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Chapter 1 : Digital Troubleshooting

Digital integrated circuits are used extensively in all branches of electronics from computing to industrial control, electronic instruments, communication systems and medical equipment.

Here are a few: Swap identical components In a system with identical or parallel subsystems, swap components between those subsystems and see whether or not the problem moves with the swapped component. I was once able to troubleshoot an elusive problem with an automotive engine ignition system using this method: I happened to have a friend with an automobile sharing the exact same model of ignition system. We swapped parts between the engines distributor, spark plug wires, ignition coilâ€”one at a time until the problem moved to the other vehicle. Normally, this type of problem could only be pinpointed using an ignition system analyzer or oscilloscope and a dynamometer to simulate loaded driving conditions. Occasionally you may swap a component and find that the problem still exists, but has changed in some way. This tells you that the components you just swapped are somehow different different calibration, different function , and nothing more. An important caveat to this technique is the possibility of causing further damage. Suppose a component has failed because of another, less conspicuous failure in the system. Swapping the failed component with a good component will cause the good component to fail as well. As a result of this, the good fuse that you move to the shorted circuit blows as well, leaving you with two blown fuses and two non-working circuits. Another example to illustrate this caveat is the ignition system problem previously mentioned. As a general rule, the technique of swapping identical components should be used only when there is minimal chance of causing additional damage. It is an excellent technique for isolating non-destructive problems. The Y axis is not working, but the X and Z axes are working. All three axes share identical components feedback encoders, servo motor drives, servo motors. Exchange these identical components, one at a time, Y axis and either one of the working axes X or Z , and see after each swap whether or not the problem has moved with the swap. A stereo system produces no sound on the left speaker, but the right speaker works just fine. Try swapping respective components between the two channels and see if the problem changes sides, from left to right. For instance, you could swap the speakers between channels: If the problem stays on the same side i. If the speakers have been verified as good, then you could check the cables using the same method. Swap the cables so that each one now connects to the other channel of the amplifier and to the other speaker. Again, if the problem changes sides i. If neither swap the speakers nor the cables causes the problem to change sides from left to right, then the problem must lie within the amplifier i. Remove parallel components If a system is composed of several parallel or redundant components which can be removed without crippling the whole system, start removing these components one at a time and see if things start to work again. None of the computers are able to communicate with each other. Try unplugging the computers, one at a time from the network, and see if the network starts working again after one of them is unplugged. A household fuse keeps blowing or the breaker keeps tripping open after a short amount of time. Unplug appliances from that circuit until the fuse or breaker quits interrupting the circuit. If you can eliminate the problem by unplugging a single appliance, then that appliance might be defective. If you find that unplugging almost any appliance solves the problem, then the circuit may simply be overloaded by too many appliances, neither of them defective. A radio is not working producing no sound at the speaker What to do: Divide the circuitry into stages: Measure signals at test points between these stages and tell whether or not a stage is working properly. An analog summer circuit is not functioning properly. I would test the passive averager network the three resistors at the lower-left corner of the schematic to see that the proper averaged voltage was seen at the noninverting input of the op-amp. I would then measure the voltage at the inverting input to see if it was the same as at the noninverting input or, alternatively, measure the voltage difference between the two inputs of the op-amp, as it should be zero. Continue testing sections of the circuit or just test points within the circuit to see if you measure the expected voltages and currents. Simplify and rebuild Closely related to the strategy of dividing a system into sections, this is actually a design and fabrication technique useful for new circuits, machines, or systems. Suppose that someone were building a custom automobile. He or she would be foolish to bolt all the parts together without checking and testing components and subsystems as they went along, expecting everything to work perfectly after its all assembled. Ideally, the builder would check the proper operation of components along the way through the construction process: It is human nature to rush to completion of a project, thinking that such checks are a waste of valuable time. However, more time will be wasted in troubleshooting a malfunctioning circuit than would be spent checking the operation of subsystems throughout the process of construction. Take the example of the analog summer circuit in the previous section for example: How would you simplify it and test it in stages? This may be essential for proving what happens first in a fast-acting system. A turbine control system shuts automatically in response to an abnormal condition. One technician I knew used a videocamera to record the turbine control panel, so he could see what happened by indications on the gauges first in an automatic-shutdown event. Simply by looking at the panel after the fact, there was no way to tell which signal shut the turbine down, but the videotape playback would show what happened in sequence, down to a frame-by-frame time resolution. An alarm system is falsely triggering, and you suspect it may be due to a specific wire connection going bad.

Chapter 2 : Digital Electronics Questions and Answers

Basic Electronic Troubleshooting Techniques Chances are, you won't be an expert in repairing these devices, but you can take some practical steps to solve problems and help get your systems operational again in a timely manner.

This document attempts to provide an entry to the world of consumer electronics troubleshooting and repair. It also covers test equipment selection, tools and supplies, parts, home made troubleshooting aide - Incredibly Handy Widgets tm - and safety. Mostly, you will learn by doing. However, you do need to prepare. There are many schools dedicated to electronics repair. Some of these are quite good. This document, however, is written from the perspective of the motivated do-it-yourselfer, hobbiest, and tinkerer. The Repair FAQs usually list suggested references for each area. Your local public or university library will probably have some of these or other repair oriented electronics books. Above all read and understand the document: Your life may depend on it. Collect broken electronics and appliances from your friends, relatives, the dump, garage sales and flea markets, etc. Start on those that have been written off - you will screw up at first. As times passes, your batting average will improve. It may not happen overnight but it will happen if you apply yourself. Sometimes, the basic design is flawed or someone before you messed up royally. Troubleshooting is like being a detective but at least the device is generally not out to deceive you. Experience will be your most useful companion. If you go into the profession, you will obtain or have access to a variety of tech tips databases. These are an excellent investment where the saying: However, to learn, you need to develop a general troubleshooting approach - a logical, methodical, method of narrowing down the problem. A tech tip database might suggest: This is good advice for a specific problem on one model. Therefore, in many cases, some reverse engineering will be necessary. As always, when you get stuck, the sci.

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Chapter 3 : Basic Logic Gate Troubleshooting | Digital Circuits Worksheets

Digital Electronics Troubleshooting. by Joseph J. Carr. ISBN: Tab Books, , page softcover, 1 lb. 3 oz. Very Good condition. Very slight wear on edges.

Transistor Q1 failed shorted collector to emitter Transistor Q2 failed shorted collector to emitter Input line A shorted to ground Input line B shorted to ground Resistor Rpullup failed open Follow-up question: Question 10 Explain why placing static-sensitive components such as CMOS integrated circuits into a block of conductive foam protects them against damage from ESD, and why this protection exists even if the entire block of foam with chip is brought to an elevated potential with respect to earth ground. Hide answer The conductive foam makes the pins electrically common to one another, so no significant difference of voltage may appear between any two pins of the component. You may underscore this principle by stating to your students that you may walk up to a piece of conductive foam with lots of CMOS chips inserted into it, and touch it with your static-charged finger, with no damage. Even if you draw a spark between your finger and the foam or any chip pin stuck into the foam , the chips will all be protected because they experience no voltage between their pins. Explain why this is. The given answer does not provide enough detail to explain why TTL inputs tend to float high, so I recommend you display an internal TTL gate schematic for your students to analyze and comment on in class. How does this compare against traditional TTL? The logic state of a floating CMOS gate input is indeterminate. Memorization is not good enough - students must grasp why these different logic families behave as they do. Question 13 As an electronics instructor, I have the opportunity to see a lot of creative mistakes made by students as they learn to build circuits. One very common mistake made in CMOS circuit construction manifests itself in erratic behavior: Then, just by waving your hand next to the circuit, it begins to work again! This problem is especially prevalent on days where the atmospheric humidity is low, and static electric charges easily accumulate on objects and people. Explain what sort of CMOS wiring mistake would cause a powered logic gate to behave erratically due to nearby static electric fields, and what the proper solution is to this problem. Hide answer This classic problem is caused by a lack of pull up or pulldown resistors on CMOS gate inputs. Hide answer Due to the biasing requirements of its constituent bipolar transistors, TTL circuitry requires a much closer-regulated power supply voltage than CMOS. Many of the old 74xx and 74LSxx logic circuits are considered obsolete, but may still be found in a lot of operating equipment! It is not uncommon to have students mistakenly research the datasheets of a newer logic family such as 74HCxx which has different power supply requirements than traditional TTL. Be prepared to elaborate on the difference s between these IC families if and when your students encounter this confusion! Question 15 Logic probes are useful tools for troubleshooting digital logic gate circuits, but they certainly have limitations. Why then does a logic probe fail to indicate a high logic state at TP2? Can you think of any other circuit or situation where a similar false reading may be displayed by a logic probe - where the logic state has not been made visually obvious by the presence of an LED? This is why in low-speed circuits I prefer to use a good digital voltmeter rather than a logic probe to discern logic states. With a voltmeter, you can see exactly what the voltage level is, and determine whether or not the logic state is marginal. Question 16 A useful test instrument for digital gate circuit troubleshooting is a logic pulser. Explain what one is and give an example of how it is used. Question 17 A technician is using a logic pulser to force the logic state of the wire connecting two of the gates together: Which gate, or gates, are we testing by placing the pulser in this position? What other instrument s would we have to connect to the circuit and where? Why does the logic pulser require a ground connection to do its job in this circuit? Hide answer In this location, the pulser is set up to test gate U1. The pulser requires a ground connection so it may drive current into or out of the circuit under test. We use a pulser to override gate outputs in order to test the function of gates receiving that signal. Question 18 In this circuit, a comparator is set up to detect whether the outside or inside temperature is greater, and turns on a cooling fan when conditions are right. Predict how the operation of this circuit will be affected as a result of the following faults. Consider each fault independently i. Comparator U1 output fails low: NAND gate U2 output fails low: NAND gate U2 output fails high: Transistor Q1 fails shorted drain to source: Resistor R2 fails open:

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directly or indirectly involved with electronics controls â€¢ Those involved with the installing, programming, maintaining and DESIGN TROUBLESHOOTING FOR DIGITAL.

Chapter 5 : Kleitz, Digital Electronics: A Practical Approach with VHDL, 9th Edition | Pearson

A useful test instrument for digital gate circuit troubleshooting is a logic pulser. Explain what one is and give an example of how it is used. Explain what one is and give an example of how it is used.

Chapter 6 : Troubleshooting Digital Circuits

Digital Electronics questions and answers with explanation for interview, competitive examination and entrance test. Fully solved examples with detailed answer description, explanation are given and it would be easy to understand.

Chapter 7 : Troubleshooting and Repair of Consumer Electronic Equipment

This book covers devices and components related to equipment like test instruments, medical instruments, digital equipment, microcomputers and microprocessor-based equipment. The reader will quickly learn the systematic procedures for identifying causes of faults and the practical methods of repairing them.

Chapter 8 : Digital Electronics Basics - Chapter 1: Logic Gates & Boolean Algebra - National Instruments

In electronics, potential difference is commonly referred to as voltage, with the symbol V. Sometimes the symbol U or E for emf (electromotive force) is used, but the standard symbol V represents any potential difference.

Chapter 9 : Digital electronics troubleshooting: Joseph J Carr: blog.quintoapp.com: Books

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