

When a signature shows up faulty on a bus line it can be difficult to decide which device is causing the problem. Moving the COM line to the faulty bus line can help isolate the device causing the problem.

### Bus fault finding with ASA and ICT

In microprocessor-based circuitry devices such as RAMs, ROMs and ports often transfer data via buses, groups of signal and control lines. The devices share the buses and the microprocessor prevents bus conflicts by controlling which devices are writing or reading data. However, to fault locators using techniques such as Analog Signature Analysis or In-Circuit Functional Test, devices connected to the bus appear in parallel. When a fault appears on a bus line it can therefore be difficult to predict which device is faulty without removing devices from the circuit. In this application note we look at ASA signatures but the techniques described are applicable to both ASA and ICT.

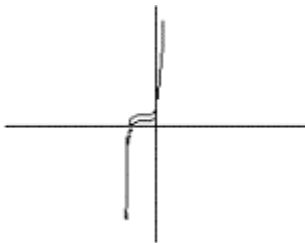


Fig 1 Typical good ASA data bus signature

### Comparing bus signatures

When fault finding using ASA on a bus system it's a useful technique to use signatures on the other lines of the bus for comparison purposes. For example, the signatures on all the lines of the data bus will look similar and will often assume the shape of the signature below.

Similarly, all the lines of the address bus will have the same general shape. When one bus line looks significantly different from the others it's usually a sign of a problem on that line. When testing devices you'll normally connect the COM line to a convenient ground point on the board under test and probe components and device pins - the fault locator displays the signature between the node under test and ground.

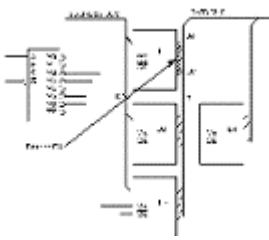


Fig 2 Data bus fault on D3

### Bus signatures

Consider the circuit below - seven of the data lines display the characteristic bus line signature (shown in Fig 1).

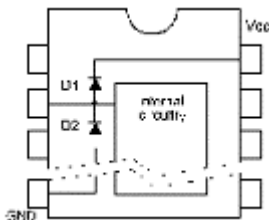


Fig 3 Device input protection

The signatures on the good data lines are typical of many data bus signatures and portray the behaviour of the input protection diode circuitry (Fig 3).



Fig 4 Faulty signature on data bus line D3

The signature on data line D3 (Fig 4) differs from the signatures on the other data lines and suggests a fault *in one of the devices on data bus line D3*. The signature no longer displays diode action and indicates a breakdown in the I/O section of one of the devices on the bus. This type of signature is typical of devices damaged by excessive voltage at the pins (e.g. lightning strikes on telephone lines).

### Isolating devices

When the COM line is connected to the ground of the board under test, devices on the bus (U1, U2, U3 and U4 in the example) appear in parallel so it can be difficult to predict which device contains the fault. The solution is to remove the COM line from the board ground and transfer it *to the line exhibiting the fault* and probe other unique lines.

In the example circuit you'll probably start testing the board by connecting the COM line to ground; once you have established that the D3 line is faulty connect the COM line to D3. Don't probe the device's Vcc and GND lines - they're common to all devices; the "CHIP ENABLE" and "OUTPUT ENABLE" lines for devices U1-U4 are unique to each device (other circuits will include other unique lines, e.g. "WRITE ENABLE" etc.) Probing the "CHIP ENABLE" and "OUTPUT ENABLE" lines should show significant differences in signatures and quickly isolate the faulty device. For methods of locating more difficult faults refer to AP108 - Advanced Bus Fault Finding Techniques.



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