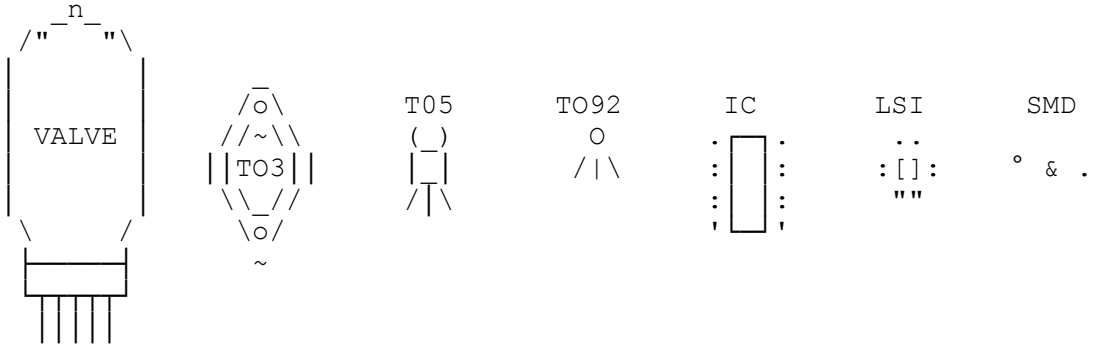
Faulting Tips

By G8MNY (Updated Sep 17)
(8 Bit ASCII graphics use code page 437 or 850, Terminal Font)

When faced with a PCB with 100 components it can be a daunting task to find the one that has failed especially if there is no circuit diagram.
Here is some tips I have used.

SKILL SET

So you need to use what clues are there, & make some VALID assumptions. Where there is obvious functional blocks to a device, e.g. PSU, Display, Rx, Tx, etc. one needs to be able to "read the PCB" & identify the relevant areas. This is an ever changing skill as components change from the Valve era, to Solid state, to Chips, LSI, & now SMD (surface mount).



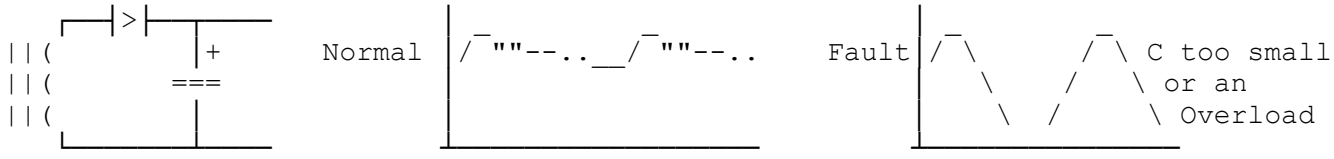
INSPECTION

As well as reading your away around a device, look out for black marks that could indicate a burnt out component, any burnt smells? Any smoke, or too hot parts after it is powered? Also look for pregnant electrolytic, leaking caps, or discoloured plastic sleeves (has been hot in the past). These may be wrong in value now & may be the fault, or caused by the fault?

LOGICAL ORDER

I always start with the PSU on most things, as a duff power rail or hummy / spiky power rail can cause all sort of problems with modern electronics.

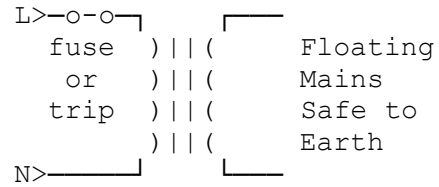
Duff capacitors are a primary cause of faults nowadays, with over stressed hot electrolytics drying out to be less than 1/100 of their original value in just a few years. N.B. there is no such thing as a high temperature capacitor, only one that dries out just after the G'tee.



On faulting suspect stages, I again start with the DC circuit, as incorrect DC will always cause AC problems. Using a scope often means you can check both DC & AC status at the same time.

SAFETY

With mains circuits there is nothing to beat an isolation transformer on the mains.
I have a 1kW Constant Voltage type that limits current to 5A.
And also a small 150W one.



With a floating supply I can earth with a scope probe before or after a mains live bridge rectifier to see what is going on. My transformer also makes a buzz noise under various load, this is also an instant indication to mains circuit function.

Remember though that most small scope probes should not be used on the high HF switching voltages of a SMPSU, because they are not rated at 600V AC @ 50kHz!

Dump large caps with a resistor, as there is always a danger they will still be charged!

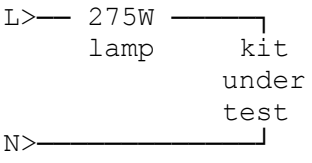
Tape over hazard areas, e.g. exposed live mains fuse etc.

N.B. Earth is a dangerous as live is!

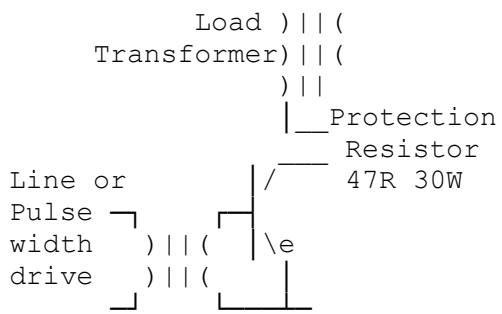
One hand behind the back is also a good safety rule!

CIRCUIT PROTECTION

For circuit protection I often use a lamp, or power resistor in series with the supply either, @ mains, or on the power rail.

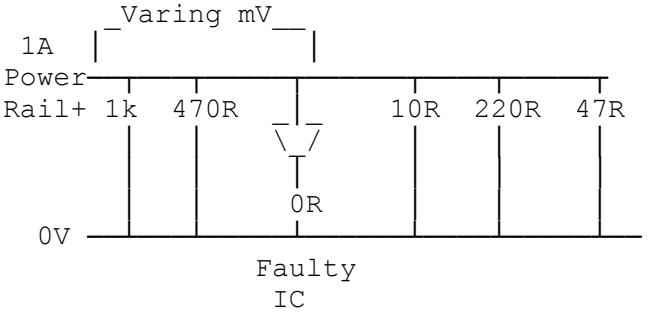


Sometime I even use one in series with the collector in a line out stage or SMPS when it likely to blow up another transistor or shut down.

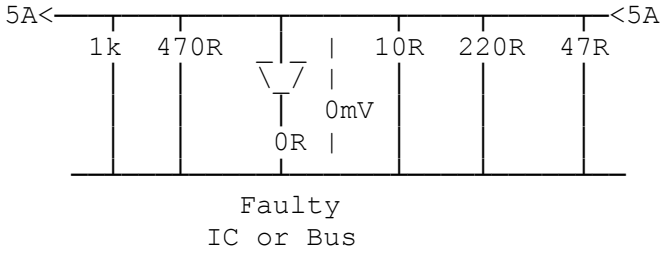


PARALLEL FAULTS

With shorts on power rail or data bus, find which part is at fault can very difficult. You need to break the circuit if possible, by removing jumpers, links, or cutting tracks if you have to. This turns the circuit into a Wheatstone Bridge. Remember ohms law & what may be inside an IC...



By passing a safe current of 1A via a car stop light lamp, this circuit will have voltage drop of a few mV down the +ve track. This will be seen as an increasing maximum to the fault then little increase after that.



Or passing the safe current down the track or a bus, there will be minium volts at the fault site.

Another approach is to see what gets hot, this method may be the only one possible in a multi layer PCB, where an ICs/Cap has gone short to an inside in accessible track layer.

INTERMITTENT FAULTS
These are a large waste of time. Some method of putting on, or removing the fault is needed to be certain you have found the cause. Heating & cooling components, but other faults can show (red herrings) that are not the cause!

Flexing the PCB, leads & tapping components (insulated screwdriver handle) may give the tell tail cause. I have found a hair line cracked track by passing 5 amps down an isolated PCB track & looking for the spark while flexing the PCB before now.

But often just a good inspection of solder connections & resoldering may be the most successful answer.

REMOVING COMPONENTS
Always identify leads, & plugs etc. (mark up/take a picture) so you can put them back. If the component is definitely dud, then cutting the legs off can often speed things up. Solder sucking, solder pumps & solder wick can be a great help. But don't forget that just heating all the legs at once with a pool of solder will let the component just drop out of the PCB with NO PCB track damage. You will have to remove all the surplus solder & clean out the holes with solder wick/pump for the new component.

For bulk stipping of components off scrap boards try a hot air gun (paint stipper), & most parts will fall off very cleanly, for parts like IC holders it may be best to leave the IC in place to maintain the shape & spring parts. Remember the PCB & parts will be very hot!

Why Don't U send an interesting bul?

73 De John, G8MNY @ GB7CIP