# Grappler Minus V2

Assembly guide

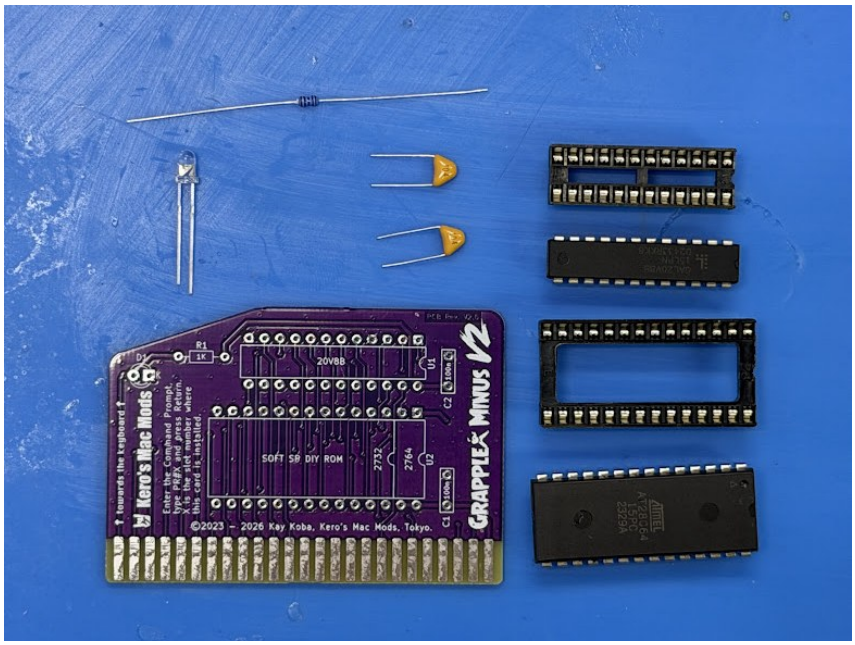
Kero's Mac Mods / Infinity Products
Board rev V2.0 / guide rev 1, October 2026

Six parts to solder. The four TTL chips from the old card are gone. All of their logic now sits in one programmable logic device, a PLD, so this build is about half the work the V1.5 kit was. Twenty minutes if you have soldered through-hole before.

Product page: en.infinityproducts.co.jp/product-page/grappler-minus-fully-assembled-card-or-bare-pcb
Store: en.infinityproducts.co.jp/shop-1
On the design files: V1.4 is still on GitHub and free to build for yourself. V2 is closed. Too many people were selling copies of the old board.

## What's in the kit

| | |
|---|---|
| **R1** | 1K resistor |
| **D1** | 3mm blue LED |
| **C1, C2** | 100nF ceramic capacitors |
| **U1** | Logic chip (PLD), already programmed, plus a 24-pin socket |
| **U2** | 28C64 with the SoftSP DIY ROM already flashed, plus a 28-pin socket |
| **PCB** | Bare Grappler Minus V2 board |




*Everything in the kit. The ROM is the 28-pin chip, the logic chip is the 24-pin one.*

## Before you start

Hot iron, sharp cutters, small parts. Keep the loose bits away from kids and pets.

I test the design in a real Apple II before a board ships, but I cannot test your soldering. A backwards LED or a solder bridge will stop the card working, and in a bad case it can take your drive card with it. Look the board over before you plug it into a slot. Damage to your machine, your drive or anything else attached to it is on you.

### Set SJ1 before you solder anything

SJ1 is on the back of the board near the top edge. It feeds pin 1 of the ROM socket.

The kit comes with a 28C64, so **leave SJ1 open**. Do not bridge it.

Close SJ1 only if you fit your own 27C64 or 2764. Those want VPP on pin 1 tied to +5V. On a 28C64 that same pin is either RDY/BUSY or nothing at all depending on which part you got, and tying it to +5V is a good way to end up with a card that does nothing. Ask me how I know.

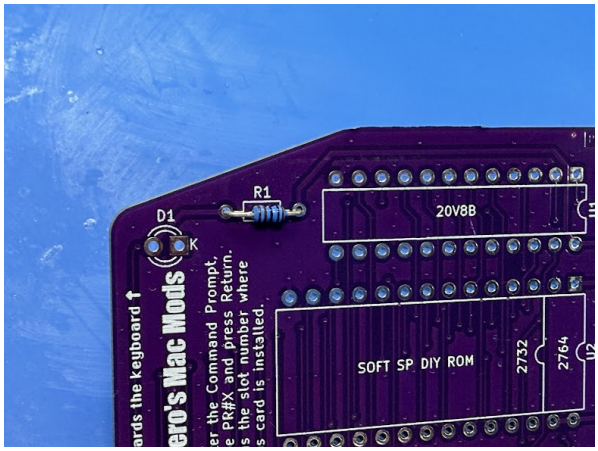
A 2732 does not use that pin, so the jumper makes no difference there. Leave it open.




*SJ1 on the back, open. That is how it stays for the 28C64 in the kit.*

## 1. R1, the 1K resistor

Shortest part first, so this one goes in before anything else. Resistors have no polarity, either way round is fine. Push it into R1, turn the board over and splay the legs so it does not drop out while you solder.




*R1 sits between D1 and the logic chip footprint.*

## 2. Solder it, then cut the legs

Both pads from the back, then trim flush. Flush cutters are worth owning for this. Side cutters leave a stub, and a stub on the back of an Apple II card can touch whatever is in the next slot.

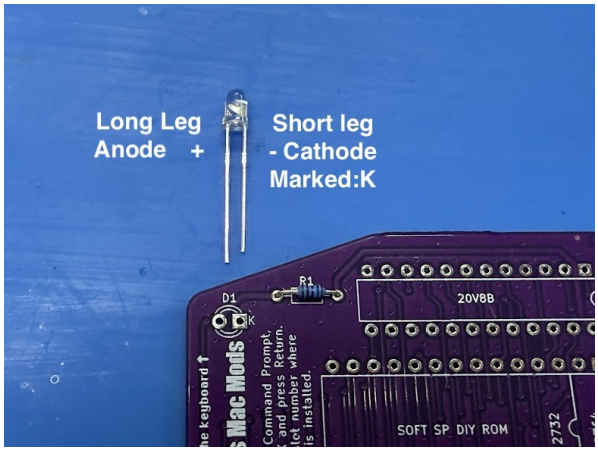



*Trim close to the joint.*

## 3. D1, the LED

This one does care which way round it goes. The long leg is the anode, the plus side. The short leg is the cathode, and the silkscreen marks that hole with a K.

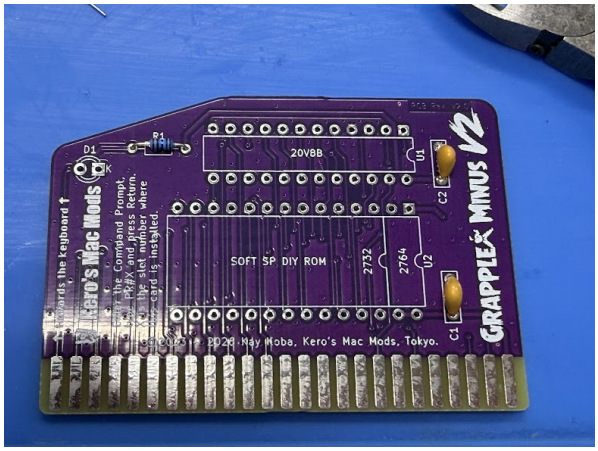
Put it in backwards and nothing is damaged, the lamp just never lights, but you have to desolder it to find out. In, bend, solder, trim, same as the resistor.




*Long leg to the plain hole, short leg to K.*

## 4. C1 and C2, the 100nF capacitors

Two ceramics, no polarity. These are the decoupling caps, C2 for the logic chip and C1 for the ROM. Solder and trim and the small parts are done.




*R1, D1, C1 and C2 in place. Everything from here on is sockets.*

### Which way round the sockets and chips go

Read this before you solder a socket. Both of them, and both chips, sit the opposite way round from what you probably expect.

Hold the card as it is in these photos, gold fingers at the bottom and the **GRAPPLER MINUS V2** logo up the right-hand edge. Both notches face **right**, toward the logo, matching the half-circles printed on the silkscreen.

That puts pin 1 of each chip in the **top** row, at the right-hand end, not in the bottom row where you would normally go looking for it. The pin 1 pad on the board is the square one if you want to check.

## 5. The 24-pin socket at U1

This is the one the logic chip goes into. Drop it in, then bend two pins at opposite corners outward so it stays put when you flip the board.

Notch to the right, toward the logo. Both sockets on this board face the same direction, which makes it easy to spot if one is wrong.

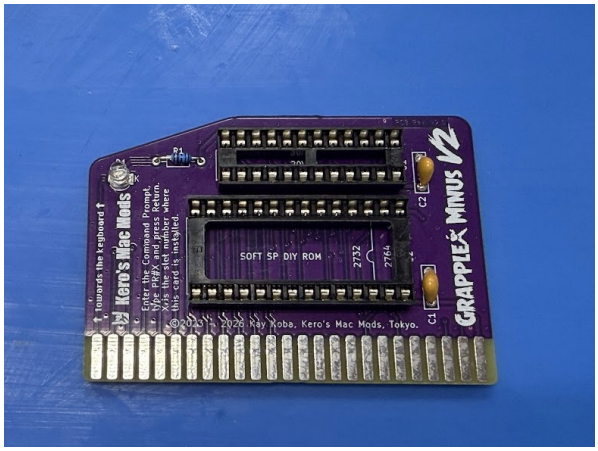



*24-pin socket at U1, notch toward the logo.*

## 6. The 28-pin socket at U2

The ROM footprint has 28 holes and two notch marks printed inside it, one labelled 2732 and one labelled 2764. The socket in the kit fills the whole footprint, and its notch goes on the **2764** mark, the one nearer the logo. A 28C64 uses the same 28-pin pinout as a 2764, which is why there is no separate mark for it.

Fit this socket whichever ROM you plan to run. A smaller 27(C)32 uses the same one, there is a separate note on that.




*Both sockets fitted. The 2732 and 2764 marks show through the ROM socket.*

### Running a 27(C)32 instead

The 2732 and 27C32 hold the same program in 4KB instead of 8KB, and the card runs either one. You do not need a different socket for it.

Fit the same 28-pin socket, then push the 24-pin chip into the top 24 contacts with its notch on the **2732** mark. Socket pins 1, 2, 27 and 28 stay empty.

SJ1 does not reach a 2732, so the jumper makes no difference. Leave it open.

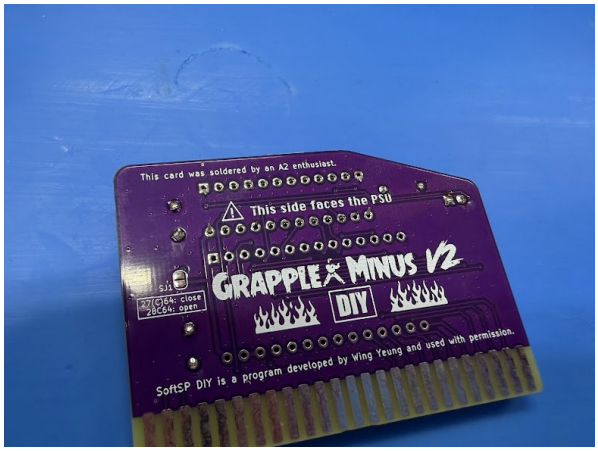



*A 2732 in the socket. The bottom four contacts stay empty.*

## 7. Solder both sockets and check the back

That is 52 pins. Take your time with them.

Then hold the back under a light and look along the rows. You are looking for two things: solder reaching across to the next pin, and joints that look like a dull grey blob instead of a shiny cone. Bridges and cold joints kill more first builds than dead parts do.

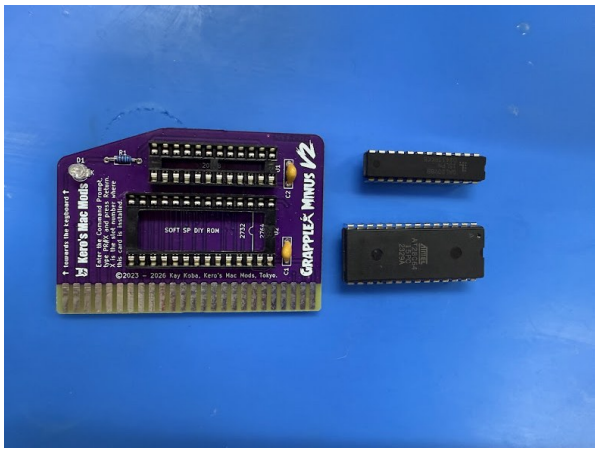



*Both sockets soldered. Nothing touching, every joint shiny.*

## 8. Drop the chips in

U1 is the logic chip, U2 is the ROM with the holographic label. Notches the same way as the sockets, to the right, toward the logo. Pin 1 of each chip ends up in the top row.

DIP legs come splayed from the factory and bend under easily. Press each chip down slowly and watch both rows go in. A leg folded under the body looks seated and is the most annoying fault on this card to track down, because the card half works.




*Sockets done, chips ready. Logic chip for U1, ROM for U2.*

## Using the card

1. Grappler Minus goes in slot 5. Any slot works except 6.

2. Your Disk II controller card, or 5.25 drive card, goes in slot 6.

3. Power on and press Control-Reset.

4. Type PR#5 and press Return. If you used a different slot, use that number instead.

The drive on the Disk II card, an SPIISD V2 for example, now runs as a SmartPort device.




*Finished card with the 28C64 from the kit.*

**About the ACT lamp.** The logic chip drives it from the ROM's output enable, so it only lights while the card's ROM is actually being read. Under SmartPort it blinks along with drive and card access. Boot the same drive as a plain Disk II with PR#6 and it stays dark the whole time. Useful when something is not working and you want to know which mode you are really in.

**Works with:** Apple IIe, IIe Platinum, IIe Euro Platinum, Apple II Plus, II Europlus, II J-Plus. You need a Disk II controller or 5.25 drive card in slot 6.

## If it does not work

Pull both chips and go over the sockets again first. Most faults are under there. Then check D1 is the right way round, then check SJ1 is open. If the card does nothing at all, a bridge you cannot see between two socket pins is the first suspect, not a dead logic chip.

Still stuck, send me a sharp photo of the back of the board. I can usually spot it.

## About SoftSP DIY

The ROM is SoftSP DIY by Wing Yeung (MFA2 WorkShop, also known as KbooHK), used with his permission. SoftSP DIY is not the same thing as the SoftSP card, also his design, sold through Chris Torrence's CT6502 Store.

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