
The NJ “Islander”

... an Elegant Pad Construction Technique

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“Some time last year, I wondered if it would be possible to do Manhattan construction by cutting the pad directly onto the substrate. The idea is really simple but would require exactly the right tool to be effective. So I started a hunt for a pad cutter ...”. The result is a 5mm diamond end mill that cuts beautiful 5mm “islands” in the copper and seems to last forever. With the construction advice of Jim Kortge, K8IQY, and the illustration genius of Paul Harden, NA5N, Dov AD0V explains how he found an ideal tool for creating “islands” for Manhattan-style construction. He calls it The NJ Islander”

I thought it would be interesting to share some of the blind alleys that I went down in my quest because it may help trigger some resource ideas for other problems that you may be trying to solve.

Never give up!

First, the most important point is not to give up. I have had a number of problems that I have worked on professionally that have seemed to evade solution. Very often, after one has lived with them for a while, one suddenly has an “Aha” experience. In a flash of insight one finds a path leading to the solution.

The problem that we are faced with is how to cut a circular path in the copper clad so as to circumscribe a pad of the right size.

I looked at the mechanical pencil I was using and pulled off the little metal cover at the back that protects the eraser. It is a hollow tube that is a little too large in diameter and is of course too soft to do the job. But it is a start. Okay, so how about finding a piece of metal tubing of about 4mm in diameter? Then cut it down to say 5cm in length and put it in a Dremel drill on a bench press. It will need to be hardened or have an edge put on it which will probably need to be constantly redone - which is undesirable. It may also be too wide for the miniature chuck - but let's at least start with this. So I walked through the local hardware store looking for something suitable. No tubing available in this size! I could try an automotive parts store but I bet a hobby store will do better. None in close proximity so it will have to wait.



Figure 1: The NJ Islander Bit ... an inexpensive, diamond-tipped 5mm end mill

Then I remember some soldering tips I've seen. They have a little barrel that screws onto the iron, which then tapers down to the soldering point. They still carry them at Radio Shack. If you reverse this and load the thin tip into the drill chuck, then the barrel is the right shape to make the circle. This is unfortunately no good because it's a little too large in diameter, too thick a cut and of course is made of copper, which is useless as a cutting tool. However, this is at least an example that I can use to explain the concept. Next time you go into a Radio Shack take a look at the soldering tips on display

and you'll see exactly what I mean. By the way, if anyone needs tips like this I would be happy to send you them to you free for the asking - I don't have an iron that accepts them and I am happy to say that I no longer need them as an example.

Solution while in the dentist's chair

In the meantime I had to see my dentist. This seems to be a constant state with me. Now we all know that dental picks are great tools to have in the shop for all kinds of work ... but there are lots of other goodies that your dentist uses that are great for the hobby. There are drill bits and grinding wheels and even those tiny root canal files (most of which are a little too soft for our use.) If you're friendly with your dentist he may be happy to give you some of his bits and pieces that are no longer good enough for his work but are fine for ours. Make sure to sterilize any used tools in boiling water and handle all sharp edges very carefully especially before you sterilize them. An alternate source is a dental supply house. I have one locally and they often have damaged merchandise which they sell fairly cheaply.

So I ask the dentist if he has any ideas for a pad cutter. He is intrigued by the idea and we bat around some possibilities but no solution presents itself.

Some other ideas that crossed my mind included:

- If you browse through a Harbor Freight catalog you will find hollow core punches - a little too big and clumsy.
- Use something like a compass or a pair of dividers with a cutting point instead of a pencil to score the circle - too clumsy though for a small circle and also too tedious.

I even checked some EMT supply catalogs - they have some interesting tools and great shears - but still no luck. While on this line of reasoning, a medical supply house, like the dental ones, are a great source of tools such as scalpels, rubber gloves, tweezers and hemostats.

A Piercing Thought

In the meantime my four year old is asking to have her ears pierced. I remember from my youth seeing a sign in ZS land out-

side a jewelry store that said, “Ears pierced while you wait!” and I asked myself - How else? Leave them there and come back for them in the morning? Anyway, many years back I bought a plastic gizmo that is a do it yourself ear-piercer. You load it up with the two supplied earring studs, which are sterile and have sharp points. Of course you have to have steady hands and find the correct position on the ear but it's fairly easy to do it yourself. It even pops the backs on the studs automatically. Well I can't find the studs for this gizmo and she really wants it quite badly.

That week I have a meeting in uptown Manhattan, not far from 47th Street, which is known as the diamond district in New York. The whole area is jewelry stores and related items. So I take a detour on my way back and ask a few stores if anyone sells these studs. I start to get the run-around from store to store like a treasure hunt - with no luck. Finally, just as my time is running out with my patience right behind it, someone sends me to a jewelry tool store. They have the professional guns for piercing ears and the refill studs. So I buy some studs hoping that they'll fit my amateur gizmo and then run for the subway.

When I get home, I can't find that plastic gizmo anywhere. You know the feeling ... saw it just last week but I can't recall where. Anyway it should turn up soon ... but it doesn't! In fact as of the time I am writing this article it still hasn't! But this is good because I decide to purchase the professional gun. The price isn't too steep and it will be useful for extended family members to use as well - if I don't misplace it.

Well I call them up to ship me one because I won't have a chance to get back uptown for a while - I'm stuck down in the Wall street area and can't spare the time for the round trip during working hours. Well, while I'm placing the order I wonder if they have something that can cut a Manhattan pad in copper. I won't go into the details of how I described what I was looking for - try to do this yourself without using your hands or any of Paul Harden's fabulous illustrations. I was ecstatic when he said that they

had something that may work. We discussed various sizes as he checked inside and outside diameters with a caliper. So we settle on 3 different sizes that he has in stock and he includes these in my order. They weren't cheap (neither is his rent) but I was happy to pay it.

So I now have three different sized bits to experiment with. One is definitely too large, the next one has a pad diameter of about 5mm and seems to work just fine. A neat cut and a clean pad, but it's slightly larger than what I want. The smaller one is 5mm outside diameter and about 3.5mm inside diameter. Perfect size! However, I discovered that it would rip out the center pad about 20% of the time. The small pad size could not maintain enough adhesion to the fiberglass backing to overcome the circumferential torque. So I went with the larger size when I ordered a couple extra of these. I wanted to get some expert unbiased opinion about their effectiveness. Of course after the order was placed, I tried some other boards and found that it held perfectly for all the drill sizes – I had just been experimenting on some poor quality board.

I shipped these bits together with a note of explanation to some of our world-renowned QRP folk to get their opinion. I got back a thumbs up from both George Heron and Jim Kortge together with some excellent suggestions. So my four year-old now has her ears pierced and we have the NJ Islander – not sure who is happier. George suggests doing a piece for QRP Homebrewer together with Paul Harden's excellent artwork and Jim Kortge's construction (after seeing photo's of his impeccable work we have to retire the term "ugly construction").

At about this time, a discussion of this idea was initiated by Bob Kimbrell, AC7BN, on the QRP-1 email reflector. If an idea is good, then it probably will occur to more than one individual. A number of ideas were posted but no elegant solution appeared. We were still not ready to release this as we had not yet procured a reasonable source for these bits and were still ironing out the kinks. So I emailed Bob directly with my solution and told him that the NJQRP club was hoping to source these to the community.

Be careful!

You have to use this in a drill press or the bit will just run all over the board and scrape it up! The desire was to have a bit without a center pin, as this would ruin the pad. Well, this obviously means there is nothing to keep the bit in position – hence the need for the drill press. You will not be able to hold it steady with your hand! I do not have a heavy-duty drill press – I am using this with a Dremel tool in a small "hobbyist" Dremel drill press.

You can do this right by setting the depth stop so that the cut just clears the copper. Once set for a given thickness this is foolproof. On the other hand, you can just use your intuition and cut until you see the fiberglass dust starting to appear. It does not take long to get the pressure right to cut the hole. If it's not enough to cut through the copper, then just apply some more pressure and you're done. However, if you do this in a rush you run the risk of drilling right through the board.

This is an excellent alternative for those of you who have complained about the vapors from heated crazy glue and the inevitable stuck fingers. However, take heed! You will probably be holding the board by hand. If you do drill too deep, the board could bind to the drill and spin out of your grip! A small board spinning with your hands in the immediate vicinity is instant disaster! Please think ahead and take it slowly.

I have done a lot of testing with many different sized bits and have never had the cut go through the board nor have I had even a partial binding of the board to the bit. However, as always, use caution at all times.

There is no need to worry about the pads interrupting the ground plane at HF frequencies. If this really worries you, then you can use double-sided board to overcome this. However, I suggest that if you worry about these things, then you will also worry about pad capacitance. (Have you seen those emails on the reflector too? Chuck Adams checked it out and that's enough for me. No need to repeat it – I trust his results implicitly). With single sided board there will be no capacitance effect with the pads!

As I mentioned above, I have been using a Dremel tool mounted in a drill press. It has a variable speed control and the speed (and hence the vibrations) will vary the neatness of the cut – needs some experimenting to get it right but it's not critical. Also, if one lets the drill stick out a lot from the chuck, it may have more vibrations and the circumference that is shaved will be slightly wider.

Be careful that no copper fillings get left in the groove and short the pad to ground. This can actually be a very insidious problem if you're not careful. Blow the residual cuttings and dust out of the hole or brush them out with a fine-toothbrush. To be sure, check that the pad is indeed isolated by using an ohmmeter. I can't stress this enough!

The pad does not stick up from the board, so the component's 2nd lead that is normally parallel to the board will have to either bend down at 90 deg over the pad or have a step in it. Take a look at the illustrations to see what this means.

The last point is that once a design is done, a paper template can be made. This will allow a copy to be produced by simply marking the template pads on the board and drilling them in one shot! Take about 2 minutes flat. Of course a misplaced pad is going to remain there permanently – you can't unglue it, and you just have to drill the new one in the correct position; but it doesn't look bad. One can also use a punched pad glued on top of it if one needs to move it only slightly. I think this beats punching and gluing.

The real benefit I got out of this was my correspondence with Jim Kortge. He not only gave me valuable feedback on the bit but gave me insight into a lot of other construction questions I had. He is a real gentleman in every sense of the word. I would like to end by quoting from an email Jim sent me:

"I tried it out last night down on the drill press, and it works great. I used my drill press running a moderate speed, and set the depth stop so that the drill only went a very small amount through the copper layer. No sense drilling the fiberglass underneath. I'd say the depth was on the order of 1/32 to 1/64th of an inch below the copper surface.

That seem to work quite well, and as I was doing the drilling, I kept some water on the surface, so that the softer copper would not clog the diamond cutter. There seems to be a bit of embedded copper, but that could probably be removed with a quick cut on a scrap piece of ceramic tile.

"The downside as you have remarked, is putting a pad in the wrong location. Two choices are available; re-do the pad at a different location, if that location is somewhat far removed, or glue down a small piece of 1/32 inch PC board material over the affected area, and redo the cut. Either one would probably be fine.

"I see the most use for the tool in rendering multiple copies of a board, perhaps after a good layout has been achieved, and several more like boards are desired. For example, that approach would have been very nice to use with the 2N2/40 project. As it was, the AZ QRP gang silkscreened the pad locations on a blank piece of PC board material, and sold that to help potential builders know where the pads were to be glued down. Having the pads already cut would have been terrific. I also thought that approach would be quite easy to setup on an N/C milling machine. The pad locations could be set up, and away you go. As many boards as you want, all with the pad locations where they are supposed to be."

I would like to thank George Heron for his continuous hard work that we are all constantly benefiting from. In particular for helping me to push this idea forward. I hope that we will soon see a directory in the NJQRP web site of NJ Islander templates, perhaps in pdf form, for all those great classic designs like Jim's 2N2/40 (how about it AZ QRP?).

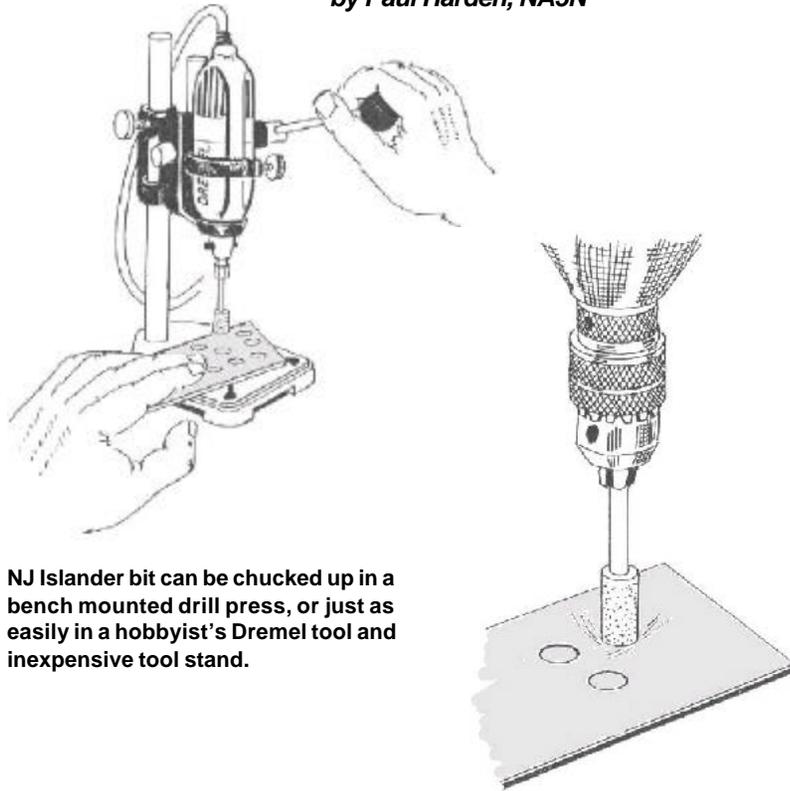
Finally, don't throw away your punch – they work beautifully for punching the front panel of your chassis for your controls.

Happy cutting!

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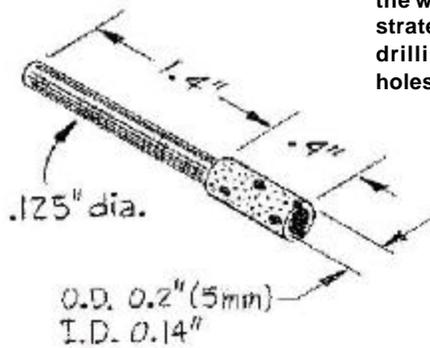
Using the NJ Islander

by Paul Harden, NA5N

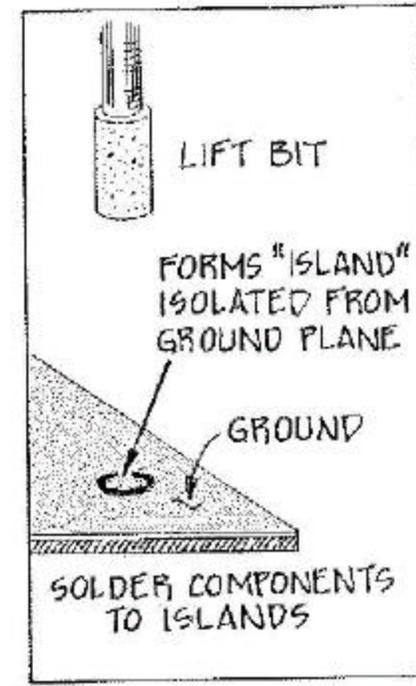


NJ Islander bit can be chucked up in a bench mounted drill press, or just as easily in a hobbyist's Dremel tool and inexpensive tool stand.

It's important to drill the islands perpendicular to the board to prevent "bit walking". A little water on the cutting surface helps. Be careful not to cut all the way through the fiberboard substrate, and to carefully clean out the drilling debris from the circular holes.

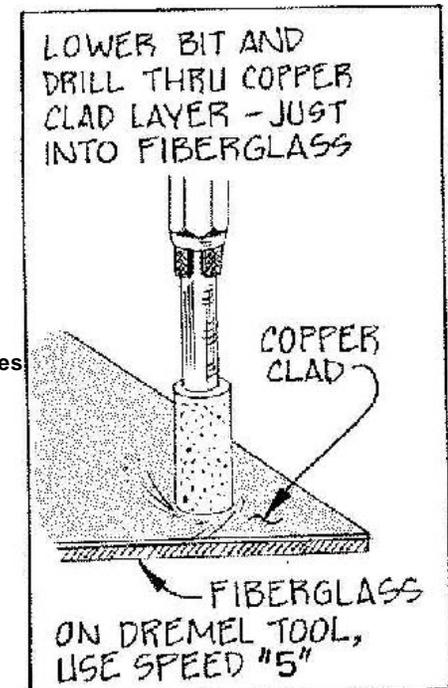


NJ Islander bit dimensions



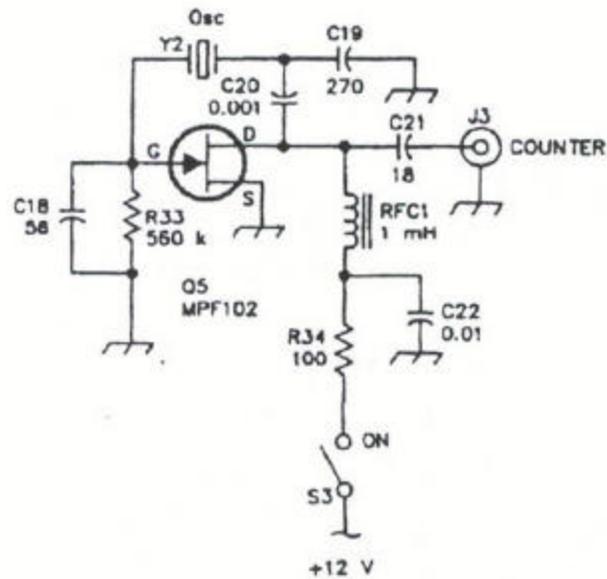
NJ Islander bit creates an "island" from the surrounding ground plane. Components may be soldered to the island just like when using Manhattan pads.

Make the island cuts at 90-degrees at Dremel speed "5".

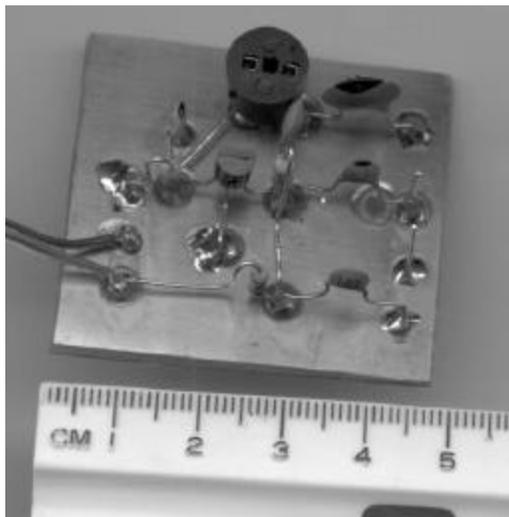


A Circuit Constructed with the NJ Islander

Jim Kortge, K8IQY



“Standard” Crystal Checker, per ARRL Handbook



Notice clean-cut “islands”