

Counterfeit Transistors (and more)

Counterfeit components identified so far

MJ15003/4 Power Transistors

OP-07 Opamps

2N2773 Power Transistors (probable)

2SA1302 and 2SC3281 (Toshiba) Found by a reader in Malaysia. The printing is (apparently) totally different from the real thing. The ones seen are marked Toshiba.

LM3915 LED VU Meter [new](#)

... and just in case you thought that this was a conspiracy affecting hobbyists, read this article from [EDTN](#) - the cost is in millions, and that's just in the US!

So, off you go to the local parts shop to buy some transistors (or indeed, other parts!). Having decided that MJ15003/4 devices fit your needs (these are rugged and powerful devices), you hand over a not insubstantial amount of cash and head home to build the masterpiece. Inexplicably, the expensive output transistors fail, but you know that their ratings are well within the design limits for the project you are building. This happens once, maybe twice, or perhaps more. You get discouraged, and shelve the project - having already spent quite a lot on all the parts needed.

Even worse, during testing, the transistors are (or seem to be) fine, only to fail later taking your expensive speakers with them. Now it is *really* serious.

So is the problem a bad design? Very probably not. It has been brought to my attention that counterfeit power transistors are available (again!). Don't bother re-reading that - you saw it correctly. Counterfeit power transistors !!!

The first instance (that I know of) of this was in 1980, when MJ15003/4 transistors were sold under the brand name "TIC". These, and many similar counterfeits were in fact 2N3055 and MJ2955 aluminium cased devices, and they (the counterfeiters) had removed the original markings and screen printed the fraudulent type numbers on the cases. Why? Because 2N3055 and MJ2955 devices are cheap, and genuine MJ15003 and MJ15004 transistors are not.

My informant tells me that only recently someone in New Zealand bought some "MJ15003/4" transistors with an amplifier kit, and they failed. I am waiting for some more information on this topic, and will add it when it is available, but in the meantime

- Beware of MJ15003 and MJ15004 transistors in aluminium cases (genuine Motorola devices use steel cases, and have done since 1982). Don't count on this, though - there are fake Motorola devices in steel cases too.
- Test the markings with a solvent (such as acetone - nail polish remover). Most genuine transistors are marked with non-removable ink, counterfeit devices may be marked with normal screen printing ink that comes off easily.
- Test the breakdown voltage with a transistor tester if one is available. Genuine devices are rated at 140V, but will usually be higher than this. Counterfeit transistors will generally have a much lower breakdown voltage. The latest batch will actually pass this test !
- Ask for confirmation from the supplier that the devices are genuine. Feel free to refer them to this page if they claim you are mad :-)

When I have more information, I shall ask one or more of the local suppliers (who may be inadvertently selling counterfeit devices) to check the authenticity of their stock. I will not name the supplier(s), as it is quite probable that they are innocent, and have been defrauded along with everyone else. Needless to say, I cannot do this checking with any supplier outside Australia, as I do not have ready access to the components they sell or to anyone who might know something.

One Australian supplier (so far) has a "Stop Sale" on their computer for these devices, so it has been noticed by them, at least. In particular, look for a manufacture code of MEX190, with the date code 9H34. Some of the counterfeit devices even have the wrong polarity (an NPN MJ15004 - I don't think so!).

Double Headed Duds!

I have been advised that the frauds - or at least some of them - have two transistor silicon dies internally, wired in parallel in a desperate (but futile) attempt to meet the specifications. These are both quite small for the claimed power rating, and are directly bonded to the steel case. The use of two dies is in itself most unusual, but they are not even bonded to a copper "coin" as is the normal practice, so thermal transfer will be much worse than it should be, and thermal expansion coefficients possibly place the silicon at much greater risk of cracking - not from anything the user does, but from normal heating and cooling cycles.

I managed to convince the salesperson at an electronics outlet to sell me one of the "MJ15003" devices, despite the "stop sale" warning from the computer. This is fine, since I already explained why I wanted one. Most discouraging was that the salesperson obtained "advice" from someone else in the store that the one I had (MEX190) was genuine. Well, excuse me. There were some others in the drawer that looked as if they might be real Motorola devices, but not these.

I got it home, and promptly ran some tests before I cut the top off. Gain was (barely) passable at 25 at 0.5A, and the breakdown voltage was above the 140V rating. Then I removed the top, and guess what I found? If you said "Two dies?", you are quite correct. They are exactly as described to me - two small dies, bonded directly to the steel case, and wired in parallel with what I thought were rather flimsy bonding wires. The whole construction was coated with a thin layer of silicone.

I have e-mailed Motorola for more, and to find out if this is a construction method they have ever used. No answer as yet, but I think I already know the answer.

Given the sophistication of this fraud, it seems more than likely that these transistors are made in a proper fabrication plant, rather than just being relabelled junk or factory rejects. The construction overall (of my sample at least) was quite neat, and was obviously performed with the proper equipment - if I were to go to that much trouble, it would be worth the effort to use the correct die in the first place! This begs the question of where they come from, and I for one would be very interested to find out. From the latest information to hand, China and India are implicated.

One way to be sure that you have the real thing is to buy ONLY from accredited and authorised Motorola distributors. This may be irksome for home constructors, as these dealers usually have a minimum order value (locally it is AU\$100 but will vary in different countries). It is not known at this stage how widespread the rort is, but I have received information from Canada that a similar racket was found there about a year ago. If anyone has further information to add, please [e-mail me](#).

Latest News

Some info received from a local supplier in response to my e-mail (reproduced verbatim) ...

Dear Mr. Elliott,

Thank you for your email regarding the above matter.

We have already been alerted to the problem about a couple of weeks ago when it was first noticed that some of the MJ15004 were found to be incorrectly polarised - that is, NPN instead of PNP. Our suspicions were raised and we proceeded to cut the devices open, finding their internal construction to be as per your description. Not only that, the chip dies were smaller than the known genuine Motorola types and the internal finishing was abysmal - not the usual high standards that is expected of a Motorola device. The counterfeiters were, fortunately, not too professional and it was possible, on close inspection and comparison to a genuine Motorola device, to tell them apart.

From our knowledge of Motorola manufacturing processes, such a shoddy quality would never have been passed and they are definitely not from Motorola. Upon ascertaining this, we contacted Motorola or rather, ON Semiconductors in the U.S. and notified them of the counterfeits. Together with that, we also provided them with whatever information we have on hand regarding the source trail of our stock which came through a local Australian importer who brought them in through an until-now trusted source in Hong Kong. We have little to doubt the trustworthiness of our supplier as we have been dealing with him for a number of years without any problem encountered. From ON Semiconductor's reply, it would appear that they are already aware of the existence of a counterfeit ring operating out of India and China. We have left any further investigations that ON Semiconductors may want to carry out with them on an international level.

There was some more information regarding store policies that I shall not disclose, since this may identify the supplier to locals, at least. I was suitably impressed with the explanation and the efforts taken to fix this problem, and can only hope that other suppliers are equally responsive.

New: Oct 2000 Dick Smith Electronics Issues "Motorola" Recall Notice

Australian electronics retailer (and wholesaler) Dick Smith Electronics has issued a recall notice on the fake Motorola transistors, and provides a detailed description of how to identify the genuine article from the frauds. This is a good move, and offers some hope to the poor purchaser, however so far no-one else has even acknowledged that this fraud exists, despite that fact that at least one Sydney based firm is still happily selling the counterfeit devices. This is a shameful situation, and one that I would like to see corrected as soon as possible. I am not about to hold my breath, as I expect it will be a long time (if ever) before the others admit their mistake (assuming that it actually *was* a mistake!)

To all other Australian resellers ...

Come clean, admit your mistake, or prove to your customers that you have never stocked counterfeit components. Please! This is not a big thing to ask, and will go a long way to proving that you value your customers and their custom. If not, you will be seen as the baddies, and rightfully so if you continue to defraud your customers!

Until further notice - beware.

Where (or What) Next?

I received an e-mail from a reader in India, who purchased some premium opamps (at a premium price, naturally). Having paid for OP-07 opamps, one would be disheartened to put it mildly to

discover that they were really 741s. I don't know if this has happened anywhere else, but it is fair warning that you could be next.

And the Saga Continues ...

So now we have Toshiba branded 2N2773 power transistors. This in itself is interesting, as a search on the Toshiba site reveals that they don't even seem to make this transistor! It would be unusual for a Japanese manufacturer to make a "2N" device at all, but doubly so since this is a very old device now, and seems to be discontinued from just about every other maker.

Again, these have all the "earmarks" of counterfeits - and naturally enough someone was caught out, and his amp failed with these transistors installed. If you happen across any of these components, be afraid - be **very** afraid!

From a reader ...

"Add 2SA1302 and 2SC3281 (Toshiba) to your counterfeit list. I found them (counterfeit ones, that is) here, in dinky Malaysia! The ink printout is totally different from the real thing, being WHITE in colour."

Toshiba plastic transistors are usually marked in white, so this could be misleading. However I do know for a fact that Chinese (unbranded) 2SA and 2SB devices are available, but these make no pretense at being Toshiba. Perhaps someone has bought the Chinese ones and "branded" them as Toshiba - a worthwhile effort for the criminal element, since the Chinese devices are quite cheap.

Since the Chinese devices are not branded, they cannot be deemed counterfeits, but what sort of quality you could expect is anyone's guess, so one should be wary. It is possible that these transistors are OK, but equally they may be completely useless.

... And Still They Come ...

From a reader in India, and reproduced (almost) verbatim:

I was reading the article about duplicate/fake transistors. Well, they started faking ICs too!. Don't get me wrong though. I live in India. In my best knowledge, there are no IC/Transistor making factory anywhere in India. So I don't think the fakes are MADE here. But there is a possibility that India is a kind of dropoff-point.

The real purpose of this mail is to add one more IC to the known frauds. (Hundreds more maybe there). I bought this IC, LM3915, supposedly made by National Semiconductor for your LED VU Meter project. It costs about 50Rs (our currency, that's about \$US1.00). But it burned out the instant I connected it to the 15-0-15 supply. I bought another one from another store. It looked a bit different. Anyway after reading your article, I got suspicious. I used a simple knife to remove the top cap like thing of the IC (Normal ICs cannot be stripped like that).

I found another IC. When I scratched the silicon, I saw what I was expecting, LB1405. A vastly inferior (in my experience) and cheap IC. I got ripped by 5 times

the cost. I might not have found out this if I didn't power it with 15 volts. I don't know how 'THEY' managed to do this. But it wouldn't have worked anyway. The pin configs are very different. I showed it to the store owner. He discarded it as my mischief. But I couldn't help my poor friend who was making a 10 channel EQ. Poor fellow. He burned out all of the ICs he bought from this store. He doesn't have the budget to replace all the chips. So he's using the EQ without the VUs. Poor chap.

The above was actually received some time ago, and I forgot about it. I have now remembered :-
) As you can see, this is widespread, and many store owners are unlikely to admit that they have fraudulent stock.

I think I can say with reasonable certainty that this is the tip of the iceberg. How much reject stock (factory 2nds, out of tolerance, incorrectly marked, etc) is gathered up by unscrupulous dealers and sold off as 1st quality? My guess is - a lot.

Always remember ... Any deal that **seems** too good to be true almost certainly **is** too good to be true!

06 Jun 2001 ... and now, two more reports (reproduced verbatim)

From South Africa ...

I live in South Africa and build audio stuff for a hobby (sometimes making the odd amp for a friend and I am presently finishing a friends amp.) I was surfing the web and stumbled onto your site again. Having looked through all the project stuff, I finally went onto the editorials and came across the counterfeit transistor story.

The hairs on the back of my neck started to rise the more I read because the amp that I am finishing is using MJ15003/15004 output devices, but I was at work and had to wait till I got home to check what devices I have installed in the amp. Needless to say they seem counterfeit, see attached jpeg image file, with MEX190/MEX1CO as the place of manufacture and 9H34/9R32 as the date codes (as per Richard Freeman's email to IndustryCommunity.com). I have as yet to open these device but I am sure that they will have two dies internally, when I get the time I will open them and take a photo of the internals. So the counterfeit devices are not only confined Australia, but are probably available throughout the world.

Note: The JPEG image I was sent confirmed the devices are fakes :-)

... And Canada ...

About three weeks ago we received a batch of transistors from Digikey... To be more specific: 2N3773's... (about... 100 of them at \$1.25 ea.)

I have worked with the original MOT's and I know the way they are built and labeled. These "new" parts, didn't look like anything I have ever seen, and I have been in this field for almost 20 years working in audio related goodies.

The Manufacturer: MEV (you tell me if you know them)
Case: Steel or something like that

The finishing: lead immersed. the whole case looked as if it had been immersed on molten solder to "give" it a "silver coat" look alike. (the pins even looked as if they were used devices and had been cleaned off to strip excess solder material.

The label (markings): looked like cheap paint barely stamped onto the top of the case. some acetone and it rubbed off. (YIKES!!!) And it looks like this:

MEV
2N3773
94N3

And, if this wasn't scary enough yet, here's the best part of the movie...

I installed one new pair on a switching amp used on a GE servo. Each board makes 1 half of an H Bridge. So a total of two boards are necessary to form a dual direction servo unit (Each amp uses a total of 12 2N3773's for a total of 90 Amps at 90Vdc, at full load when the trannies are completely either on or off depending on the direction of rotation) all the original devices on the amp were ok, except two that were shorted. After double and triple checking of the board, I installed it on a test bench we have built. (to simulate the working conditions required by GE's service manuals).

The "new" trannies lasted 15 seconds... they started off fine and gradually deteriorated until they went off with a bang!!! The rest is history... replaced them again with two more from the same batch and they worked for an hour...

So I decided to crack the first pair open... (considering i had read your stories on your website...) The Dies are smaller than those of a 2N3055. 25% smaller than the original Motorola devices.

Silicon is Silicon any way you slice it and (normally; did I hear... counterfeit???) current densities are the same from one device or manufacturer to another... Regardless of it's use or purpose. Once you go beyond this set parameter, you're in trouble. Even worse if the TO-3 case (like this aforementioned device) has a coin no bigger that 1 CM wide by 2.5 mm high. (Yes I love Metric system too)

Footnote: I just remembered another device I ran into that same day... A 2N3055 (supposedly MOTOROLA, as it was labeled. Yet the ink used for the label was the cheap kind.) that looked almost identical to a genuine MOT device, BUT it was made in MEXICO. So far that sounds believable... Right???

Wrong!!! I opened the casing after i had blown one up at only 6 amps, and came to see that the die was slightly bigger than that of a TIP 41C. Like I might have said before, I know very well the dies in these devices. I cracked many of them open to see their guts after they blow. Weird, eh? No coin, or any internal heat spreader at all. The chip looked like it was glued to the case. No traces of the usual solder material that's normally used.