BUGTRAP MODEL 2074A
LOGIC COMPARATOR

REFERENCE MANUAL

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THEORY OF OPERATION

The Model 2074A incorporates a new comparison technique not used in other logic comparators. Conventional logic comparators require some sort of preprogramming prior to testing any specific IC. Generally, this preprogramming involves the separation of inputs from outputs on an IC. The inputs are usually tied directly together while the outputs are separated for routing through the comparison circuits. The technique used in the Model 2074A requires all nodes, with the exception of power and ground, be indirectly tied together. Since all nodes are indirectly tied, the circuitry in the Model 2074A has the unique ability to treat each node as an input, an output or a "don't care" as each application may require. The switches are used only for directly tying VCC and ground from the reference IC to the IC under test (UUT) since the current requirements are such that indirect connections are not suitable.

IT TAKES ONE TO KNOW ONE!

The 2074A is designed to let you know when a reference IC and an IC under test are in disagreement. There are three positions that a digital integrated circuit node may take at any one time. These are a logic "1" (high or on), a logic 0 (low or off), and a "don't care" or floating status. To determine if a suspect IC is performing the way that it should, the first thing that is required is to bring in an expert. What could be more of an expert on the proper operation of a particular IC than one of it's own kind? By comparing the operation of a "known good" IC to that of the suspect IC you have allowed the comparator to tell you if there are any disagreements between the two. These disagreements may take place between the two ICs on any of the three positions (high, low, or "don't care") discussed above. The behavior of these little devices has been designed and programmed by people that have spent years making them perform just right. Learning their proper operation is fine, however, for rapid in-circuit troubleshooting we suggest that you cash in on the headaches of others and use the "experts".

TO CARE OR NOT TO CARE

An IC that has outputs connected to a bus has it's own set of problems. Looking at an output that is on the same trace as ten other ICs can be confusing at best. What you really want to know is what is going on when the IC that you're testing has something to say or when it is "enabled". The 2074A also has the ability to determine when the output activity is relevant or not. This is done internally so that the user need not be concerned with the connection of external enable connections. This feature is also useful if a device being tested has given up all together. This type of failure often includes floating nodes or nodes that simulate a tri-state "don't care" condition.

BACK AND FORTH . . . REAL FAST

The feature of the 2074A that ties together nodes and treats them as required is the key to it's versatility. In the case of bi-directional ICs, a node that at one moment was an input may instantly become an output. Since this change can take place thousands or even millions of times per second, you can see that nimble fingers would be a necessity to keep up with these changes if you needed to flip switches accordingly.

DIGITAL FAITH HEALER?

There are few things in this universe that can get a technician frazzled as a good intermittent failure. If you have been working on digital troubleshooting for any length of time, the experience of receiving a "faulty" board only to find out that as soon as you lay your healing hands on it the problem goes away is most likely a familiar experience. If you have spent hours on end watching a scope screen looking for that failure to occur where you think it will occur, then you probably don't need this comparator, since you're either in another line of work by now or in a straight jacket. However, for those of you that are stuck returning those intermittent boards while knowing deep inside that they will probably come back, good news! The 2074A has the patience to "watch" these boring signals for you. If a failure should occur at any time the 2074A will latch it's error indicator LED for the corresponding node. This feature frees you to work on something else, or eat, or sleep, as the case may be, and still catch those failures that may span minutes or even hours between an occurrence.

SHOTGUNNING WITHOUT A TRACE

This common troubleshooting technique is used by the best of technicians. After all, if you had the ability to glance at an unfamiliar board and pinpoint a problem you would most likely be making a bunch more bucks than you are now. Anyone who has done much troubleshooting using the shotgunning method knows that the result of removing and replacing ICs that were good to begin with can be an expensive and time consuming exercise. This method quite often results in a technician "chasing his tail" because of damaged traces or heat damaged components that occurred while trying to locate the original problem. While not even the 2074A will eliminate the need for some "educated guesswork", at least your shotgunning can be done without leaving it's traditional telltale signs. Since IC removal and replacement is no longer necessary, your savings in replacement parts is dwarfed only by the savings in time and frustration.

USING THE 2074A

We've spent a lot of time here trying to figure out how to turn something so simple into pages of instructions, so we have had to resort to a few "what ifs" and a bunch of details. Don't worry, once you've read these instructions and have used the 2074A there's a good chance that you will never have to read this section again.

CONNECTING POWER AND GROUND

The 2074A is powered by the unit under test (UUT) via the two E-Z hook cables provided. You will notice that one cable is red (+5VDC) and the other one is black (GROUND or GND). To connect power and ground, first make sure that the power to the UUT is off and that the IC test clip on the 2074A is not connected to the UUT. Next, locate appropriate hook-up points on the UUT for both +5VDC and GND. It is recommended that the power and ground leads of an IC not be used since the E-Z hooks may short to adjacent pins. If the UUT board has test points for GND and +5VDC use these, as they should be ideal. If not, some good connection points may be capacitor leads, large resistors, or diodes that may be connected to the power or ground bus.

IMPORTANT NOTE

It is important that the voltage to the 2074Anot exceed +5VDC. It is highly recommended that you verify the voltage at your hook-up points prior to connecting the 2074A.

The current draw of the 2074A will not exceed 400 mA, however, if it is more convenient, you may use a separate power supply for powering your 2074A. If another power supply is used, you must connect the ground from your power supply to the ground on the UUT so that the ground to the 2074A is continuous to the ground supplied to the ICs being tested. Once everything is hooked up, power up the unit under test. Check to see that the "POWER" LED on the 2074A is lit. If the power LED appears dim, check the security of the E-Z hook connectors, and if necessary, verify the voltage present at the hook-up points. If there is no power indication on the 2074A, check for the correct polarity of the connectors. Remember, red is +5VDC and black is ground.

SELECTING A KNOWN GOOD IC

As mentioned before, the key to the operation of the 2074A is that the "known good" IC will be compared to your suspect IC in the UUT. It is important that the known good IC be a match to the IC under test. For example, if the IC under test is a "74LS161" then a "74161" may or may not work. When you are testing an IC, "may or may not" doesn't cut it. The key in the above example is obviously the "LS". For now, just take our word for it, they must match. Generally the part # is sufficient, however, on rare occasions we have seen the performance of ICs vary between manufacturers. You may not see this in your lifetime, but just remember to have as close a match as possible. Don't forget that the idea here is to select a "known good" IC. We realize that on many occasions the best you could hope to find is a "thought to be O.K." IC, so we suggest that when you find a good one, label it and keep it for the purpose of testing. Testing ROMs and gate arrays is simple enough, but again, be sure that you have a match. Part numbers for these usually aren't enough. Since the function of these ICs is to provide custom or semi-custom performance through their programming, it is important that the programming is an exact match to the IC under test.

SETTING POWER AND GROUND SWITCHES

At this point it is a good idea to refer to the "IC REFERENCE SECTION" of this manual (Appendix E), for the proper power and ground switch settings. You will notice that one of the columns is labeled "VCC PIN" and one of the columns is labeled "GND PIN". Once you have selected the IC that you want to test by the number in the left hand column, move over to the VCC PIN column. There will be two numbers listed. The top number is the actual pin number of the IC that is used for VCC or power. The number underneath in parenthesis is the channel number of the 2074A that will correspond to the VCC pin of the IC once it is placed into the ZIP socket on the 2074A. For example, if you wanted to test a 7404 IC, you would first locate the 7404 in the IC REFERENCE SECTION. In the VCC PIN column there will be two numbers, 14 and (20). The number 14 refers to the actual IC pin and the number (20) refers to the channel number of the 2074A once the IC is placed into the ZIP socket. Notice that while the GND pin assignments are also expressed in two numbers, both numbers are the same in most cases (example: 7 and (7) on the 7404). This is because the ground pins of an IC are usually located on the left side of the IC. Any pin numbers on the left side of an IC will match their corresponding channel numbers exactly. In this example of the 7404, you've seen that comparator channel 7 corresponds to the ground pin of the IC and comparator channel 20 corresponds to the VCC pin. These are the two switches (7 and 20) that must be thrown inward toward the ZIP socket. All other switches remain in the outward position.

PLUGGING IN YOUR "KNOWN GOOD"

Insert a "known good" IC of the type that you want to test into the ZIP socket on the top of the comparator with the #1 pin of the IC in the left uppermost position of the ZIP socket, closest to the locking handle. The locking lever should be in the "up" position before inserting IC and then locked to the "down" position to securely hold the IC in place as well as to assure good contact. If the IC is less than 20 pins in size, you will notice that some of the spaces in the ZIP socket are not used. This is no problem. If you are using a 20 pin test clip on a smaller IC, the same channels will also not be used.

SELECTING A TEST CLIP

Your 2074A Logic Comparator comes with two test clips, a 20 pin size and a 16 pin size. For most purposes the 20 pin test clip should be fine as it's perfectly OK to use the 20 pin clip on smaller ICs (14, 16, and 18 pin). As with the "known good" IC in the ZIP socket, some of the pins will not be used. The 16 pin test clip has been provided for the testing of 14 and 16 pin ICs that may be in areas on a board where a 20 pin test clip simply won't fit without contacting something that it shouldn't. It is important that the test clip make contact only with pins of the IC being tested. After you have pondered all of the pros and cons of your test clip selection simply insert the IDC connector of the test clip cable into the IDC receptical in the logic comparator and lock the locking arms into position. To remove a test clip, push the locking arms toward the outside of the comparator to eject the IDC connector.

CLIPPING ONTO THE UUT

There are only a few things to keep in mind here. First, make sure that the #1 pin position of the IC test clip (marked by a red dot) is on the #1 pin of the IC. Second, never, ever, ever connect to an IC that has a voltage greater than + 5VDC or less than 0VDC present on any pins. If the pins of the IC appear to be dirty or oxidized try gently rocking the test clip back and forth on the IC to achieve a better contact. This technique is worth a try if you should receive an error indication. Sometimes this will cause the error to clear and prevent an unnecessary IC replacement.

READY TO GO

OK, now that you have the test clip connected, a "known good" IC chosen and locked into the ZIP socket (that hopefully matches the IC you clipped onto), the power and ground leads connected, the wind to your back, and a smile on your face, apply power to the UUT. Make sure that the power light comes on. If any of the other LEDs should light on power up, press the "reset" button on the comparator. If all of the red LEDs remain unlit then you're done with your test (unless the problem is intermittent, in which case you would test as long as necessary). If one or more of the LEDs persist in relighting, note the channel numbers and refer to the "FAILURE

TABLE", Appendix A. The "FAILURE TABLE" will assist you in verifying that you have correctly connected your 2074A and determine if you have to clear the IC prior to pronouncing it dead. Noting the channel number of the miscompare will be helpful in identifying the exact node of any failure or problem.

IMPORTANT NOTE: While testing, the user should not test a suspect IC by placing it in the ZIP socket of the comparator (reference IC socket) and testing it against a known good IC in circuit on a circuit board. For a reliable test, the "bad" IC must be on the circuit board connected to the test clip of the 2074A and the known good reference IC must be in the ZIP socket. The design of the comparator precludes having these ICs reversed. Also, with the 2074A powered up and the test clip attached to the suspect IC, the user should not expect to see error indications if no reference IC is placed in the ZIP socket. The reference socket "floats" along with the logic levels of the IC being tested unless a known good reference IC "tells" it differently. By the same token, if the reference IC is a tri-state type and is mismatched to the IC being tested, the comparator may not show an error indication. This happens when the logic conditions keep the reference IC from being enabled, in which case it's outputs will be floating along with whatever logic is taking place on the unit under test, as if you had an empty reference socket. As long as you use the correct reference IC, there will be complete and accurate testing.

2074A INSTRUCTION SUMMARY

1. Connect the 2074A to VCC and GND by using the E-Z hooks provided. Red is +5VDC and black is ground. Do not exceed +5VDC.

2. Set toggle switches on the 2074A to correspond to the VCC and GND pins of the IC to be tested. With an IC of less than 20 pins you must convert the IC pin numbers to match the channel numbers of the comparator. For example, on a 14 pin IC, pin #14 would correspond to channel number 20 on the comparator since it is in the upper right corner of the ZIP socket. IC pins on the left side of the ZIP socket need not be converted. On the VCC and GND channels, the switches must be switched inward as directed by the VCC and GND arrows on the top of the comparator. If in doubt, double check the VCC and GND pins by reference to IC documentation.

3. Insert your "known good" reference IC into the ZIP socket of the comparator with the #1 pin of the IC in the top left corner of the socket (handle position). Push down the ZIP lever to lock in the IC.

4. Clip the test clip over the IC to be tested with the red dot on the test clip in the #1 pin position. The 20 pin clip may be used for any size IC of 20 pins or less (some of the pins will not be used on ICs smaller than 20 pins). However, a 16 pin cable has been provided for tight fit areas.

5. Power-up the unit under test. Make sure that the power light comes on. Press the reset button on the comparator. If any of the red LEDs light, make sure you have good connections on the test clip and ZIP socket and also verify #1 pin orientation on the test clip and ZIP socket. Also check to see if the IC is the type that needs to be "cleared". On some occasions this must be done manually, either by using a logic pulser or a hard wire to the appropriate pin(s). If any LEDs continue to remain lit they may be treated as an error indication for the corresponding nodes. Make sure

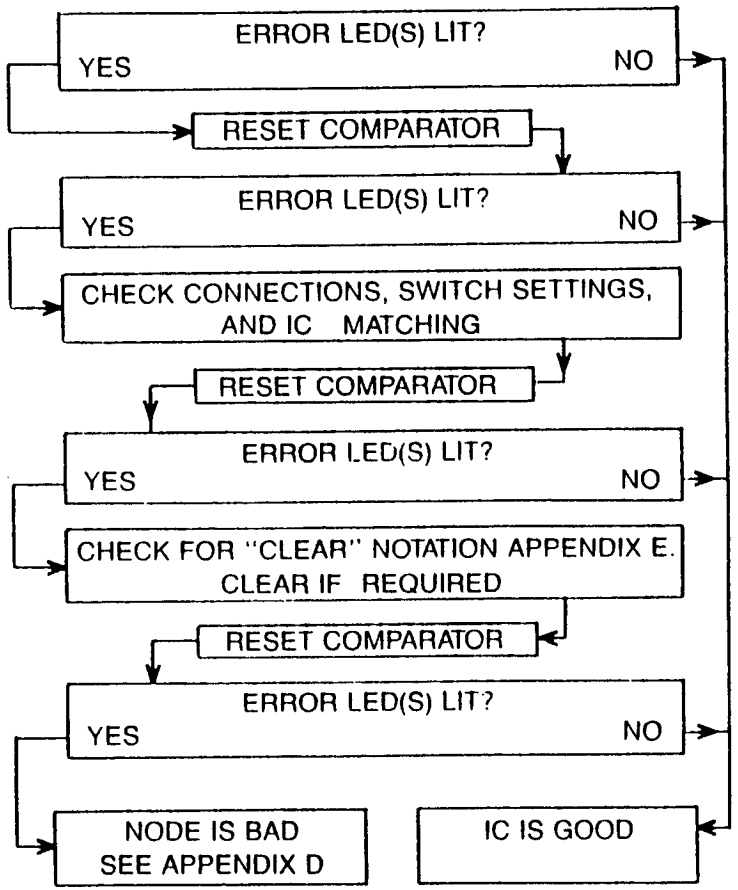
that the reference or "known good" IC is a match for the IC under test. Pay close attention to the type of IC, such as "L, S, H, LS", etc.

6. NOTE: If a known good IC is mismatched to the IC under test, the result will not always be an error indication as you might expect. An example might be if a tri-state IC is inadvertantly placed in the ZIP socket to compare to a non-matching IC on your board. In order to get an error indication, it would be essential for the known good tri-state IC to receive the proper signal on it's enable pin. It needs to be enabled in order to produce a different output than the UUT.

7. CAUTION! Do not attempt to connect the 2074A to any IC that has more than +5VDC or less than 0VDC present on any pin.

APPENDIX A

FAILURE TABLE



APPENDIX B
I.C. PIN TO LOGIC COMPARATOR CHANNEL CONVERSION TABLE

COMPARATOR CHANNEL #	20 PIN	18 PIN	16 PIN	14 PIN
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	N/C
9	9	9	N/C	N/C
10	10	N/C	N/C	N/C
11	11	N/C	N/C	N/C
12	12	10	N/C	N/C
13	13	11	9	N/C
14	14	12	10	8
15	15	13	11	9
16	16	14	12	10
17	17	15	13	11
18	18	16	14	12
19	19	17	15	13
20	20	18	16	14

APPENDIX C
"CLEARING" AN IC

Provided in the IC REFERENCE SECTION is information on which ICs may have to be "cleared" or reset, which pins would have to be pulsed to clear the IC, and what polarity the pulse would have to be. Clearing an IC will reset the reference IC and the unit under test IC to "square one" together or will load the two ICs with the same information at the same time and thus "sync them up". Generally, this will not be necessary if the board has an operating clock and the damage to the board is not extensive. However, it is recommended that an IC with a "clear" be cleared, if a miscompare should occur.

Generally, the easiest way to reset or clear an IC is to either temporarily interrupt power to the board under test, thereby causing a "power-on" reset, or by resetting the MPU, usually done with a reset button on board. In cases where this doesn't accomplish the reset, you must manually clear the IC. The ICs are cleared by a pulse of a logic 1 (high) or a logic 0 (low) to a designated input pin or pins on the UUT. When the UUT is pulsed, the signal will reach the reference IC and clear both ICs at the same time. It is strongly recommended that a logic pulser be used for this purpose. The clear instructions are written for simple interpretation. They are a combination of a number (IC pin number) and a pulse state. For example, if you need to clear a 74161, you will see the instruction "1/L". This means you should pulse pin #1 low or to logic 0. Some of the clear instructions will show more than one IC pin that should be pulsed (Example: 7476). Multiple clear instructions usually indicate a dual pack IC that has two separate clears, one for each half of a dual function. They may be cleared separately. If the clear instructions are accompanied by "SEE NOTE 5", then these clear commands must be performed at the same time, together.

Although it is not recommended, these clear pulses can be executed by a brief contact of a wire jumper from a logic high source (VCC) or a logic low source (GND). These VCC and GND pin locations are noted in the IC REFERENCE SECTION, Appendix E. If you should choose to use this method,

please use extreme caution. The jumper wire has a great potential for shorting adjacent pins if not handled carefully. The length of time that is required to clear the IC is very, very short. Momentarily touching or striking the GND or VCC source to the clear pin is all that is required. If a logic pulser is used, as recommended, it will automatically source and sink a signal required for a "clear".

Please keep in mind that the pulsing must be done on the appropriate pin of the IC being tested, not on the same pin of the reference IC. Pulsing the pin of the IC under test will simultaneously reset it and the reference IC, but not vice-versa. In cases of difficult access to the pins of the IC being tested, you can pulse the pin of the reference IC, but only if you first throw the corresponding switch on the logic comparator inward, towards the ZIP socket. This ties the pin of the reference IC and the pin of the IC being tested directly together allowing a simultaneous reset pulse. For example, on a 74161 that isn't getting a reset pulse on the board you're testing, (and you don't have access to pin #1 under the test clip), simply throw switch #1 of the 2074A inward and pulse pin #1 of the reference IC to a logic 0 (GND). The two ICs are now reset together and accurate testing can now be done.

APPENDIX D
REASONS FOR ERROR INDICATIONS

In the vast majority of cases, failure of the IC under test will be the direct cause of an error LED lighting. However, there are other possible reasons for an error indication. While these error indications may not be a direct result of an IC under test failure, they do point out a valid problem on the indicated node. Node failure indications may be caused by any of the following:

1. PHYSICAL SHORT OF TRACE ON ASSOCIATED NODE. This type of short may be caused by a solder splash, liquids, stray lead clippings, etc.

2. SHORTED INPUT NODE DRIVEN BY THE ERROR INDICATING OUTPUT NODE. As with the physical short, the 2074A will sense the fault caused by this shorted input.

3. ANOTHER SHORTED OUTPUT SHARING THE COMMON TRACE. Be alert for this in wire-ored and bus oriented circuits.

APPENDIX E
IC REFERENCE SECTION

This section is meant to be a handy reference guide for quickly checking the function of an IC, the pin numbers of it's outputs, and the pin numbers for the IC's VCC and GND.

Please note that this table lists the IC pin numbers on the top line of the IC listing. The numbers on the second line of the IC listing appear in parenthesis and represent the LED and switch number of the corresponding comparator channel. This conversion is necessary when testing chips less than 20 pins since some comparator channels will not be used. Appendix B contains an "IC PIN TO LOGIC COMPARATOR CHANNEL CONVERSION TABLE", but for your convenience, we have done all the necessary conversions in this reference section.

As you have already read, the only switch settings required on the 2074A are for VCC and GND. In most cases you can determine the VCC and GND pins of an IC by simply looking at which pins of the IC are connected to the VCC and GND bus of the circuit board being tested. However, if it isn't obvious, simply look up the IC number in this section. In the "VCC PIN" and "GND PIN" columns of the table are the appropriate IC pin numbers and more importantly, in parenthesis, are the corresponding numbers of the logic comparator switches that must be set.

For example, the listing for a 7404 IC shows pin #14 is VCC and pin #7 is GND. The numbers in parenthesis below these tell you that switch 20 must be switched inward (toward the ZIP socket) for VCC and switch 7 must be switched inward for GND.

As discussed earlier, certain ICs may have to be "cleared". The "CLEAR PIN(S) OF IC" column in this table tells you which pins of the IC may have to be pulsed to clear the IC and what polarity pulse is required (L = logic low pulse and H = logic high pulse).

The "NOTES" column is for pointing out tips or cautions when testing a particular IC. The notes are summarized at the end of the reference section.

Any abbreviations used in this IC REFERENCE SECTION are explained at the end of the section.

APPENDIX F
FUSE REPLACEMENT PROCEDURE

1. Remove rubber feet on box bottom.
2. Remove four phillips screws.
3. Replace fuse in fuse holder mounted in box bottom with 3AG 1A fuse.
4. Replace box bottom.

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
7400	NAND GATE	3 6 8 11 [3 6 14 17]	14 [20]	7 [7]		
7401	NAND GATE [OC]	1 4 10 13 [1 4 16 19]	14 [20]	7 [7]		
74H01	NAND GATE [OC]	3 6 8 11 [3 6 14 17]	14 [20]	7 [7]		
7402	NOR GATE	1 4 10 13 [1 4 16 19]	14 [20]	7 [7]		
7403	NAND GATE [OC]	3 6 8 11 [3 6 14 17]	14 [20]	7 [7]		
7404	INVERTER	2 4 6 8 10 12 [2 4 6 14 16 18]	14 [20]	7 [7]		
7405	INVERTER [OC]	2 4 6 8 10 12 [2 4 6 14 16 18]	14 [20]	7 [7]		
7406	INVERTER [OC]	2 4 6 8 10 12 [2 4 6 14 16 18]	14 [20]	7 [7]		CAUTION! SEE NOTE 4

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
7407	BUFFER [OC]	2 4 6 8 10 12 [2 4 6 14 16 18]	14 [20]	7 [7]	2-14/H	CAUTION! SEE NOTE 4
7408	AND GATE	3 6 8 11 [3 6 14 17]	14 [20]	7 [7]		
7409	AND GATE [OC]	3 6 8 11 [3 6 14 17]	14 [20]	7 [7]		
7410	NAND GATE	6 8 12 [6 14 18]	14 [20]	7 [7]		
7411	AND GATE	6 8 12 [6 14 18]	14 [20]	7 [7]		
7412	NAND GATE [OC]	6 8 12 [6 14 18]	14 [20]	7 [7]		
7413	NAND GATE	6 8 [6 14]	14 [20]	7 [7]		
7414	INVERTER	2 4 6 8 10 12 [2 4 6 14 16 18]	14 [20]	7 [7]		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
7415	AND GATE (OC)	6 8 12 (6 14 18)	14 (20)	7 (7)		
7416	INVERTER (OC)	2 4 6 8 10 12 (2 4 6 14 16 18)	14 (20)	7 (7)		CAUTION! SEE NOTE 4
7417	BUFFER (OC)	2 4 6 8 10 12 (2 4 6 14 16 18)	14 (20)	7 (7)		CAUTION! SEE NOTE 4
7418	NAND GATE	6 8 (6 14)	14 (20)	7 (7)		
7419	INVERTER	2 4 6 8 10 12 (2 4 6 14 16 18)	14 (20)	7 (7)		
7420	NAND GATE	6 8 (6 14)	14 (20)	7 (7)		
7421	AND GATE	6 8 (6 14)	14 (20)	7 (7)		
7422	NAND GATE (OC)	6 8 (6 14)	14 (20)	7 (7)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
7423	NOR GATE	7 9 (7 13)	16 (20)	8 (8)		
7424	NAND GATE	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		
7425	NOR GATE	6 8 (6 14)	14 (20)	7 (7)		
7426	NAND GATE (OC)	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		CAUTION! SEE NOTE 4
7427	NOR GATE	6 8 12 (6 14 18)	14 (20)	7 (7)		
7428	NOR BUFFER	1 4 10 13 (1 4 16 19)	14 (20)	7 (7)		
7430	NAND GATE	8 (14)	14 (20)	7 (7)		
7432	OR GATE	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
7433	NOR GATE (OC)	1 4 10 13 (1 4 16 19)	14 (20)	7 (7)		CAUTION! SEE NOTE 4
7437	NAND GATE	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		
7438	NAND GATE (OC)	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		
7439	NAND GATE (OC)	1 4 10 13 (1 4 16 19)	14 (20)	7 (7)		
7440	NAND GATE	6 8 (6 14)	14 (20)	7 (7)		
7441	DECODER	1 2 6 9 10 11 13 14 15 16 (1 2 8 13 14 15 17 18 19 20)	5 (5)	12 (16)		CAUTION! SEE NOTE 4
7442	DECODER	1 2 3 4 5 6 7 9 10 11 (1 2 3 4 5 6 7 13 14 15)	16 (20)	8 (8)		
7443	DECODER	1 2 3 4 5 6 7 9 10 11 (1 2 3 4 5 6 7 13 14 15)	16 (20)	8 (8)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
7444	DECODER	1 2 3 4 5 6 7 9 10 11 (1 2 3 4 5 6 7 13 14 15)	16 (20)	8 (8)		
7445	DECODER (OC)	1 2 3 4 5 6 7 9 10 11 (1 2 3 4 5 6 7 13 14 15)	16 (20)	8 (8)		CAUTION! SEE NOTE 4
7446	DECODER (OC)	9 10 11 12 13 14 15 (13 14 15 16 17 18 19)	16 (20)	8 (8)		CAUTION! SEE NOTE 4
7447	DECODER (OC)	9 10 11 12 13 14 15 (13 14 15 16 17 18 19)	16 (20)	8 (8)		CAUTION! SEE NOTE 4
7448	DECODER	9 10 11 12 13 14 15 (13 14 15 16 17 18 19)	16 (20)	8 (8)		
7449	DECODER	6 8 9 10 11 12 13 (6 14 15 16 17 18 19)	14 (20)	7 (7)		
7450	AND/NOR	6 8 (6 14)	14 (20)	7 (7)		
7451	AND/NOR	6 8 (6 14)	14 (20)	7 (7)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
7452	AND/OR	8 (14)	14 (20)	7 (7)		
7453	AND/NOR	8 (14)	14 (20)	7 (7)		
7454/ 74H54	AND/NOR	8 (14)	14 (20)	7 (7)		
74L54/ 74LS54	AND/NOR	6 (6)	14 (20)	7 (7)		
7455	AND/NOR	8 (14)	14 (20)	7 (7)		
7464	AND/NOR	8 (14)	14 (20)	7 (7)		
7465	AND/NOR	8 (14)	14 (20)	7 (7)		
7470	JK FLIP FLOP	6 8 (6 14)	14 (20)	7 (7)	2/L	

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74H71	JK FLIP FLOP	6 8 (6 14)	14 (20)	7 (7)	5/L	
74L71	JK FLIP FLOP	6 8 (6 14)	14 (20)	7 (7)	2/L	
7472	JK FLIP FLOP	6 8 (6 14)	14 (20)	7 (7)	2/L	
7473	JK FLIP FLOP	8 9 12 13 (14 15 18 19)	4 (4)	11 (17)	2-6/L	
7474	D FLIP FLOP	5 6 8 9 (5 6 14 15)	14 (20)	7 (7)	1-13/L	
7475	LATCH	1 8 9 10 11 14 15 16 (1 8 13 14 15 18 19 20)	5 (5)	12 (16)	4-13/H	
7476	JK FLIP FLOP	10 11 14 15 (14 15 18 19)	5 (5)	13 (17)	3-8/L	
7477	LATCH	8 9 13 14 (14 15 19 20)	4 (4)	11 (17)	3-12/H	

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74H78	JK FLIP FLOP	2 3 5 6 (2 3 5 6)	14 (20)	7 (7)	12/L	
74L78/ 74LS78	JK FLIP FLOP	8 9 12 13 (14 15 18 19)	4 (4)	11 (17)	5/L	
7480	ADDER	4 5 6 (4 5 6)	14 (20)	7 (7)		
7481	RAM	11 12 (17 18)	4 (4)	10 (16)	9-13/H	SEE NOTE 5
7482	ADDER	1 10 12 (1 16 18)	4 (4)	11 (17)		
7483	ADDER	2 6 9 15 (2 6 13 19)	5 (5)	12 (16)		
7484	RAM	13 14 (17 18)	5 (5)	12 (16)	10-11- 15-16/H	SEE NOTE 5
74L85	COMPARATOR	3 12 13 (3 16 17)	16 (20)	8 (8)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
7485/ 74LS85	COMPARATOR	5 6 7 (5 6 7)	16 (20)	8 (8)	2-14/H	CAUTION! NOTE 4
74L86	XOR GATE	3 4 10 11 (3 4 16 17)	14 (20)	7 (7)		
7486/ 74LS86	XOR GATE	3 4 8 11 (3 6 14 17)	14 (20)	7 (7)		
7487	TRUE/COMP/ ZERO/ONE	3 6 9 12 (3 6 15 18)	14 (20)	7 (7)		
7488	ROM	1 2 3 4 5 6 7 9 (1 2 3 4 5 6 7 13)	16 (20)	8 (8)		SEE NOTE 1
7489	RAM (OC)	5 7 9 11 (5 7 13 15)	16 (20)	8 (8)	2-3/L	SEE NOTES 2 AND 5
7490	COUNTER	8 9 11 12 (14 15 17 18)	5 (5)	10 (16)	2-3/H	SEE NOTE 5
7491	SHIFT REG	13 14 (19 20)	5 (5)	10 (16)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
7492	COUNTER	8 9 11 12 (14 15 17 18)	5 (5)	10 (16)	6-7/H	SEE NOTE 5
7493	COUNTER	8 9 11 12 (14 15 17 18)	5 (5)	10 (16)	2-3/H	SEE NOTE 5
7494	SHIFT REG	9 (13)	5 (5)	12 (16)	10/H	
74L95	SHIFT REG	9 10 12 13 (15 16 18 19)	4 (4)	11 (17)	6/H	
7495/ 74LS95	SHIFT REG	10 11 12 13 (16 17 18 19)	14 (20)	7 (7)	6/H	
7496	SHIFT REG	10 11 13 14 15 (14 15 17 18 19)	5 (5)	12 (16)	16/L	
7498	STORAGE REG	11 13 14 15 (15 17 18 19)	16 (20)	8 (8)		
7499	SHIFT REG	10 11 12 14 15 (14 15 16 18 19)	5 (5)	13 (17)	7/H	

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74101	JK FLIP FLOP	6 8 (6 14)	14 (20)	7 (7)	5/L	
74102	JK FLIP FLOP	6 8 (6 14)	14 (20)	7 (7)	2/L	
74103	JK FLIP FLOP	8 9 12 13 (14 15 18 19)	4 (4)	11 (17)	2-6/L	
74106	JK FLIP FLOP	10 11 14 15 (14 15 18 19)	5 (5)	13 (17)	3-8/L	
74107	JK FLIP FLOP	2 3 5 6 (2 3 5 6)	14 (20)	7 (7)	10-13/L	
74108	JK FLIP FLOP	2 3 5 6 (2 3 5 6)	14 (20)	7 (7)	12/L	
74109	JK FLIP FLOP	6 7 9 10 (6 7 13 14)	16 (20)	8 (8)	1-15/L	
74110	JK FLIP FLOP	6 8 (6 14)	14 (20)	7 (7)	2/L	

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74111	JK FLIP FLOP	6 7 9 10 (6 7 13 14)	16 (20)	8 (8)	3-13/L	
74112	JK FLIP FLOP	5 6 7 9 (5 6 7 13)	16 (20)	8 (8)	14-15/L	
74113	JK FLIP FLOP	5 6 8 9 (5 6 14 15)	14 (20)	7 (7)	4-10/L	
74114	JK FLIP FLOP	5 6 8 9 (5 6 14 15)	14 (20)	7 (7)	1/L	
74125	BUFFER (TRI)	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		
74126	BUFFER (TRI)	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		
74128	NOR BUFFER	1 4 10 13 (1 4 16 19)	14 (20)	7 (7)		
74132	NAND GATE	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74133	NAND GATE	9 (13)	16 (20)	8 (8)		
74134	NAND GATE	9 (13)	16 (20)	8 (8)		
74135	XOR/XNOR	3 7 9 13 (3 7 13 17)	16 (20)	8 (8)		
74136	XOR (OC)	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		
74138	DECODER	7 9 10 11 12 13 14 15 (7 13 14 15 16 17 18 19)	16 (20)	8 (8)		
74139	DECODER	4 5 6 7 9 10 11 12 (4 5 6 7 13 14 15 16)	16 (20)	8 (8)		
74140	LINE DRIVER	6 8 (6 14)	14 (20)	7 (7)		
74141	DECODER	1 2 8 9 10 11 13 14 15 16 (1 2 8 13 14 15 17 18 19 20)	5 (5)	12 (16)		CAUTION! SEE NOTE 4

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74145	DECODER (OC)	1 2 3 4 5 6 7 9 10 11 (1 2 3 4 5 6 7 13 14 15)	16 (20)	8 (8)		
74147	ENCODER	6 7 9 14 (6 7 13 18)	16 (20)	8 (8)		
74148	ENCODER	6 7 9 14 15 (6 7 13 18 19)	16 (20)	8 (8)		
74151	MULTIPLEXER	5 6 (5 6)	16 (20)	8 (8)		
74152	MULTIPLEXER	6 (6)	14 (20)	7 (7)		
74153	MULTIPLEXER	7 9 (7 13)	16 (20)	8 (8)		
74155	DECODER	4 5 6 7 9 10 11 12 (4 5 6 7 13 14 15 16)	16 (20)	8 (8)		
74156	DECODER (OC)	4 5 6 7 9 10 11 12 (4 5 6 7 13 14 15 16)	16 (20)	8 (8)		
74157	MULTIPLEXER	4 7 9 12 (4 7 13 16)	16 (20)	8 (8)		
74158	MULTIPLEXER	4 7 9 12 (4 7 13 16)	16 (20)	8 (8)		
74160	COUNTER	11 12 13 14 15 (15 16 17 18 19)	16 (20)	8 (8)	1/L	
74161	COUNTER	11 12 13 14 15 (15 16 17 18 19)	16 (20)	8 (8)	1/L	
74162	COUNTER	11 12 13 14 15 (15 16 17 18 19)	16 (20)	8 (8)	1/L	
74163	COUNTER	11 12 13 14 15 (15 16 17 18 19)	16 (20)	8 (8)	1/L	
74164	SHIFT REG	3 4 5 6 10 11 12 13 (3 4 5 6 16 17 18 19)	14 (20)	7 (7)	9/L	
74165	SHIFT REG	7 9 (7 13)	16 (20)	8 (8)	1/L	

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74166	SHIFT REG	13 (17)	16 (20)	8 (8)	9/L	
74168	COUNTER	11 12 13 14 15 (15 16 17 18 19)	16 (20)	8 (8)	9/L	
74169	COUNTER	11 12 13 14 15 (15 16 17 18 19)	16 (20)	8 (8)	9/L	
74170	REG FILE (OC)	6 7 9 10 (6 7 13 14)	16 (20)	8 (8)	12/L	
74173	D FLIP FLOP (TRI)	3 4 5 6 (3 4 5 6)	16 (20)	8 (8)	15/L	
74174	D FLIP FLOP	2 5 7 10 12 15 (2 5 7 14 16 19)	16 (20)	8 (8)	1/L	
74175	D FLIP FLOP	2 3 6 7 10 11 14 15 (2 3 6 7 14 15 18 19)	16 (20)	8 (8)	1/L	
74176	COUNTER	2 5 9 12 (2 5 13 16)	14 (20)	7 (7)	13/L	
74177	COUNTER	2 5 9 12 (2 5 13 16)	14 (20)	7 (7)	13/L	
74178	SHIFT REG	4 6 8 10 (4 6 14 16)	14 (20)	7 (7)	9/H	
74179	SHIFT REG	5 7 9 11 12 (5 7 13 15 16)	16 (20)	8 (8)	1/L	
74180	PARITY GEN	5 6 (5 6)	14 (20)	7 (7)		
74182	CARRY GEN	7 9 10 11 12 (7 13 14 15 16)	16 (20)	8 (8)		
74183	ADDER	5 6 8 10 (5 6 14 16)	14 (20)	7 (7)		
74184	CONVERTER	1 2 3 4 5 6 7 9 (1 2 3 4 5 6 7 13)	16 (20)	8 (8)		
74185	CONVERTER	1 2 3 4 5 6 7 9 (1 2 3 4 5 6 7 13)	16 (20)	8 (8)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74187	ROM	9 10 11 12	16	8		SEE NOTE 1
	(OC)	(15 16 17 18)	(20)	(8)		
74188	PROM	1 2 3 4 5 6 7 9	16	8		SEE NOTE 1
	(OC)	(1 2 3 4 5 6 7 13)	(20)	(8)		
74189	RAM	5 7 9 11	16	8	2-3/L	SEE NOTES
	(TRI)	(5 7 13 15)	(20)	(8)		2 AND 5
74190	COUNTER	2 3 6 7 12 13	16	8	11/L	
		(2 3 6 7 16 17)	(20)	(8)		
74191	COUNTER	2 3 6 7 12 13	16	8	11/L	
		(2 3 6 7 16 17)	(20)	(8)		
74192	COUNTER	2 3 6 7 12 13	16	8	14/H	
		(2 3 6 7 16 17)	(20)	(8)		
74193	COUNTER	2 3 6 7 12 13	16	8	14/H	
		(2 3 6 7 16 17)	(20)	(8)		
74194	SHIFT REG	12 13 14 15	16	8	1/L	
		(16 17 18 19)	(20)	(8)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74195	SHIFT REG	11 12 13 14 15	16	8	1/L	
		(15 16 17 18 19)	(20)	(8)		
74196	COUNTER	2 5 9 12	14	7	13/L	
		(2 5 15 18)	(20)	(7)		
74197	COUNTER	2 5 9 12	14	7	13/L	
		(2 5 15 18)	(20)	(7)		
74200	RAM	6	16	8	3-4-5-12/L	SEE NOTES
	(TRI)	(6)	(20)	(8)		2 AND 5
74201	RAM	6	16	8	3-4-5-12/L	SEE NOTES
	(TRI)	(6)	(20)	(8)		2 AND 5
74222	FIFO MEMORY	3 12 13 14 16 17	20	10	11/L	
	(TRI)	(3 12 13 14 16 17)	(20)	(10)		
74224	FIFO MEMORY	2 10 11 12 13 14	16	8	9/L	
	(TRI)	(2 14 15 16 17 18)	(20)	(8)		
74225	FIFO MEMORY	2 3 11 12 13 14 15 17	20	10	18/L	
	(TRI)	(2 3 11 12 13 14 15 17)	(20)	(10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74227	FIFO MEMORY (OC)	3 12 13 14 16 17 (3 12 13 14 16 17)	20 (20)	10 (10)	11/L	
74228	FIFO MEMORY (OC)	2 10 11 12 13 14 (2 14 15 16 17 18)	16 (20)	8 (8)	9/L	
74240	INV BUFFER (TRI)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
74241	BUFFER (TRI)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
74242	TRANSCEIVER (TRI BI INV)	3 4 5 6 (3 4 5 6)	14 (20)	7 (7)		PINS 1 AND 13 LOGIC HI
74242	TRANSCEIVER (TRI BI INV)	8 9 10 11 (14 15 16 17)	14 (20)	7 (7)		PINS 1 AND 13 LOGIC LO
74243	TRANSCEIVER (TRI BI)	3 4 5 6 (3 4 5 6)	14 (20)	7 (7)		PINS 1 AND 13 LOGIC HI
74243	TRANSCEIVER (TRI BI)	8 9 10 11 (14 15 16 17)	14 (20)	7 (7)		PINS 1 AND 13 LOGIC LO

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74244	BUFFER (TRI)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
74245	TRANSCEIVER (TRI BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (20)		PIN 1 LOGIC LO
74245	TRANSCEIVER (TRI BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
74246	DECODER (OC)	9 10 11 12 13 14 15 (13 14 15 16 17 18 19)	16 (20)	8 (8)		CAUTION! SEE NOTE 4
74247	DECODER (OC)	9 10 11 12 13 14 15 (13 14 15 16 17 18 19)	16 (20)	8 (8)		CAUTION! SEE NOTE 4
74248	DECODER	9 10 11 12 13 14 15 (13 14 15 16 17 18 19)	16 (20)	8 (8)		
74249	DECODER (OC)	9 10 11 12 13 14 15 (13 14 15 16 17 18 19)	16 (20)	8 (8)		
74251	MULTIPLIER (TRI)	5 6 (5 6)	16 (20)	8 (8)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74253	MULTIPLIER (TRI)	7 9 (7 13)	16 (20)	8 (8)		
74256	LATCH	4 5 6 7 9 10 11 12 (4 5 6 7 13 14 15 16)	16 (20)	8 (8)	15/L	
74257	MULTIPLEXER (TRI)	4 7 9 12 (4 7 13 16)	16 (20)	8 (8)		
74258	MULTIPLEXER (TRI INV)	4 7 9 12 (4 7 13 16)	16 (20)	8 (8)		
74259	LATCH	4 5 6 7 9 10 11 12 (4 5 6 7 13 14 15 16)	16 (20)	8 (8)	15/L	
74260	NOR GATE	5 6 (5 6)	14 (20)	7 (7)		
74261	MULTIPLEXER	5 6 7 9 10 (5 6 7 13 14)	16 (20)	8 (8)		
74265	COMP OUT	2 3 6 7 9 10 13 14 (2 3 6 7 13 14 17 18)	16 (20)	8 (8)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74266	XNOR GATE (OC)	3 4 10 11 (3 4 16 17)	14 (20)	7 (7)		
74270	ROM (OC)	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		SEE NOTE 1
74271	ROM (OC)	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		SEE NOTE 1
74273	D FLIP FLOP	2 5 6 9 12 15 16 19 (2 5 6 9 12 15 16 19)	20 (20)	10 (10)	1/L	
74274	MULTIPLIER	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		
74275	WALLACE TREE	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		
74276	JK FLIP FLOP	5 6 15 16 (5 6 15 16)	20 (20)	10 (10)	1/L	
74278	PRIORITY REG	5 6 8 9 10 (5 6 14 15 16)	14 (20)	7 (7)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74279	SR LATCH	4 7 9 13 (4 7 13 17)	16 (20)	8 (8)		
74280	PARITY GEN	5 6 (5 6)	14 (20)	7 (7)		
74283	ADDER	1 4 9 10 13 (1 4 13 14 17)	16 (20)	8 (8)		
74284	MULTIPLIER	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		
74285	MULTIPLIER	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		
74287	PROM (TRI)	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		SEE NOTE 1
74288	PROM (TRI)	1 2 3 4 5 6 7 9 (1 2 3 4 5 6 7 13)	16 (20)	8 (8)		SEE NOTE 1
74289	RAM (OC)	5 7 9 11 (5 7 13 15)	16 (20)	8 (8)	2-3/L	SEE NOTE 5

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74290	COUNTER	4 5 8 9 (4 5 14 15)	14 (20)	7 (7)	12-13/H	SEE NOTE 5
74292	FREQ DIVIDER	3 6 7 13 (3 6 7 17)	16 (20)	8 (8)	11/L	
74293	COUNTER	4 5 8 9 (4 5 14 15)	14 (20)	7 (7)	12-13/H	SEE NOTE 5
74294	FREQ DIVIDER	3 7 (3 7)	16 (20)	8 (8)	11/L	
74295	SHIFT REG	10 11 12 13 (16 17 18 19)	14 (20)	7 (7)	6/H	
74298	MULTIPLEXER	12 13 14 15 (16 17 18 19)	16 (20)	8 (8)		
74299	SHIFT REG (TRI BI)	8 17 (8 17)	20 (20)	10 (10)	9/L	PINS 1 AND 19 LOGIC HI
74299	SHIFT REG (TRI BI)	4 5 6 7 8 13 14 15 16 17 (4 5 6 7 8 13 14 15 16 17)	20 (20)	10 (10)	9/L	PINS 1 AND 19 LOGIC LO

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74300	RAM (OC)	6 (6)	16 (20)	8 (8)	12/L	SEE NOTE 2
74301	RAM (OC)	6 (6)	16 (20)	8 (8)	12/L	SEE NOTE 2
74302	RAM (OC)	6 (6)	16 (20)	8 (8)	12/L	SEE NOTE 2
74314	RAM (OC)	7 (7)	16 (20)	8 (8)	14/L	SEE NOTE 2
74319	RAM (OC)	5 7 9 11 (5 7 13 15)	16 (20)	8 (8)	2-3/L	SEE NOTE 2
74322	SHIFT REG (TRI BI)	12 (12)	20 (20)	10 (10)	9/L	SEE NOTE 3
74322	SHIFT REG (TRI BI)	4 5 6 7 12 13 14 15 16 (4 5 6 7 12 13 14 15 16)	20 (20)	10 (10)	9/L	SEE NOTE 3
74323	SHIFT REG (TRI BI)	8 17 (8 17)	20 (20)	10 (10)	9/L	SEE NOTE 3

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74323	SHIFT REG (TRI BI)	4 5 6 7 8 13 14 15 16 17 (4 5 6 7 8 13 14 15 16 17)	20 (20)	10 (10)	9/L	SEE NOTE 3
74340	BUFFER (TRI INV)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
74341	BUFFER (TRI)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
74344	BUFFER (TRI)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
74347	DECODER (OC)	9 10 11 12 13 14 15 (13 14 15 16 17 18 19)	16 (20)	8 (8)		
74348	ENCODER (TRI)	6 7 9 14 15 (6 7 13 18 19)	16 (20)	8 (8)		
74350	SHIFTER (TRI)	11 12 14 15 (15 16 18 19)	16 (20)	8 (8)		
74351	MULTIPLEXER (TRI)	1 19 (1 19)	20 (20)	10 (10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74352	MULTIPLEXER (INV)	7 9 (7 13)	16 (20)	8 (8)		
74353	MULTIPLEXER (TRI INV)	7 9 (7 13)	16 (20)	8 (8)		
74354	MULTIPLEXER (TRI)	18 19 (18 19)	20 (20)	10 (10)		
74355	MULTIPLEXER (OC)	18 19 (18 19)	20 (20)	10 (10)		
74356	MULTIPLEXER (TRI)	18 19 (18 19)	20 (20)	10 (10)		
74357	MULTIPLEXER (OC)	18 19 (18 19)	20 (20)	10 (10)		
74363	LATCH (TRI)	2 5 6 9 12 15 16 19 (2 5 6 9 12 15 16 19)	20 (20)	10 (10)	11/H	
74364	D FLIP FLOP (TRI)	2 5 6 9 12 15 16 19 (2 5 6 9 12 15 16 19)	20 (20)	10 (10)	1/L	

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74365	BUS DRIVER (TRI)	3 5 7 9 11 13 (3 5 7 13 15 17)	16 (20)	8 (8)		
74366	BUS DRIVER (TRI BI)	3 5 7 9 11 13 (3 5 7 13 15 17)	16 (20)	8 (8)		
74367	BUS DRIVER (TRI)	3 5 7 9 11 13 (3 5 7 13 15 17)	16 (20)	8 (8)		
74368	BUS DRIVER (TRI INV)	3 5 7 9 11 13 (3 5 7 13 15 17)	16 (20)	8 (8)		
74370	ROM (TRI)	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		SEE NOTE 1
74371	ROM (TRI)	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		SEE NOTE 1
74373	LATCH (TRI)	2 5 6 9 12 15 16 19 (2 5 6 9 12 15 16 19)	20 (20)	10 (10)	11/H	
74374	D FLIP FLOP (TRI)	2 5 6 9 12 15 16 19 (2 5 6 9 12 15 16 19)	20 (20)	10 (10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74375	LATCH	2 3 5 6 10 11 13 14 (2 3 5 6 14 15 17 18)	16 (20)	8 (8)	4-12/H	
74376	JK FLIP FLOP	4 5 12 13 (4 5 16 17)	16 (20)	8 (8)	1/L	
74377	D FLIP FLOP	2 5 6 9 12 15 16 19 (2 5 6 9 12 15 16 19)	20 (20)	10 (10)	1/L	
74378	D FLIP FLOP	2 5 7 10 12 15 (2 5 7 14 16 19)	16 (20)	8 (8)	1/L	
74379	D FLIP FLOP	2 3 6 7 10 11 14 15 (2 3 6 7 14 15 18 19)	16 (20)	8 (8)	1/L	
74381	ALU	8 9 11 12 13 14 (8 9 11 12 13 14)	20 (20)	10 (10)		
74382	ALU	8 9 11 12 13 14 (8 9 11 12 13 14)	20 (20)	10 (10)		
74384	MULTIPLIER	6 (6)	16 (20)	8 (8)	1/L	

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74385	ADD/SUB	2 9 12 19 (2 9 12 19)	20 (20)	10 (10)	11/L	
74386	XOR	3 4 10 11 (3 4 16 17)	14 (20)	7 (7)		
74387	PROM (OC)	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		SEE NOTE 1
74390	COUNTER	3 5 6 7 9 10 11 13 (3 5 6 7 13 14 15 17)	16 (20)	8 (8)	2-14/H	
74393	COUNTER	3 4 5 6 8 9 10 11 (3 4 5 6 14 15 16 17)	14 (20)	7 (7)	2-12/H	
74395	SHIFT REG (TRI)	11 12 13 14 15 (15 16 17 18 19)	16 (20)	8 (8)	1/L	
74396	STORAGE REG	1 2 4 5 10 11 13 14 (1 2 4 5 14 15 17 18)	16 (20)	8 (8)	15/L	
74398	MULTIPLEXER	2 3 8 9 12 13 18 19 (2 3 8 9 12 13 18 19)	20 (20)	10 (10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74399	MULTIPLEXER	2 7 10 15 (2 7 14 19)	16 (20)	8 (8)		
74425	BUFFER (TRI)	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		
74426	BUFFER (TRI)	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		
74436	LINE DRIVER	3 5 7 9 11 13 (3 5 7 13 15 17)	16 (20)	8 (8)		
74437	LINE DRIVER (TRI)	3 5 7 9 11 13 (3 5 7 13 15 17)	16 (20)	8 (8)		
74440	TRANSCEIVER (OC TRIDIR)	2 3 4 5 6 7 8 9 13 14 15 16 (2 3 4 5 6 7 8 9 13 14 15 16)	20 (20)	10 (10)		SEE NOTE 3
74441	TRANSCEIVER (OC TRIDIR)	2 3 4 5 6 7 8 9 13 14 15 16 (2 3 4 5 6 7 8 9 13 14 15 16)	20 (20)	10 (10)		SEE NOTE 3
74442	TRANSCEIVER (TRI TRIDIR)	2 3 4 5 6 7 8 9 13 14 15 16 (2 3 4 5 6 7 8 9 13 14 15 16)	20 (20)	10 (10)		SEE NOTE 3

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74443	TRANSCEIVER (TRI TRIDIR)	2 3 4 5 6 7 8 9 13 14 15 16 (2 3 4 5 6 7 8 9 13 14 15 16)	20 (20)	10 (10)		SEE NOTE 3
74444	TRANSCEIVER (TRI TRIDIR)	2 3 4 5 6 7 8 9 13 14 15 16 (2 3 4 5 6 7 8 9 13 14 15 16)	20 (20)	10 (10)		SEE NOTE 3
74445	DECODER	1 2 3 4 5 6 7 9 10 11 (1 2 3 4 5 6 7 13 14 15)	16 (20)	8 (8)		
74446	TRANSCEIVER (TRI BI)	2 4 5 7 (2 4 5 7)	16 (20)	8 (8)		PINS 3-6-10-13/LOGIC LO
74446	TRANSCEIVER (TRI BI)	9 11 12 14 (13 15 16 18)	16 (20)	8 (8)		PINS 3-6-10-13/LOGIC HI
74447	DECODER (OC)	9 10 11 12 13 14 15 (13 14 15 16 17 18 19)	16 (20)	8 (8)		
74448	TRANSCEIVER (OC TRIDIR)	2 3 4 5 6 7 8 9 13 14 15 16 (2 3 4 5 6 7 8 9 13 14 15 16)	20 (20)	10 (10)		SEE NOTE 3
74449	TRANSCEIVER (TRI BI)	2 4 5 7 (2 4 5 7)	16 (20)	8 (8)		PINS 3-6-10-13/LOGIC LO

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74449	TRANSCEIVER (TRI BI)	9 11 12 14 (13 15 16 18)	16 (20)	8 (8)		PINS 3-6-10-13/LOGIC HI
74465	BUFFER (TRI)	3 5 7 9 11 13 15 17 (3 5 7 9 11 13 15 17)	20 (20)	10 (10)		
74466	BUFFER (TRI INV)	3 5 7 9 11 13 15 17 (3 5 7 9 11 13 15 17)	20 (20)	10 (10)		
74467	BUFFER (TRI)	3 5 7 9 11 13 15 17 (3 5 7 9 11 13 15 17)	20 (20)	10 (10)		
74468	BUFFER (TRI INV)	3 5 7 9 11 13 15 17 (3 5 7 9 11 13 15 17)	20 (20)	10 (10)		
74470	PROM (OC)	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		SEE NOTE 1
74471	PROM (TRI)	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		SEE NOTE 1
74472	PROM (TRI)	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		SEE NOTE 1

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74473	PROM (OC)	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		SEE NOTE 1
74484	CONVERTER	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		
74485	CONVERTER	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		
74490	COUNTER	3 5 6 7 9 10 11 13 (3 5 6 7 13 14 15 17)	16 (20)	8 (8)	2-14/H	
74518	COMPARATOR (OC)	19 (19)	20 (20)	10 (10)		
74519	COMPARATOR (OC)	19 (19)	20 (20)	10 (10)		
74520	COMPARATOR (TOTEM POLE)	19 (19)	20 (20)	10 (10)		
74521	COMPARATOR (TOTEM POLE)	19 (19)	20 (20)	10 (10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74522	COMPARATOR	19	20	10		
	(OC)	(19)	(20)	(10)		
74533	LATCH	2 5 6 9 12 15 16 19	20	10		
	(TRI)	(2 5 6 9 12 15 16 19)	(20)	(10)		
74534	D FLIP FLOP	2 5 6 9 12 15 16 19	20	10		
	(TRI)	(2 5 6 9 12 15 16 19)	(20)	(10)		
74538	DECODER	1 2 3 8 9 11 18 19	20	10		
	(TRI)	(1 2 3 8 9 11 18 19)	(20)	(10)		
74539	DECODER	1 2 3 8 9 11 18 19	20	10		
	(TRI)	(1 2 3 8 9 11 18 19)	(20)	(10)		
74540	BUFFER	11 12 13 14 15 16 17 18	20	10		
	(TRI INV)	(11 12 13 14 15 16 17 18)	(20)	(10)		
74541	BUFFER	11 12 13 14 15 16 17 18	20	10		
	(TRI)	(11 12 13 14 15 16 17 18)	(20)	(10)		
74560	COUNTER	13 14 15 16 18 19	20	10	8-9/L	
		(13 14 15 16 18 19)	(20)	(10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74561	COUNTER	13 14 15 16 18 19	20	10	8-9/L	
		(13 14 15 16 18 19)	(20)	(10)		
74563	LATCH	12 13 14 15 16 17 18 19	20	10	1/L	
		(12 13 14 15 16 17 18 19)	(20)	(10)		
74564	D FLIP FLOP	12 13 14 15 16 17 18 19	20	10	1/L	
		(12 13 14 15 16 17 18 19)	(20)	(10)		
74568	COUNTER	13 14 15 16 18 19	20	10	8-9/L	
		(13 14 15 16 18 19)	(20)	(10)		
74569	COUNTER	13 14 15 16 18 19	20	10	8-9/L	
		(13 14 15 16 18 19)	(20)	(10)		
74573	LATCH	12 13 14 15 16 17 18 19	20	10	1/L	
	(TRI)	(12 13 14 15 16 17 18 19)	(20)	(10)		
74574	D FLIP FLOP	12 13 14 15 16 17 18 19	20	10	1/L	
	(TRI)	(12 13 14 15 16 17 18 19)	(20)	(10)		
74576	D FLIP FLOP	12 13 14 15 16 17 18 19	20	10	1/L	
		(12 13 14 15 16 17 18 19)	(20)	(10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74580	LATCH	12 13 14 15 16 17 18 19	20	10	1/L	
	(TRI)	(12 13 14 15 16 17 18 19)	(20)	(10)		
74590	COUNTER	1 2 3 4 5 6 7 9 15	16	8	10/L	
	(TRI)	(1 2 3 4 5 6 7 13 19)	(20)	(8)		
74591	COUNTER	1 2 3 4 5 6 7 9 15	16	8	10/L	
	(OC)	(1 2 3 4 5 6 7 13 19)	(20)	(8)		
74592	COUNTER	9	16	8	10/L	
		(13)	(20)	(8)		
74593	COUNTER	1 2 3 4 5 6 7 8 11	20	10	12/L	SEE NOTE 3
	(TRI BI)	(1 2 3 4 5 6 7 8 11)	(20)	(10)		
74594	REGISTER	1 2 3 4 5 6 7 9 15	16	8	10-13/L	
		(1 2 3 4 5 6 7 13 19)	(20)	(8)		
74595	REGISTER	1 2 3 4 5 6 7 9 15	16	8	10/L	
	(TRI)	(1 2 3 4 5 6 7 13 19)	(20)	(8)		
74596	REGISTER	1 2 3 4 5 6 7 9 15	16	8	10/L	
	(OC)	(1 2 3 4 5 6 7 13 19)	(20)	(8)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74597	SHIFT REG	9	16	8	10/L	
		(13)	(20)	(8)		
74598	SHIFT REG	1 2 3 4 5 6 7 8 11	20	10	12/L	SEE NOTE 3
	(TRI BI)	(1 2 3 4 5 6 7 8 11)	(20)	(10)		
74599	SHIFT REG	1 2 3 4 5 6 7 9 15	16	8	10-13/L	
	(OC)	(1 2 3 4 5 6 7 13 19)	(20)	(8)		
74620	TRANSCEIVER	2 3 4 5 6 7 8 9	20	10		PINS 1 AND 19
	(TRI BI)	(2 3 4 5 6 7 8 9)	(20)	(10)		LOGIC LO
74620	TRANSCEIVER	11 12 13 14 15 16 17 18	20	10		PINS 1 AND 19
	(TRI BI)	(11 12 13 14 15 16 17 18)	(20)	(10)		LOGIC HI
74621	TRANSCEIVER	2 3 4 5 6 7 8 9	20	10		PINS 1 AND 19
	(OC BI)	(2 3 4 5 6 7 8 9)	(20)	(10)		LOGIC LO
74621	TRANSCEIVER	11 12 13 14 15 16 17 18	20	10		PINS 1 AND 19
	(OC BI)	(11 12 13 14 15 16 17 18)	(20)	(10)		LOGIC HI
74622	TRANSCEIVER	2 3 4 5 6 7 8 9	20	10		PINS 1 AND 19
	(OC BI)	(2 3 4 5 6 7 8 9)	(20)	(10)		LOGIC LO

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74622	TRANSCEIVER (OC BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC HI
74623	TRANSCEIVER (TRI BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC LO
74623	TRANSCEIVER (TRI BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC HI
74638	TRANSCEIVER (OC INV)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
74638	TRANSCEIVER (TRI INV)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
74639	TRANSCEIVER (OC BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
74639	TRANSCEIVER (TRI BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
74640	TRANSCEIVER (TRI BI INV)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
74640	TRANSCEIVER (TRI BI INV)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
74641	TRANSCEIVER (OC BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
74641	TRANSCEIVER (OC BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
74642	TRANSCEIVER (OC BI INV)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
74642	TRANSCEIVER (OC BI INV)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
74643	TRANSCEIVER (TRI BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
74643	TRANSCEIVER (TRI BI INV)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
74644	TRANSCEIVER (OC BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74644	TRANSCEIVER	11 12 13 14 15 16 17 18	20	10		PIN 1
	(OC BI INV)	(11 12 13 14 15 16 17 18)	(20)	(10)		LOGIC HI
74645	TRANSCEIVER	2 3 4 5 6 7 8 9	20	10		PIN 1
	(TRI BI)	(2 3 4 5 6 7 8 9)	(20)	(10)		LOGIC LO
74645	TRANSCEIVER	11 12 13 14 15 16 17 18	20	10		PIN 1
	(TRI BI)	(11 12 13 14 15 16 17 18)	(20)	(10)		LOGIC HI
74668	COUNTER	11 12 13 14 15	16	8	9/L	
		(15 16 17 18 19)	(20)	(8)		
74669	COUNTER	11 12 13 14 15	16	8	9/L	
		(15 16 17 18 19)	(20)	(8)		
74670	REG FILE	6 7 9 10	16	8	12/L	
	(TRI)	(6 7 13 14)	(20)	(8)		
74671	SHIFT REG	15 16 17 18 19	20	10	8/L	
	(TRI)	(15 16 17 18 19)	(20)	(10)		
74672	SHIFT REG	15 16 17 18 19	20	10	8/L	
	(TRI)	(15 16 17 18 19)	(20)	(10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74679	COMPARATOR	18	20	10		
		(18)	(20)	(10)		
74680	COMPARATOR	18	20	10	19/L	
		(18)	(20)	(10)		
74682	COMPARATOR	1 19	20	10		
	(TOTEM POLE)	(1 19)	(20)	(10)		
74683	COMPARATOR	1 19	20	10		
	(OC)	(1 19)	(20)	(10)		
74684	COMPARATOR	1 19	20	10		
	(TOTEM POLE)	(1 19)	(20)	(10)		
74685	COMPARATOR	1 19	20	10		
	(OC)	(1 19)	(20)	(10)		
74688	COMPARATOR	19	20	10		
	(TOTEM POLE)	(19)	(20)	(10)		
74689	COMPARATOR	19	20	10		
	(OC)	(19)	(20)	(10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74690	COUNTER REG	15 16 17 18 19	20	10	1-8/L	
	(TRI)	(15 16 17 18 19)	(20)	(10)		
74691	COUNTER REG	15 16 17 18 19	20	10	1-8/L	
	(TRI)	(15 16 17 18 19)	(20)	(10)		
74692	COUNTER REG	15 16 17 18 19	20	10	1-8/L	
	(TRI)	(15 16 17 18 19)	(20)	(10)		
74693	COUNTER REG	15 16 17 18 19	20	10	1-8/L	
	(TRI)	(15 16 17 18 19)	(20)	(10)		
74696	COUNTER REG	15 16 17 18 19	20	10	8/L	
	(TRI)	(15 16 17 18 19)	(20)	(10)		
74697	COUNTER REG	15 16 17 18 19	20	10	8/L	
	(TRI)	(15 16 17 18 19)	(20)	(10)		
74698	COUNTER REG	15 16 17 18 19	20	10	8/L	
	(TRI)	(15 16 17 18 19)	(20)	(10)		
74699	COUNTER REG	15 16 17 18 19	20	10	8/L	
	(TRI)	(15 16 17 18 19)	(20)	(10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74716	COUNTER	1 7 9 15	16	8	10/L	
		(1 7 13 19)	(20)	(8)		
74718	COUNTER	1 7 9 15	16	8	10/L	
		(1 7 13 19)	(20)	(8)		
74795	BUFFER	3 5 7 9 11 13 15 17	20	10		
	(TRI)	(3 5 7 9 11 13 15 17)	(20)	(10)		
74796	BUFFER	3 5 7 9 11 13 15 17	20	10		
	(TRI INV)	(3 5 7 9 11 13 15 17)	(20)	(10)		
74797	BUFFER	3 5 7 9 11 13 15 17	20	10		
	(TRI)	(3 5 7 9 11 13 15 17)	(20)	(10)		
74798	BUFFER	3 5 7 9 11 13 15 17	20	10		
	(TRI INV)	(3 5 7 9 11 13 15 17)	(20)	(10)		
74800	AND/NAND	11 12 13 14 15 16	20	10		
		(11 12 13 14 15 16)	(20)	(10)		
74802	OR/NOR	11 12 13 14 15 16	20	10		
		(11 12 13 14 15 16)	(20)	(10)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
74804	NAND DRIVER	3 6 9 11 14 17 (3 6 9 11 14 17)	20 (20)	10 (10)		
74805	NOR DRIVER	3 6 9 11 14 17 (3 6 9 11 14 17)	20 (20)	10 (10)		
74808	AND DRIVER	3 6 9 11 14 17 (3 6 9 11 14 17)	20 (20)	10 (10)		
74832	OR DRIVER	3 6 9 11 14 17 (3 6 9 11 14 17)	20 (20)	10 (10)		
74940	BUFFER (TRI INV)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
74941	BUFFER (TRI)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
741000	NAND GATE	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		
741002	NOR BUFFER	1 4 10 13 (1 4 16 19)	14 (20)	7 (7)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
741003	NAND BUFFER (OC)	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		
741004	INV BUFFER	2 4 6 8 10 12 (2 4 6 14 16 18)	14 (20)	7 (7)		
741005	INV BUFFER (OC)	2 4 6 8 10 12 (2 4 6 14 16 18)	14 (20)	7 (7)		
741008	AND BUFFER	6 8 12 (6 14 18)	14 (20)	7 (7)		
741010	NAND BUFFER	6 8 12 (6 14 18)	14 (20)	7 (7)		
741011	AND BUFFER	6 8 12 (6 14 18)	14 (20)	7 (7)		
741020	NAND BUFFER	6 8 (6 14)	14 (20)	7 (7)		
741032	OR BUFFER	3 6 8 11 (3 6 14 17)	14 (20)	7 (7)		

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
741034	BUFFER	2 4 6 8 10 12 (2 4 6 14 16 18)	14 (20)	7 (7)		
741035	BUFFER (OC)	2 4 6 8 10 12 (2 4 6 14 16 18)	14 (20)	7 (7)		
741240	LINE DRIVER (TRI INV)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
741241	LINE DRIVER (TRI)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
741242	TRANSCEIVER (TRI BI INV)	3 4 5 6 (3 4 5 6)	14 (20)	7 (7)		PINS 1 AND 13 LOGIC HI
741242	TRANSCEIVER (TRI BI INV)	8 9 10 11 (14 15 16 17)	14 (20)	7 (7)		PINS 1 AND 13 LOGIC LO
741243	TRANSCEIVER (TRI BI)	3 4 5 6 (3 4 5 6)	14 (20)	7 (7)		PINS 1 AND 13 LOGIC HI
741243	TRANSCEIVER (TRI BI)	8 9 10 11 (14 15 16 17)	14 (20)	7 (7)		PINS 1 AND 13 LOGIC LO
741244	LINE DRIVER (TRI)	3 5 7 9 12 14 16 18 (3 5 7 9 12 14 16 18)	20 (20)	10 (10)		
741245	TRANSCEIVER (TRI BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
741245	TRANSCEIVER (TRI BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
741620	TRANSCEIVER (TRI BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC LO
741620	TRANSCEIVER (TRI BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC HI
741621	TRANSCEIVER (OC BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC LO
741621	TRANSCEIVER (OC BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC HI
741622	TRANSCEIVER (OC BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC LO

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
741622	TRANSCEIVER (OC BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC HI
741623	TRANSCEIVER (TRI BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC LO
741623	TRANSCEIVER (TRI BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PINS 1 AND 19 LOGIC HI
741638	TRANSCEIVER (OC BI INV)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
741638	TRANSCEIVER (TRI BI INV)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
741639	TRANSCEIVER (OC BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
741639	TRANSCEIVER (TRI BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
741640	TRANSCEIVER (TRI BI INV)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
741640	TRANSCEIVER (TRI BI INV)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
741641	TRANSCEIVER (OC BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
741641	TRANSCEIVER (OC BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
741642	TRANSCEIVER (OC BI INV)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
741642	TRANSCEIVER (OC BI INV)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
741643	TRANSCEIVER (TRI BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
741643	TRANSCEIVER (TRI BI INV)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
741644	TRANSCEIVER (OC BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
741644	TRANSCEIVER (OC BI INV)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
741645	TRANSCEIVER (TRI BI)	2 3 4 5 6 7 8 9 (2 3 4 5 6 7 8 9)	20 (20)	10 (10)		PIN 1 LOGIC LO
741645	TRANSCEIVER (TRI BI)	11 12 13 14 15 16 17 18 (11 12 13 14 15 16 17 18)	20 (20)	10 (10)		PIN 1 LOGIC HI
TBP14S10	PROM (TRI)	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		SEE NOTE 1
TBP14SA10	PROM (OC)	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		SEE NOTE 1
TBP18S22	PROM (TRI)	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		SEE NOTE 1
TBP18SA22	PROM (OC)	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		SEE NOTE 1
TBP18S030	PROM (TRI)	1 2 3 4 5 6 7 9 (1 2 3 4 5 6 7 13)	16 (20)	8 (8)		SEE NOTE 1

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
TBP18SA030	PROM (OC)	1 2 3 4 5 6 7 9 (1 2 3 4 5 6 7 13)	16 (20)	8 (8)		SEE NOTE 1
TBP18S42	PROM (TRI)	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		SEE NOTE 1
TBP18SA42	PROM (OC)	6 7 8 9 11 12 13 14 (6 7 8 9 11 12 13 14)	20 (20)	10 (10)		SEE NOTE 1
TBP24S10	PROM (TRI)	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		SEE NOTE 1
TBP24SA10	PROM (OC)	9 10 11 12 (13 14 15 16)	16 (20)	8 (8)		SEE NOTE 1
TBP24S41	PROM (TRI)	11 12 13 14 (13 14 15 16)	18 (20)	9 (9)		SEE NOTE 1
TBP24SA41	PROM (OC)	11 12 13 14 (13 14 15 16)	18 (20)	9 (9)		SEE NOTE 1
TBP24S81	PROM (TRI)	11 12 13 14 (13 14 15 16)	18 (20)	9 (9)		SEE NOTE 1

IC	FUNCTION	IC OUTPUT PINS (LED #(S))	VCC PIN (SWITCH#)	GND PIN (SWITCH#)	CLEAR PIN(S) OF IC	NOTES
TBP24SA81	PROM	11 12 13 14	18	9		SEE NOTE 1
	(OC)	(13 14 15 16)	(20)	(9)		
TBP28L22	PROM	6 7 8 9 11 12 13 14	20	10		SEE NOTE 1
	(TRI)	(6 7 8 9 11 12 13 14)	(20)	(10)		
TBP28LA22	PROM	6 7 8 9 11 12 13 14	20	10		SEE NOTE 1
	(OC)	(6 7 8 9 11 12 13 14)	(20)	(10)		
TBP28L42	PROM	6 7 8 9 11 12 13 14	20	10		SEE NOTE 1
	(TRI)	(6 7 8 9 11 12 13 14)	(20)	(10)		
TBP28LA42	PROM	6 7 8 9 11 12 13 14	20	10		SEE NOTE 1
	(OC)	(6 7 8 9 11 12 13 14)	(20)	(10)		

IC REFERENCE NOTES

1. You must have a matching programmed ROM as your reference IC.
2. Chip Select (CS) and Write Enable (WE) may have to be manually enabled to load the reference IC and unit under test (UUT) with the same information.
3. The input/output status of the IC pin depends on which direction is enabled on the IC (bidirectional).
4. CAUTION! IC outputs may have higher voltages present than normal +5VDC TTL logic levels. Do not attach the comparator test clip to any IC with greater than +5VDC present on any pin under any circumstances!
5. The clear pins noted must be pulsed simultaneously.

ABBREVIATIONS

BI: Bidirectional
GND: Ground
IC: Integrated Circuit
H = High speed TTL
L = Low power TTL
LS = Low power Schottky TTL
S = Schottky TTL
INV: Inverter
LED: Light Emitting Diode
O.C.: Open Collector
TRI: Tri-state
TRIDIR: Tridirectional
UUT: Unit Under Test
VCC: Supply voltage (+5VDC)
ZIP: Zero-Insertion-Pressure socket

MODEL 2074A SPECIFICATIONS*

IC CAPACITY:
14,16,18,20 pin dual-in-line packages, digital TTL, +5VDC.

TEST RATE:
Continuous, 10 MHz. maximum.

INPUT LOGIC LEVELS:
TTL logic levels, 0VDC to +5VDC.

SUPPLY VOLTAGE:
+5VDC.

SUPPLY CURRENT:
100 mA (maximum of 400 mA with all 20 LEDs lit).

SUPPLY PROTECTION:
Reverse polarity protected; fused for over voltage protection (1 amp, 3AG). See Appendix F for fuse replacement procedure.

ERROR SENSITIVITY:
Error detection sensitivity increases as error frequency increases:

DETECTABLE ERROR	ERROR RATE FREQUENCY
300 nanoseconds	Single error
200 nanoseconds	1.0 MHz.
150 nanoseconds	1.5 MHz.
100 nanoseconds	3.0 MHz.
50 nanoseconds	6.0 MHz.

Errors smaller than those listed are considered to be within reasonable tolerance at the corresponding frequency and are ignored.

*Subject to change without notice.