SMD / SMT chip (de)soldering guide

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This guide is based on my experience with TSOP chips while unbricking badly flashed devices such as WiFi access points, routers and repeaters or BIOS. This is a last resort procedure. Extreme care should be taken, especially if you are not familiar with surface mount devices (SMD) (de)soldering.
The soldering iron's temperature is at least 350°C (662°F). You can imagine what could happen to you if you touch anything that is (or still was not long ago) in contact with the soldering iron. If not, you really should consider not following this guide, and let someone experienced do it instead.
Don't hesitate to watch videos or ask for help around you if you don't feel confident with some steps, or all of them.
Take some time to search for soldering safety guidelines on your favourite search engine.
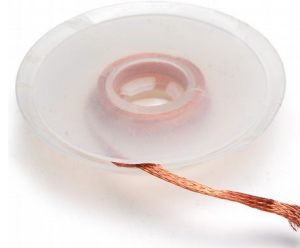
1. Bill of materials

You will need a few common tools, be sure you have everything before going any further. The quality of your works mainly depends on the quality of your tools.

| Soldering iron | Solder: 0,5mm (approx. 0,02in) | Desoldering braid | Cutter blade | Adhesive tape |

I did not accidentally put a picture of a Weller soldering station. I have used cheap soldering irons in my childhood and I can tell you they are not appropriate for working on SMDs. Well, actually I don't believe they are appropriate for anything else either but that's just my point of view. You can chose to give it a try anyway, and you might get good results with such soldering irons, but I prefer to warn you.
I would also recommend to use leaded solder if you own a 50W (or less) soldering iron, because of its lower melting point.
You can use anti-flux or 90% alcohol to clean the PCB and the chip but you must ensure it's totally evaporated before using the soldering iron in the cleaned area. A used hard toothbrush will help to scrub and get rid of dirts.

2. Identify the Flash chip

This might seem obvious, but you don't want to work on the wrong one, then do everything all over again with the right one. Moreover, you'll have to reprogram that chip so you'd better be sure you can do it before going any further.
Take a clear picture of it with its nearby components to remember the chip's position.
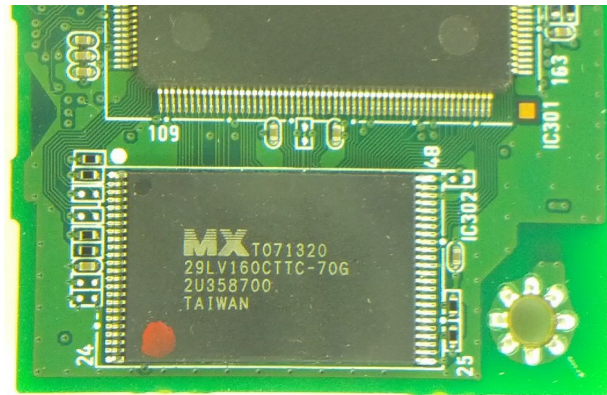
Picture 1: 29LV160 Flash chip (IC302)

3. Desoldering

This will be the most difficult part if you're doing this for the first time. TSOP chips have quite fragile leads so you must not apply any pressure with the soldering iron tip. The same caution also applies when lifting up the chip.
Heat is the only thing you need to melt the solder, so keep it in mind, mostly when you'll handle the chip or the desoldering braid.
Unwind a reasonably long length of desoldering braid to maintain your fingers far enough from the tip.
Don't hesitate to wait a little bit and let the temperature decrease sufficiently before touching anything with your hands on the board.

Desoldering will be achieved by following these steps (which will be detailed later below):
1. Apply solder over all the chip's leads on the same row;
2. Place a cutter blade between the printed circuit board (PCB) and the chip;
3. Melt the solder on the entire row by moving the tip slowly from one end to the other;
4. As the whole solder is melting, pull the cutter blade slightly to lift up that side of chip 1mm (approx. 0.04in) away from the PCB;
5. Once the chip is sufficiently apart of the PCB, keep the blade under the chip and absorb the solder with the desoldering braid;
6. Hold the desoldered side of the chip with your hand or preferably tweezers and melt the solder on the other side. You'll be able to withdraw the chip as soon

as the solder will start to liquefy;
7.   Clean the pads and do the same with the chip's leads.

3.1. Apply solder all over the chip's leads

Cover all leads of the same row with solder: this will help heating all leads at the same time. Don't do this on both sides of the chip. Don't hesitate to put a lot of solder, otherwise you'll notice that some of it will follow the tip when you'll move it across the row, leaving a few leads without hot solder on it, which will cause a bad heating of the whole row and potentially lead to irreparable damages when lifting up the chip.
Take care not to desolder any nearby component.
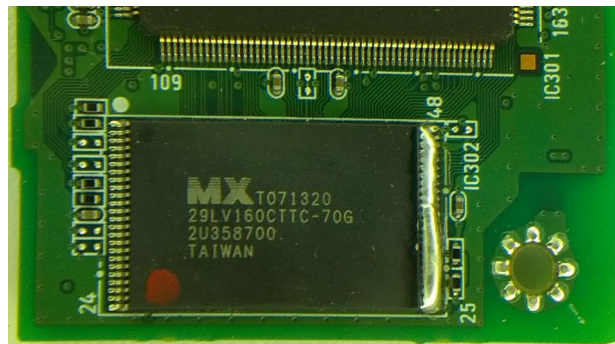
Picture 2: All leads on the same row covered with solder

3.2. Place a cutter blade between the PCB and the chip

This must be a bare cutter blade, so you might want to wind adhesive tape on the part you'll handle, to avoid injuries.
You must not force the blade under the chip or you'll break it. You just need to place the cutting side of the blade between both items and wait for the solder over all leads to be sufficiently hot to allow the chip to move apart of the board. Then you'll be able to apply a slight pressure to slip the blade under the chip.
Take care not to damage the PCB (i.e.: strike out the solder mask, cut tracks).
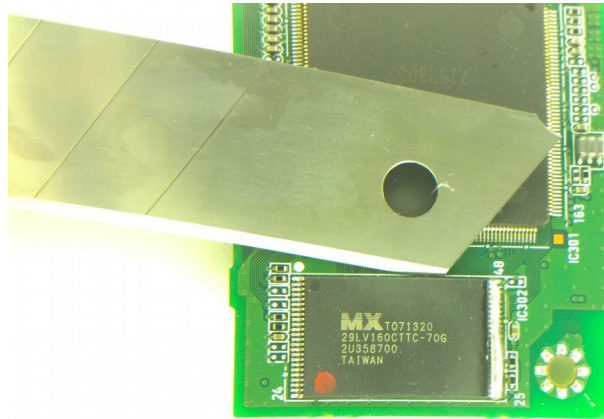
Picture 3: cutter blade placed between the chip and the PCB

3.3. Melt the solder on the entire row

Putting the tip on a single point won't melt the whole solder ball. You need to move the tip on the whole solder ball to obtain a homogeneous heating of all leads. You must pay attention not to press the leads while making this movement, otherwise you will bend the leads, which will extremely complicate your work.

3.4. Lift the chip

You must ensure that the solder is melt on all leads. You should not feel any resistance but you must be very careful while lifting the side of the chip. As written before, the chip's leads are very fragile, you must not try to lift the chip too far away from the board. You just need it to be sufficiently apart of the board to be able to easily remove all the solder between the leads and the pads on the PCB.
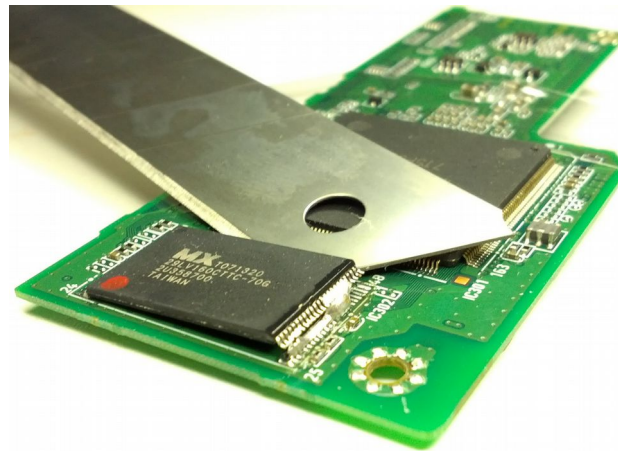
Picture 4: cutter blade under the chip

3.5. Absorb the solder between the chip's leads and the pads

Don't apply any pressure on the leads. You might need to add solder on the desoldering braid to help heat transfer. You must never put the tip too far under the leads, to avoid bending them. So, add more solder on the PCB if you see unattainable solder far under a lead. Then, place the braid between the tip and the solder ball you want to absorb. You should not have any difficulty to absorb everything with the braid. Otherwise add more solder and try again.
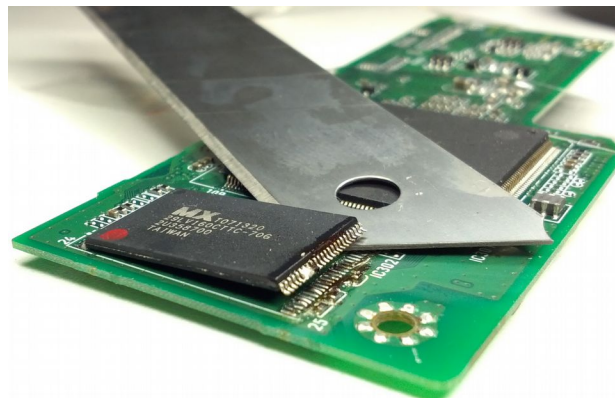
Picture 5: solder between the chip and the pads is removed

3.6. Desolder the other side of the chip

The only thing that holds the chip on the PCB is the other row. Double check the desoldered row for any remaining solder: try to slip the blade or a piece of paper under the leads. As you will need both hands in this step, it might be useful to firmly fasten the board to your desk, with masking or removable repositionable tape for instance. Be sure to allow easy removal of the chip as you must pull it straight. Damages to the leads or the chip's body will result if pulled out in any other way.

Picture 6: desoldering the other side, the chip is held with tweezers

3.7. Clean the pads and the chip's leads

Remove all solder from the pads with the braid, to allow an easy soldering.
The chip must be placed on a non flammable surface, because you will have to remove the solder from the leads with the chip out of the board. I use a piece of PCB without bare copper, but a plank of wood will do the job too, as long as you don't let the soldering iron on it for too long (let's say a couple of minutes) without removing it. You might need to add some solder on the braid, in order to facilitate the absorption of the small quantity of solder that's still on the leads. Clean everything with flux cleaner or 90% alcohol, to remove all the flux left by the solder.
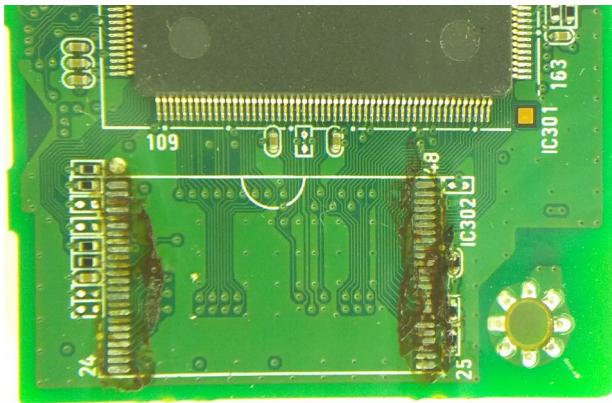
Picture 7: solder flux over the pads
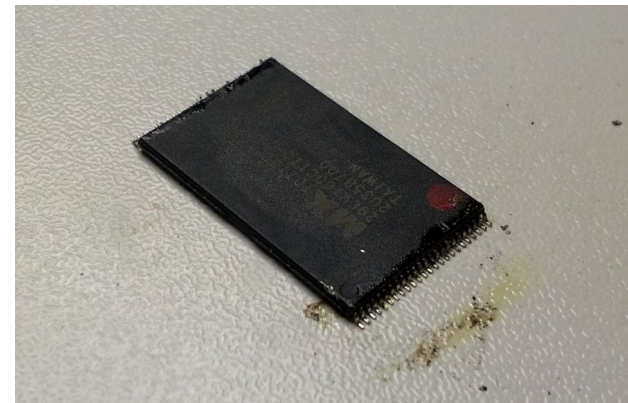
**Picture 8**: solder flux on the leads
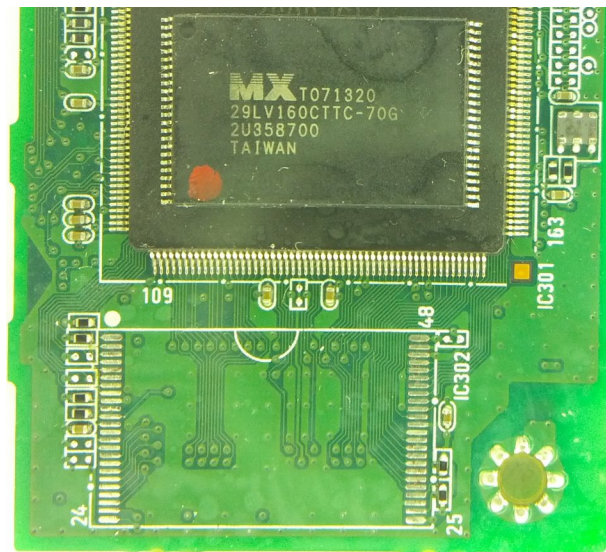
**Picture 9**: PCB and chip cleaned with flux cleaner

My programmer reported bad contacts when I tried to reprogram the Flash chips. The trick was to rub the chip's leads with the cutter blade, with its snap-off lines facing the leads. Don't apply too much pressure on the blade while moving it backwards and forwards. Hold the chip tightly while moving the blade.
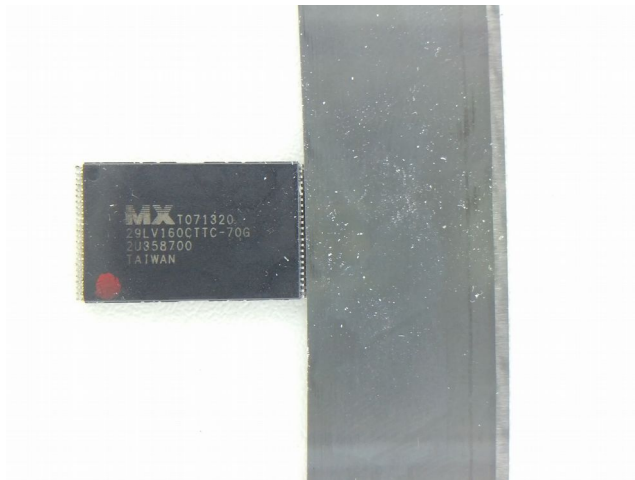
Picture 10: Place the blade above the flat part of the leads
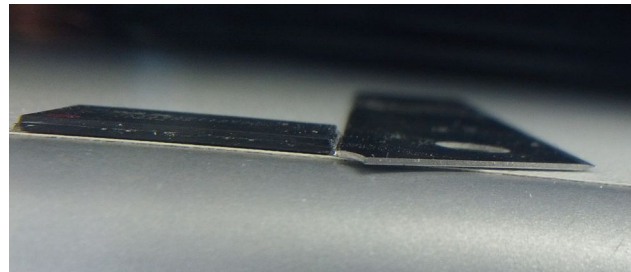
Picture 11: Side view
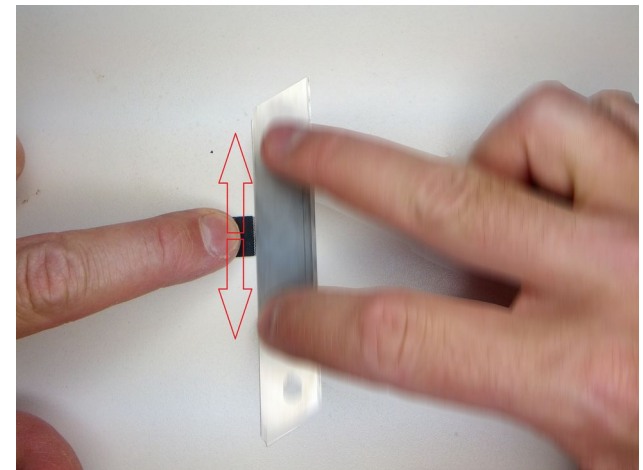
Picture 12: Move the blade backwards and forwards while holding the chip

Repeat this movement 3 or 4 times.

This step is not needed if you plan to solder the chip on a home-made adapter.

4. Reprogramming the Flash chip

Please read this document.

5. Soldering

Soldering SMDs is not an easy task. Hopefully, there is a trick that can make it easier.
First, check the picture you made before desoldering and put the chip in the exact same position. Don't hesitate to double check. The chip must be perfectly aligned on the pads.
Then solder the pin number 1 and the opposite pin. Make sure the chip is still perfectly aligned and perfectly plated to the PCB. Then solder all other leads.
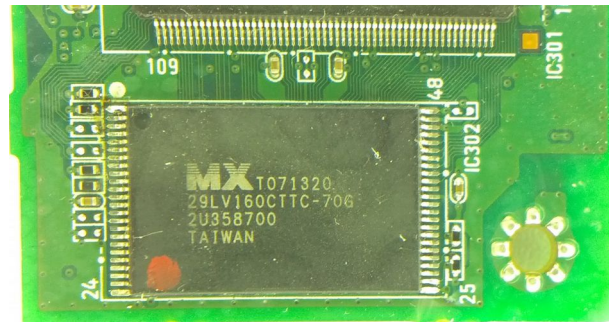
Picture 13: chip is aligned, only pins 1 and 25
are soldered during the first part of this step

I personally prefer to solder SMDs chips with a large tip, which can seem contradictory. I actually use it to put solder on the leads without taking care of not making soldering joints, the only important thing is to only put a small amount of solder on the part of the lead that is in contact with the pad. This allows easy removal of soldering joints with the braid. I got best results with leaded solder.

You will certainly need a magnifier to ensure there is no remaining solder joint, since we're dealing with pretty narrow pitch,. Another trick is to put the magnifier in front of your camera and take a close up picture, then watch it on your computer.

Picture 14: slightly misaligned chip with a bent
lead, still acceptable though (WRE54G V1.0)
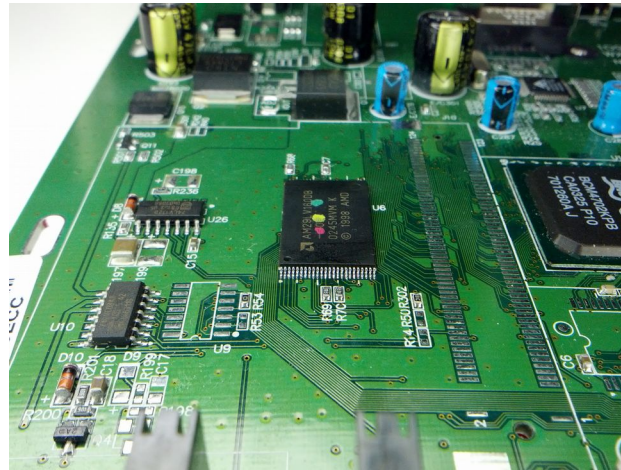
Picture 15: perfectly aligned chip (WAP54G V1.0)