

ShortSniffer SS3 Operating Principles:

The ShortSniffer products are designed to locate shorts on printed circuit assemblies and bare boards. They operate by injecting an audio current into the shorted nets, allowing the current path to be followed by ear, using the amplified sounds from the pickup probes. Electrical contact to the nets is required for the current injection clips, but the pickup probes operate by proximity, and do not require contact to the conductors. This allows you to follow the current path under solder mask, under components, on inner layers, and even on the opposite side of the board.

The ShortSniffer audio pickup probe senses the induced field produced by the injected currents. The amplitude of the received signal is directly related to current density and inversely related to distance. Since the current flows through the path of least resistance (or impedance), that path can be followed with the pickup probe.

ShortSniffer SS3 Operating Details

First, you must know which Nets on your PC board are shorted together so you can select locations to connect the test current injection alligator clips. This “shorted net” identification is most often done with an ohmmeter or by observing waveforms with an oscilloscope. The ShortSniffer cannot tell you which Nets are shorted together, but it can show you where the short occurs on a previously identified pair of shorted nets.

Connect the current injection Test Clip Cable’s alligator clips to the two shorted nets. If there are no easy contact points, you may need to solder short extension wires to the Nets, providing connection points for the alligator clips.

Connect the pick-up probe cable to the probe jack (USB-A style connector) on the side of the ShortSniffer, and then adjust the ShortSniffer controls as necessary for the short location search. The term “as necessary” is a little vague at this point, but the ShortSniffer Practice Board will teach the proper use of the controls.

Wave the probe around the PC board and “Follow the Sound to the Short.” Yes, more vague words; but true for a great many shorts. The most difficult shorts can be quite a challenge, like all good puzzles, but finding them will be both entertaining and satisfying.

The ShortSniffer SS3 has been designed for convenience and optimized for PC board short circuit locating performance. The majority of short circuits are “dead shorts”, usually less than 1 Ohm, and there is little ambiguity in applying the ShortSniffer motto: “Follow the Sound to the short.” Your ears allow you to guide the pick-up probe along “the path of least resistance” towards the short circuit fault. For occasional higher resistance “short circuits,” parallel components may cause a significant fraction of the ShortSniffer’s test current to flow through an alternate path.

While looking for a power supply short, large parallel capacitor values may provide additional current paths, since the injected audio current flows through the caps based on their value. Locating shorts between nets with capacitance across the shorted nets (greater than 10 to 100uF) may require removal of these capacitors.

Power Planes and power grids can provide multiple current paths to the short circuit, often cancelling the sensed magnetic fields, producing confusing results. Proper use of Drive, Gain, and Slope controls will improve your ability to follow the correct path in these special cases. The ShortSniffer Practice board has an extensive training document that can be found on the main page at www.shortsniiffer.com

Circuit Safety (for the ShortSniffer and for you)

The ShortSniffers are designed to work on circuits that are un-powered. This includes discharging charged capacitors before connecting the current injection probes. This is not a problem under normal conditions, since

any capacitors across the shorted nets will already be discharged by the short you are trying to find. You should discharge all other capacitors for your safety.

The ShortSniffer current injection signal is AC coupled pulses, diode clamped (less than +/- 1V), and has a peak value of about 3A into a dead short. The diodes limit over-voltage damage to connected circuitry in the event of an intermittent short. Current will be less in "shorts" that are more than 0.3 Ohms, because of the diode clamp voltage limiting. These currents and voltages are safe for standard analog and digital circuits. If these levels are potentially dangerous to your circuits, add 10 to 100 Ohms in series with the injection leads to reduce these levels at the expense of detection sensitivity. You can also add a pair of low-drop Schottky diodes across the current injection leads to reduce the peak voltage to less than 0.3 volts.

Probe Selection for the ShortSniffer:

Normal (Yellow): This probe is good for general purpose short finding.

High Sensitivity (Red): This probe is helpful when normal probe is not sensitive enough to follow the sound to the short (when the current densities are low). The low current density can be caused by wide conductors (ground planes) or high resistance (hairline shorts in the 100 to 1000 Ohm range).

Tiny (Blue): This probe is smaller than the "normal" probe and can be used to better pinpoint the shorted area. For instance the "tiny" probe may let you determine the position to within 1mm, while the "normal" probe might give you an indication over a 3mm radius.

User Adjustments

Before starting your ShortSniffer session, verify functionality by connecting the red and black current injection clips together. Set both knobs to the full clockwise rotation and set both switches to the right. The green power LED should be lit, and you should hear sounds as you wave the probe across the connected clip lead wires. Adjust the controls for your ShortSniffing needs as indicated in the ShortSniffer Practice Board training document.

Additional Features

The headphone jack allows you to hear both the direction of the current flow, and the faintest of sounds from low current densities of ground plane shorts, or high resistance shorts. The combination of the high sensitivity probe and the headphone jack is why the SS3 out-performs all previous models in locating the most difficult shorts.

The micro connection kit is array of tiny adapters (with extension wires) that allow easy connection to your boards (or fine pitch parts) for signal injection. Select and connect an appropriate pair connectors for your contact points on your shorted nets, then connect the current injection clips to the extension wires.

The Voltage Probe can be used for hearing signals that may be invisible to oscilloscope methods. The high gain of the ShortSniffer can let you hear the noise on power supply rails or in analog signal paths for both design and troubleshooting.

Using the Practice Board

The practice board is for learning to hear what various current flow paths sound like (and how the various ShortSniffer probes behave). The ShortSniffer Practice Board document has extensive training examples and exercises to teach you how to best use your ShortSniffer..