

Converting modern Tubescreamers into the real 808 version

This is one of the most discussed subjects and a lot of nonsense was written in the past ... if you want to take place in this discussions you will find them in almost every fx-related webpage with a message board or a forum, enjoy ! You will find out that 10 people will have 10 different things to say. This paper here is not to reinvent the wheel, it´s simply a collection of facts and things that are based on experiences with Tubescreamers. Follow this step-by-step guide and convert your modern Tubescreamer pedal into the real 808 version if you like this sound. If you like your stock sound ... do something different ;-)

The resistor and IC mojo

The two things that are discussed mostly are the resistors for this mod and the correct IC (aka "chip").

Resistors

You will need some resistors to do this mod and an often discussed subject is wether to use the old carbon comp resistors or the modern metal film ones. Some selfproclaimed TS-gurus swear on the old-style carbon comp resistors with horrible tolerances and you can find a lot of words for this, it´s called "brown sound", "vintage mod" and whatever else. They say that´s the real material for this mod because the original 808 was also equipped with this resistors. The others swear on modern metal film resistors because they have almost no tolerances and can help to reduce noise in a pedal.

Here are my two cents we are talking about two (2 !!!) resistors you have to change and I doubt that it´s audible if you use carbon comp or metal film resistors for this mod. I think it would make a difference to change all resistors to carbon comp but only two I tried both and I can´t hear any difference. And did the original 808 really had all carbon comp resistors ? Well, nobody seems to really know this exactly but for sure no modern TS has them !!!!

IC (chip)

A lot of discussion is about the correct IC and you can also find a lot of twaddle about this subject. A good thing is to desolder the IC and put in a socket, so you can try different IC´s and see what you like best. As for the discussion about the "real" and "correct" IC for this mod, please read what my friend Andreas Möller has to say on his personal webpage

"The original TS-808 chip"

The JRC4558D is claimed to be "the original TS-808 chip" - not only by people peddling surplus NOS units on eBay, but moreso by regular people who have heard this, and perceive it to be true. Let's put this issue to rest once and for all: **there is no single "original TS-808 chip", ok?**

The TS-808 was shipped with at least three different op-amps during its lifespan - probably due to what was available at the time. The schematic simply calls for a 4558, which is a fairly standard dual operational amplifier, which can be had from several manufacturers. The Japan Radio Company was/is just one of many such manufacturers. As a result, many of the TS-808's were shipped with the TI RC4558P, a cheaper malaysian version produced by Texas Instruments. Other TS-808s used the JRC version, while others still had a TL4558P. I haven't heard the TL version myself, as there seems to be relatively few of these around, but the other two sounds very similar. While it's the JRC chip that has gotten all the attention, some of the awesome-sounding TS-808s have had the RC4558P chip inside...

To NOS or not to NOS?

I've stated this before, but for the sake of it, here goes... Let's start by making two assumptions:

- You hold in your hand two prime examples of the same op-amp. Same designation number, same manufacturer, same specs. One was manufactured some 20 years ago, while the other just came off the line.
- These two op-amps were manufactured using the same production line, and that their specs haven't been "improved" somewhere along the way.

As long as these two conditions are met, there will be no difference whatsoever between a new, unused op-amp that was manufactured in the '80s, and one manufactured yesterday. Integrated circuits don't change with age, like electrolytic capacitors do, they only change with use (and even that isn't a certainty). Now, since NOS - that most coveted of labels - simply means New (as in "never used") Old (as in "manufactured long ago") Stock (as in "has been sitting in a warehouse somewhere"), a NOS op-amp is just as new as a "new" one...

Hence, putting that NOS JRC4558D op-amp into your reissue TS-9 will not turn it into that awesome-sounding 1981 TS-808. It will get you closer to what that specific 808 might have sounded like 20 years ago, but unless you find an op-amp that has seen 20 years of use, you will not get there...

Unless you need to know that you have "the real thing" in your pedal, there's no need whatsoever to chase after that NOS op-amp. There's no need to pay top dollar (\$15 or so isn't unusual for an '80s NOS JRC4558D, but I've seen them advertised for as much as \$45) either, when the same part will cost you 50 cents at Small Bear. But... if only it was that easy. Remember the two main op-amps found in TS-808's? For some reason, only the JRC chip has been elevated to "NOS" status - there seems to be no real market for NOS RC4558P chips, even though some of the best-sounding TS-808's used them. Upon further investigation, we find that their production histories differ somewhat, which means that they might not meet the two conditions as outlined earlier.

TI RC4558P vs JRC4558D - what's the story?

As mentioned earlier, there were several different types of op-amp chips used in the TS-808 and TS-9 - all are of the general 4558 type, but from different manufacturers. This feature only focuses on the two main contenders - the 4558D from JRC and the Malaysian-made RC4558P from Texas Instruments. However, I'd like to start out with a brief chip history.

TS-808	TS-9
JRC4558D	JRC2043DD
RC4558P	TA75558
TL4558P	JRC4558D

As we can see, there were at least three different chips in use, in each of the pedals. In the case of the TS-808, the TL4558P is by far the rarest, with the other two being used rather randomly, as it would appear - they both appear all over the timeline. With the TS-9, the timeline is clearer. For some reason, the first TS-9's had a 2043 chip from JRC, instead of the others that worked so well before. After that, they switched to yet another previously untried contender, this time from Toshiba (the TA75558), before switching to the JRC4558D. For the last production run, they switched once again, this time back to the TA75558 - which incidentally is the op-amp that is used exclusively in the reissue TS-9's. With that established, we need to look at the two main contenders here, and what happened to their production lines. Pictures are of original '80s items - current production looks slightly different.

- Texas Instruments RC4558P (Malaysian) - this chip has been in production in Malaysia ever since the time we're interested in (late '70s - early '80s), and the factory hasn't changed much since. As previously mentioned, there seems to be no market for NOS RC chips, and this may well be the cause.



- Japan Radio Corporation JRC4558D - this one has a slightly different story, as it happens. In the early '80s, JRC churned out millions of these chips, and they appear in virtually every piece of Japanese electronica from this period. The company later (mid-to-late '80s) changed their name to NJM, and moved their production facilities to East Asia. They continued to produce 4558 op-amps - aptly named NJM4558D - but since the factory was moved and new production equipment brought in, it wasn't the same. A few years later, NJM started re-issuing the JRC4558D, but not produced at the old plant, sadly. The specs are the same as the old one, but the suspicion still lingers - since they changed facilities, are the reissue chips really as good as the old ones? If anything, the doubts has made room for a NOS market.



So... what to do? If you ask Robert Keeley - whose opinions and taste I definitely trust - the reissue JRC4558D is only fit for the bin, whereas the NOS units are just fine. For most of his work, though, he uses the current-production RC4558P, as it is his favourite. Analog Man takes a different approach - he will happily install the RC chip if you ask for it, but his own preference is for the new JRC chip. And he doesn't seem to be the least bit interested in NOS chips at all...

So, is it in the chip? Or, what is it that makes the difference?

In some cases, simply replacing the op-amp chip will make a definite improvement in tone. For instance, the reissue TS-9 uses the same Toshiba op-amp as some of the later original TS-9s - the TA75558 - and though it is a lower-noise, higher-spec version of the 4558, it doesn't seem to suit this purpose very well. Replacing one of those with any of the usual 4558 op-amps will make a big difference, no doubt. But from there on out, once you get one of the "good" chips in, the differences gets increasingly marginal. Scott Henderson once said, upon having tested a RI TS-9 modded to 808 specs - using the reissue JRC4558D, to boot - that it sounded much better than his original TS-9 - despite the fact that his pedal had the original JRC chip... Apparently, once you get one of the proper op-amps in, it's the two resistors in the output section that make the big difference.

And do remember that the op-amp has very little to do with the actual clipping in a TS circuit. It's just there to amplify the signal - the diodes to the clipping. Changing one or both of the diodes will make a huge impact on the overdrive character, while the differences incurred by different op-amps are minute.

To complicate matters further, there are also other differences between the pedals that we haven't even begun to touch - for instance, the pots used in the TS-808 are vastly different from those in the TS-9. Their values are the same, but their looks and construction are different. Also, the capacitors used in the different series (TS-808, TS-9 and reissue TS-9) vary - and sometimes they vary within the same model/year as well, for the same reasons that the op-amps varied.

Conclusions

Several thoughts and hunches have surfaced during my writing this piece, and to some extent - and on certain issues - I have actually changed my position somewhat. Here are my findings:

- Basically, the RC4558P produced today seems to be exactly the same as the early '80s ones, whereas there seems to be some merit to the claim that the JRC4558D manufactured today isn't quite the same as the '80s units.
- If your pedal is a reissue TS-9 or a TS-9DX, it will definitely benefit from an 808 mod. In fact, any TS-9 with the TA75558 chip will improve a lot. Slighter improvements will be had from TS-9's with the JRC2043DD chip - even though some claim it to be a "bad" chip, it's not that bad... And if yours has a JRC4558D chip, you will still notice an improvement if you change the resistors to 808 specs.
- When shopping for a suitable op-amp, consider the RC4558P from Texas Instruments - you will only pay half a dollar, and it's just as good as the ones that came in lots of the TS-808's. Also, don't hesitate to try the current production JRC4558D - after all, it's good enough for Analog Man... The LM833 is an outsider, which is reported to have a smoother tone.
- If you decide to get a NOS item - make **very** sure that is what you're actually getting. '80s JRC chips has a four-digit date code in the lower right-hand corner, and they are shiny. Reissue chips have five digit codes, sometimes with letters, and are matte-finished. Don't pay more than \$15 or so - there's no need to inflate the market further. For that price, you should get a complete kit with op-amp and socket, resistors and instructions. And again - look carefully at what you're getting. You won't have to search long on the Internet to find mod kits with reissue JRC chips, selling at \$15 or above - remember, that's an item that costs 50¢ at Mouser...

So after knowing this it's up to you to decide what to use. As mentioned before, it's a good idea to put in an IC socket and try different chips to A/B them. You can also put in sockets for the two resistors to try different types and materials. As for me, I have an old TS-10 and TS-9, both have an IC socket and metal film resistors for the 808 mod and they sound great (as long as you like the mid-humping sound of them). My TS-10 still has the original old JRC4558D IC it came with, I desoldered the IC and put in a socket to have the possibility to change the IC. My TS-9 came with a 2043 chip from JRC, I desoldered it, put in a socket and a new RC4558P, great sounding chip. I also built a true-bypass Tubescreamer clone, all with metal film resistors and film caps, as well as some silver mica caps. I also used an IC socket with the RC4558P chip here and I'm more than pleased with the sound.

So know that you know all about the parts we can start to take a closer look at the TS and how it works. For this there is nothing comparable out there to Mr. R.G. Keen's article about the "Tubescreamer anatomy". It's published on his GEOFEX webpage (www.geofex.com) and the direct link to this article is:

www.geofex.com/Article_Folders/TStech/tsxfram.htm

Do yourself a favour and read this article carefully and more than one time. It's absolutely worth the time and you will understand how this tone machines really work.

So let's start and modify a modern Tubescreamer to the original 808 specs. First of all it's the IC - don't forget it's your stombox and you have to decide what to do. After reading until here you know everything about this subject and it's only up to you what to do. First and foremost you should put in a socket so you can try different chips to see what you like best.

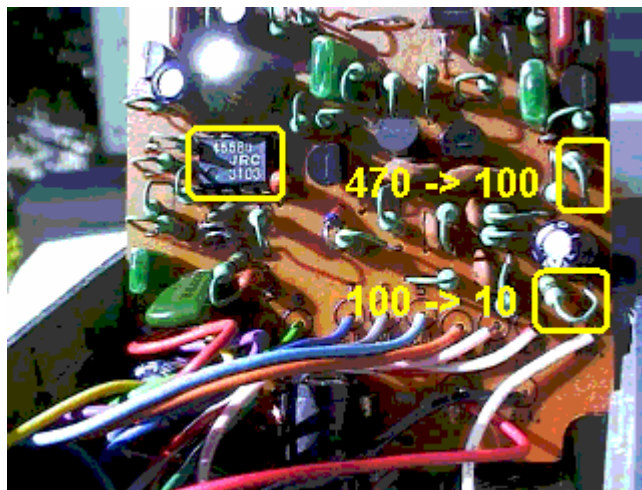
Second thing is to replace the two resistors in the output section of your TS, this is different from model to model and is according to the year it was produced, let's see we have TS9, TS10, TS5, TS7, TS9 reissue and TS808 reissue. Besides the TS10 (that model requires some more work to modify it, more later ...) modding is very easy. Decide on the resistors you want to use (carbon comp, carbon or metal film), heat the soldering iron and here we go

TS-7

1. Desolder the IC chip and put in a socket
2. Flip in the IC you like or you want to try
3. Desolder resistor R55 (470 ohm) and put in a 100 ohm resistor
4. Desolder resistor R58 (100k) and put in a 10k resistor

TS-5 / TS-9 / TS-9 reissue / TS-808 reissue

1. Desolder the IC chip and put in a socket
2. Flip in the IC you like or you want to try
3. Find the 470 Ohm (yellow-purple-brown-gold) and 100 kOhm (brown-black-yellow-gold) resistors located on either side of an electrolytic capacitor at the edge of the circuit board on the output buffer transistor. Replace the 470 Ohm with a 100 Ohm resistor (brown-black-brown-gold) and replace the 100 kOhm with a 10 kOhm (brown-black-orange-gold)



TS-10

1. Desolder the IC chip and put in a socket
2. Flip in the IC you like or you want to try. When you own an early MIJ TS-10 chances are good that it contains the original old chip !
 - a. There is an extra transistor in the signal path when the effect is in the OFF position on the TS-10. Remove the 10K (R40) and run a jumper from the end of the 1K (R39) resistor furthest from Q6 to the end of C15 nearest Q6. Then remove transistor Q6.
 - b. Replace the output resistors. The 470 Ohm resistor (R21) connected to the output socket via a 10uF capacitor gets changed to 100 Ohm. The 100k resistor (R22) from the output to ground is changed to 10k.
 - c. Short out R6 and C11. Remove R17
 - d. Regard that 4.7K/0.047uF network on the (-) input of the clipping amp. Increase that cap to about 0.1uF. The (-) input is pin 2. (BROWN Mod !)
 - e. In the TS10 the external DC adapter connector is prone to cracking either the solder or the board where it's soldered on. This can lead to intermittent operation of the unit, as the normal battery power goes through there as well. To fix this, open the unit up and examine the power jack and board immediately around it. If you have solder cracking, just remelting the solder with a touch of an iron and a little fresh rosin core solder will fix it right up. If the board itself is cracked, just remelting the solder will temporarily fix it by bridging over the crack, but solder is a very poor mechanical material and it is likely to crack again through the solder. In this case, use a bit of resistor lead on the traces, bent to shape and soldered in place for a ways back from the connector leads. It's a good idea to shape the resistor lead into a tight loop around the power connector leads for more support. Solder the resistor lead along its entire length for 1/4" or so along the trace leading away from the connector. The resistor lead is tin/solder plated soft steel, and will mechanically support the connection.

There are tons of all kinds of mods available at the internet, just do a search or visit the corresponding webpages and you can shape your TS into a very personal and individual sounding tone machine. Everything is possible ... more or less bass, more or less gain, more or less mid-humping, different clipping behaviour

A very good mod I suggest is to change some non polarized and tantalum caps to film caps to quieten the pedal and to receive a much clearer and transparent sound. You can find out more about this at the GEO webpage at the Tubescreamer article mentioned above.

To close I would like to show you some pics of my modded TS-10, the red plastic caps are the film caps I talked about just a minute ago - a very good mod that I highly recommend !

