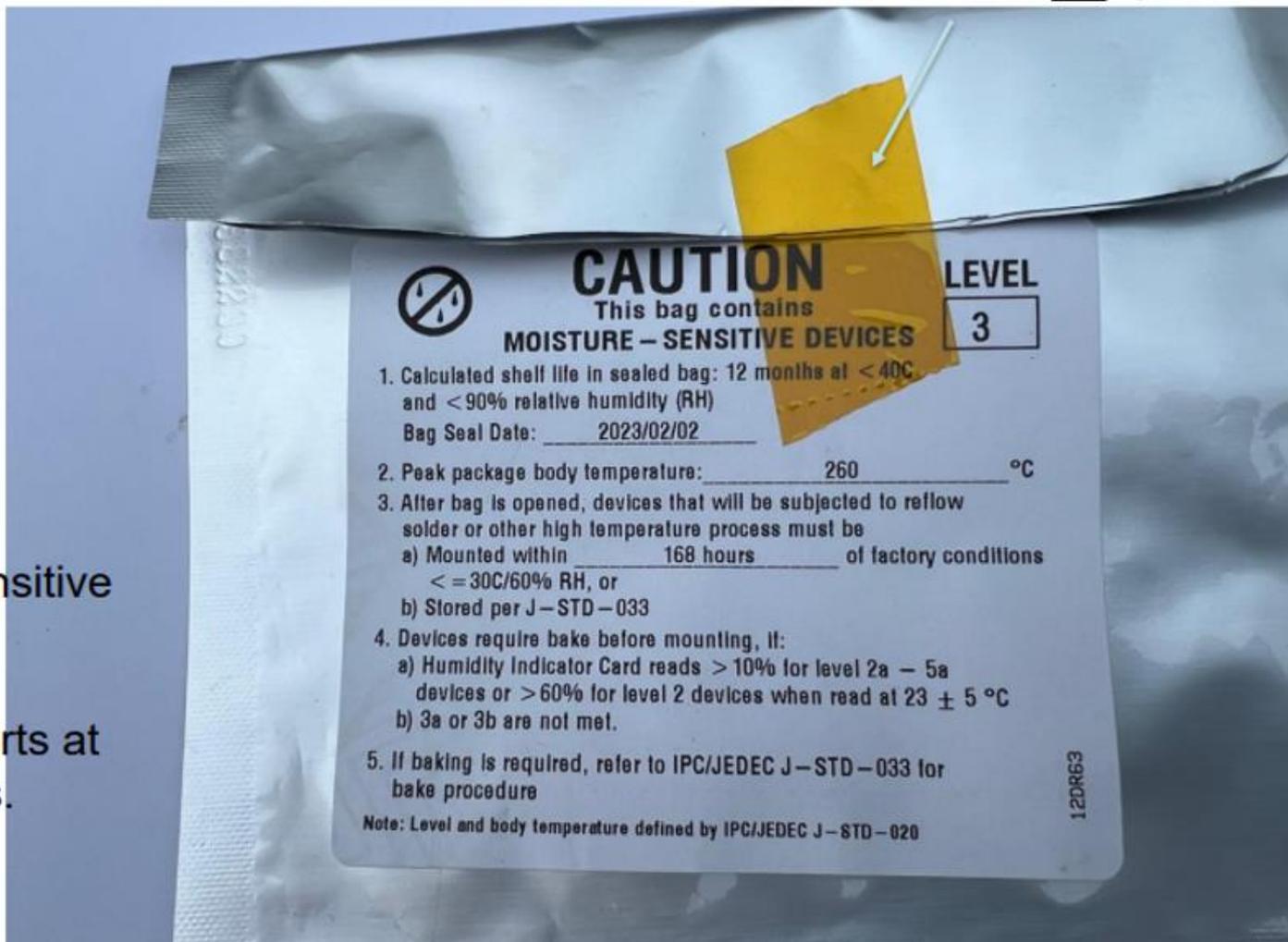


Plastic Package
Can absorb water!

Rapid heating can
Convert water to
Steam and Pop-Corn
Package.

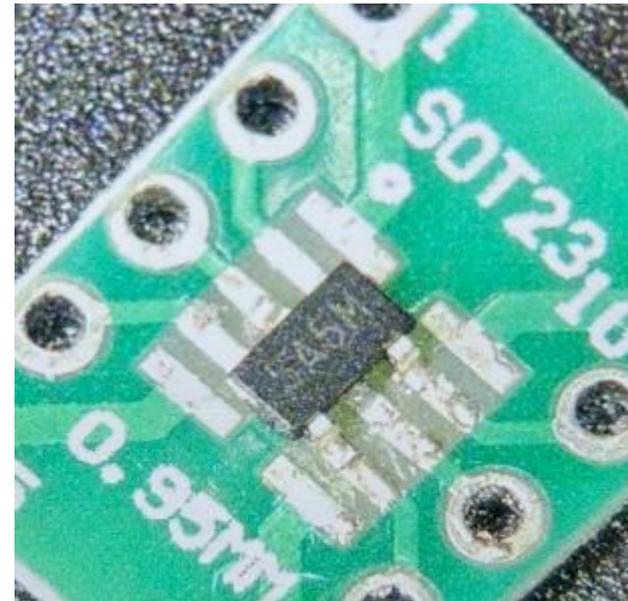
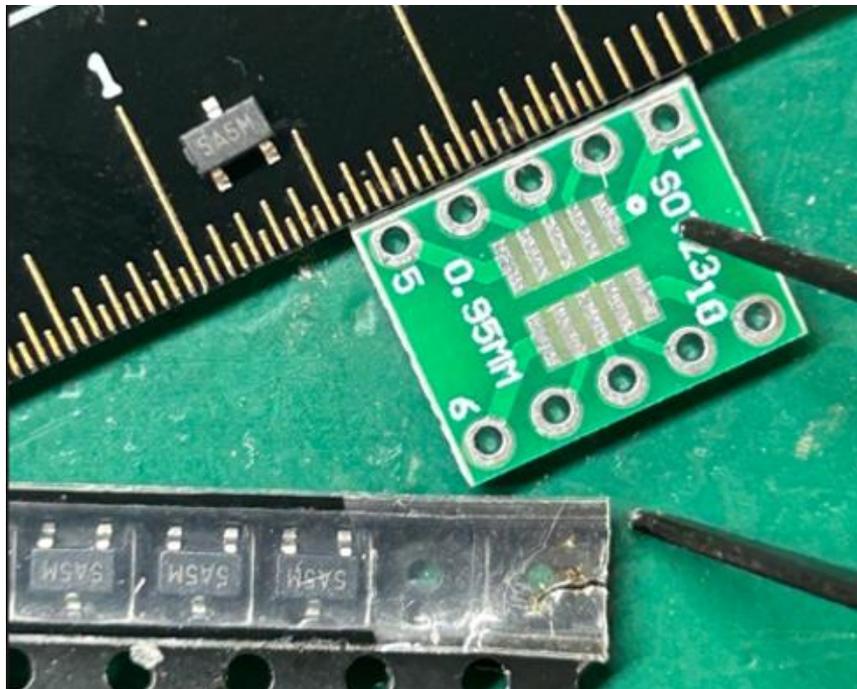
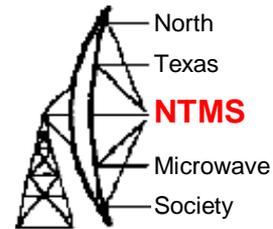
MSL rating defines sensitive
1-5, 5 most sensitive

If unsure bake your parts at
70 C 158 F for 2 hours.

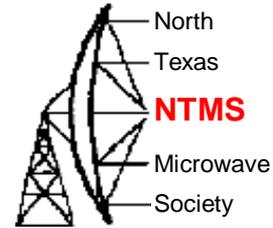


Demo

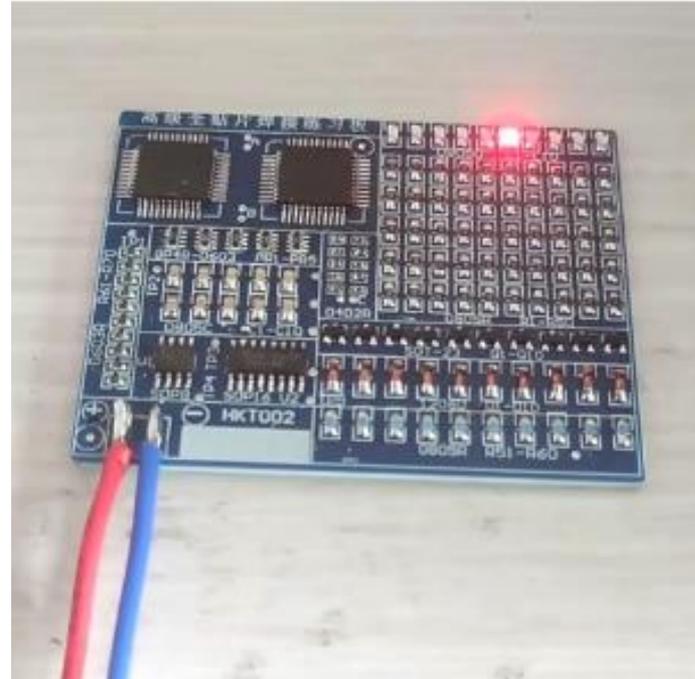
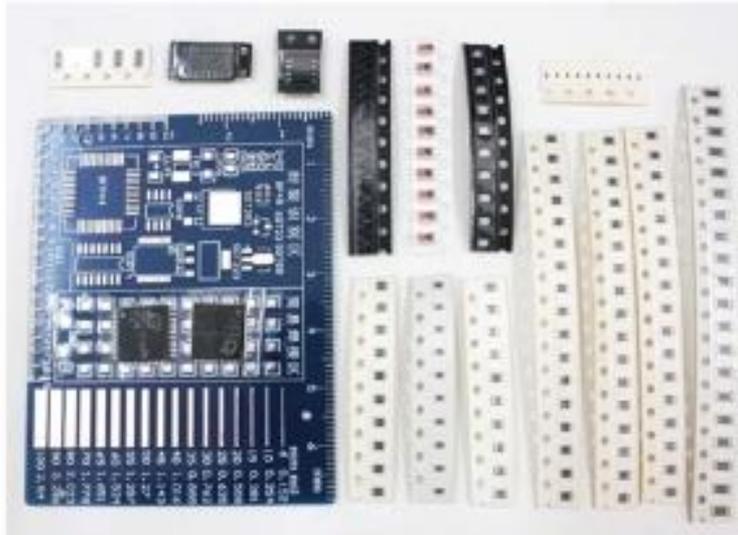
- Hot plate and hot air gun
- Clean up with Everclear

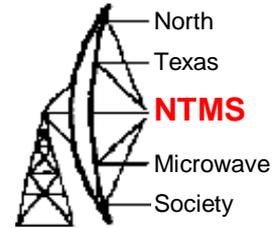


SMD solder kits given away (4)



Micro Soldering Practice Kit





Attendance: over 20

NTMS members: 10+

BBQ lunch followed the
last NTMS presentation

Other comments from
those who came to the
Hamfest? What did you
buy to take home?