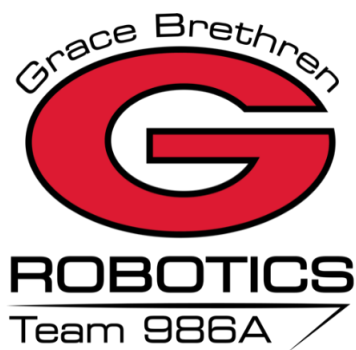


2021 Electronics Online Challenge Sponsored by



**Deconstructing the Cisco 2620
Modular Access Router**



Team Number: 986A

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School: Grace Brethren Schools

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Thanks to all the mentors for all the support through the years!

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Final Summary Report

The COVID-19 pandemic affected students and required learning via Zoom and the majority of working people moved their businesses online. More individuals utilize internet/Wi-Fi systems and routers for daily use. With communication devices central to our education, we were intrigued to learn more about routers. One of our team members went ‘dumpster-diving’ at the recycling bin at his parent’s company and recovered a large device suitable for our online challenge deconstruction: a Cisco 2620 Modular Access Router used for mid-size to large companies. Our team decided to communicate and expand our knowledge, with a lot of patience and perseverance, we completed the challenge.

With school district specific restrictions from COVID-19, and with the approval from our mentor, we decided to deconstruct the CISCO router. We had to be creative in setting team meetings. We concurred that Zoom meetings would allow members to effectively view the router deconstruction process. Deconstruction was done by one team member in order to avoid mutual contact, but all could learn during the process. The deconstructions included, the chassis, memory cards, interfaces, fan assembly, power supply, and the back panel. We documented 841 chip/components on 6 circuit boards: Motherboard, 3-Memory Cards, 2-WIC. It was fun because we looked forward to our weekly zoom meetings discussing status updates, and we had frequent meetings the last 3 weeks.

The motherboard had a 50MHz XPC860ZP50C1 Motorola Processor that takes care of the main function of the router, a One Time Programmable STMicroelectronics M27C4001 EPROM, and a flash memory which had 8 LH28F008SAT-85 Sharp chips that maintained storage information even when power is off. We found 11 Integrated Circuits by Texas Instrument on the 6 board/cards.

Through our research, we found that the router had 365-Resistors, 295-Capacitors, 89-Integrated Circuits, 28-Inductors, 21-Diodes, 21-Resistor Networks, 12-Jacks, 5-Transistors, 3-Crystals, 1-Plug, and 1-Transformer. Together, the components connect to talk to each other and perform their roles so the router can connect device(s) to the internet. It communicates with other components on the board and executes instructions for the operating system. It allows the best route for information transferred to your device: computer, cell phone, laptop, etc. In Section 4, we discuss the function and purpose of components. The Tables in our report identify each component with close-up images and a description of what it does and the role they play.

In conclusion, we learned that a router plays an important role in our daily connection to the internet. We gained knowledge of how to decode the markings on chips and components, and learned about the companies that manufacture them, how each chip functions, and the enormous number of components assembled inside the router. But most of all we learned that we were able to communicate and work well together on a project through weekly and sometimes daily Zoom meetings. By Using Google Docs we created one spot for each member to input their information, and most importantly we learned to work together as a team.

Word Count: 495

Section 1: Overview of Deconstruction Process

Deconstruction Steps



STEP 01 Wear Safety Glasses!
+ set up zoom



Measure the Dimensions and Weigh the Router

STEP 02



STEP 03 Remove Top Screws and Top Chassis

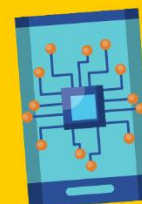


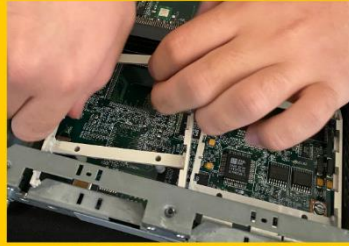
Remove and Label Memory Cards 1,2,3

STEP 04



STEP 05 Remove and Label the WAN Interface Cards





STEP 06 Remove WAN Interface Card Guides



STEP 07 Remove Wire Connector and LEDs



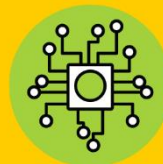
STEP 08 Remove Screws and Fan Assembly.



STEP 09 Remove Screw and Power Supply.



STEP 10 Remove Screws and MotherBoard



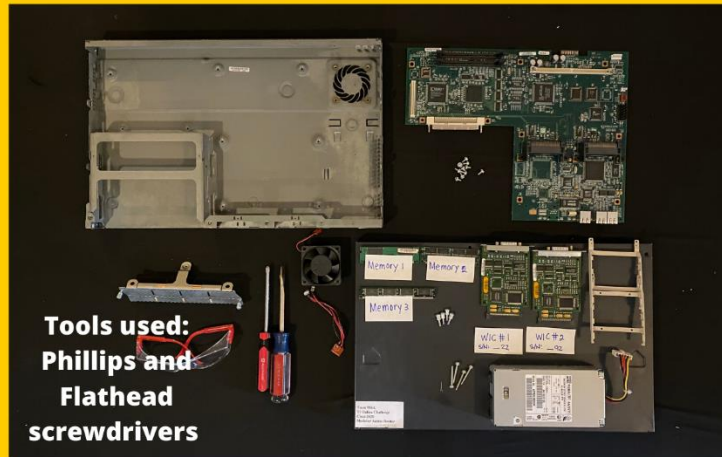


STEP
11

Remove
Thumb
Screws
and Blank
Network
Module
Panel



Voilà!



Section 2: Detailed Deconstruction Process

All photos taken with an iPhone11.

Step by Step Instructions on Deconstructing a Cisco 2620 Router



Step 1: Prepare Safety Glasses, Phillips, and flathead screwdriver. Set up Zoom.



Step 2: Inspect Top Chassis for screws.



Step 3: Inspect Rear Panel for screws. Note: No power cord or cables attached.



Step 4: Inspect Bottom Chassis for screws.



Step 5: Weigh the router.



Step 6: Measure the height.



Step 7: Measure the width.



Step 8: Measure the length.



Step 9: Remove screws located on the top chassis.

Step by Step Instructions on Deconstructing a Cisco 2620 Router



Step 10: Locate Top Chassis Indented Guide Marks for thumb placement.



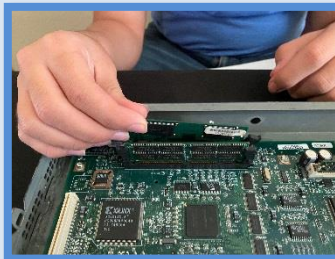
Step 11: Depress arrows on left and right side and push chassis forward to release the top chassis from the bottom chassis.



Step 12: Remove chassis by lifting the top chassis from the bottom chassis.



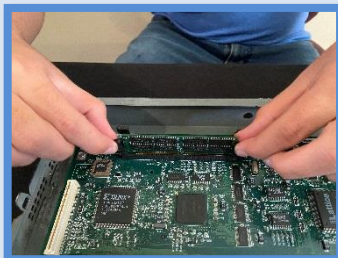
Step 13: View of the Internal Components of the Router, look for components that can be removed.



Step 14: Pull connectors outwards to unlatch the DRAM DIMM, Pull out Memory Card 1 upwards.



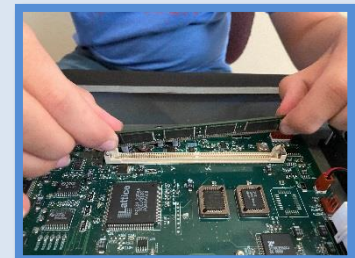
Step 15: Label Memory Card 1.



Step 16: Pull the connectors outwards to unlatch the DRAM DIMM. Pull out Memory Card 2 upwards.



Step 17: Label Memory Card 2.



Step 18: Pull connectors outwards to unlatch the DRAM DIMM. Pull out Memory Card 3 upwards.

Step by Step Instructions on Deconstructing a Cisco 2620 Router



Step 19: Label Memory Card 3.



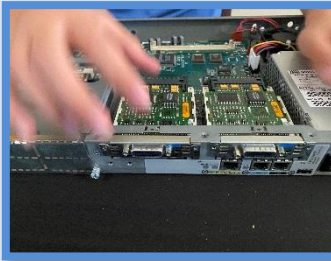
Step 20: Loosen and remove thumb screws from the WAN Interface Card 1.



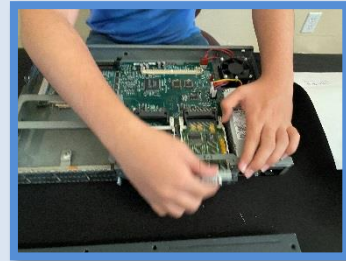
Step 21: Pull out and remove WAN Interface Card 1.



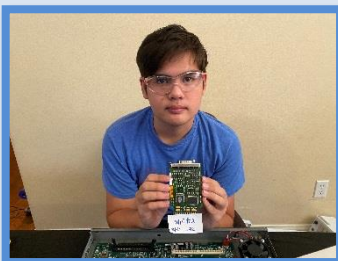
Step 22: Label WIC#1 and write the last few serial numbers.



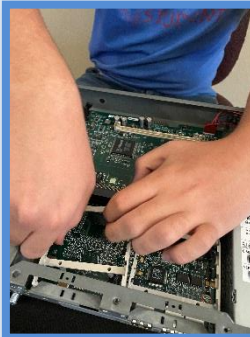
Step 23: Loosen and remove thumb screws on WAN Interface Card 2.



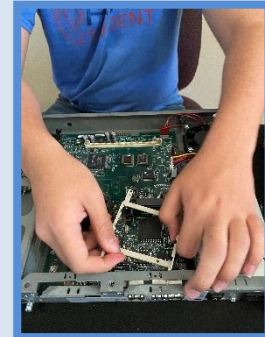
Step 24: Pull out and remove WAN Interface Card 2.



Step 25: Label WIC#2 and write the last few serial numbers.

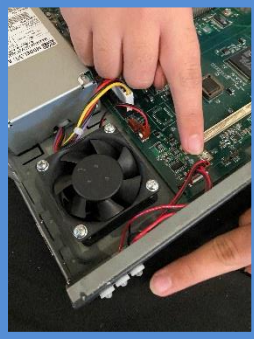


Step 26: Remove 1st Guide for WAN Interface Card 1.

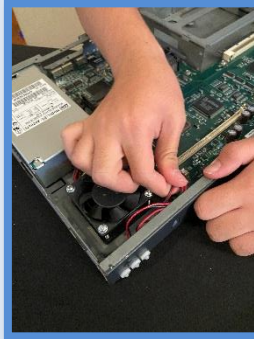


Step 27: Remove 2nd Guide for WAN Interface Card 2.

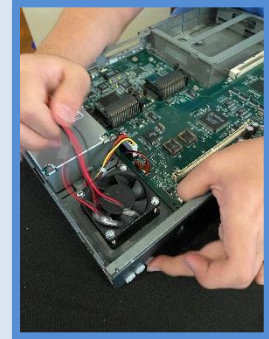
Step by Step Instructions on Deconstructing a Cisco 2620 Router



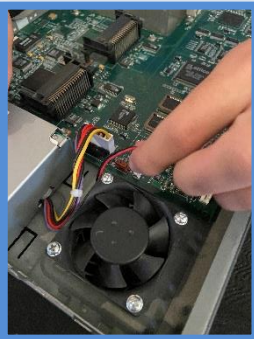
Step 28: Locate connector pin for LEDs:Power, RPS, & Activity.



Step 29: Detach LED cable from connector pin.



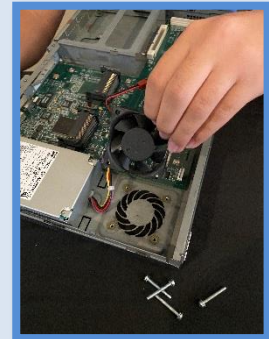
Step 30: Push LEDs out from front panel.



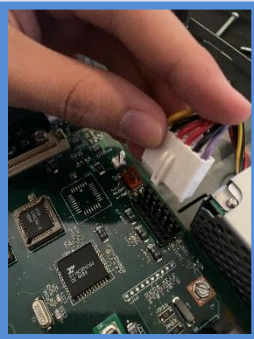
Step 31: Detach Fan Cable from connector pin.



Step 32: Remove 4 screws on the Fan Assembly.



Step 33: Remove Fan Assembly.



Step 34: Detach Power Supply Cable from connector pin.

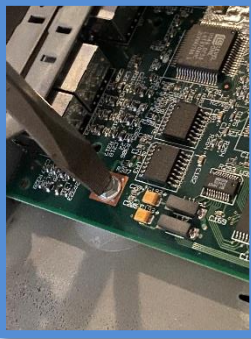


Step 35: Remove screw on Power Supply.



Step 36: Remove Power Supply from Bottom Chassis.

Step by Step Instructions on Deconstructing a Cisco 2620 Router



Step 37: Remove 9 screws on the motherboard.



Step 38: Wiggle the motherboard out of the bottom chassis.



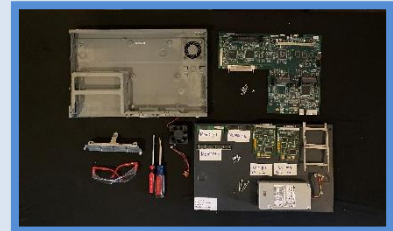
Step 39: Remove thumb screws on the Blank Network Module Panel from Rear Panel.



Step 40: Remove Blank Network Module Panel from Rear Panel.



Bare Bottom Chassis



Deconstruction Complete Components and Tools



Front Side of the Motherboard



Deconstruction Zoom Meeting

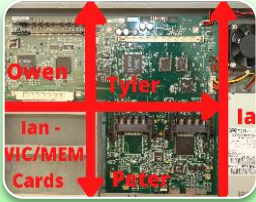


Box to Hold Parts and Screws

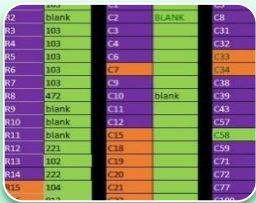
Section 3: Research Process



Step 1: Take pictures of all boards to be analyzed and close-ups of all components.



Step 2: Divide the workload among team members and set deadlines. Brainstorm on format and layout of report.



Step 3: Record reference designators, components (mechanical or electrical), and integrated circuits. Identify and count all the components.



Step 4: Conduct online research on what the component does and its role within the entire system.

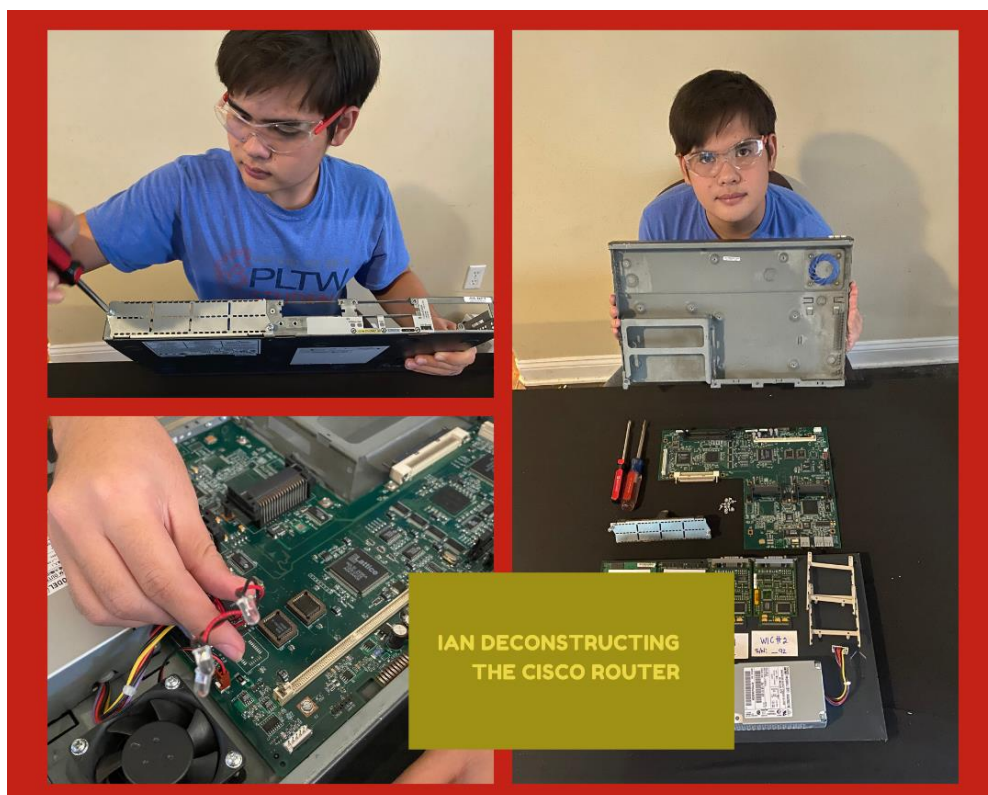


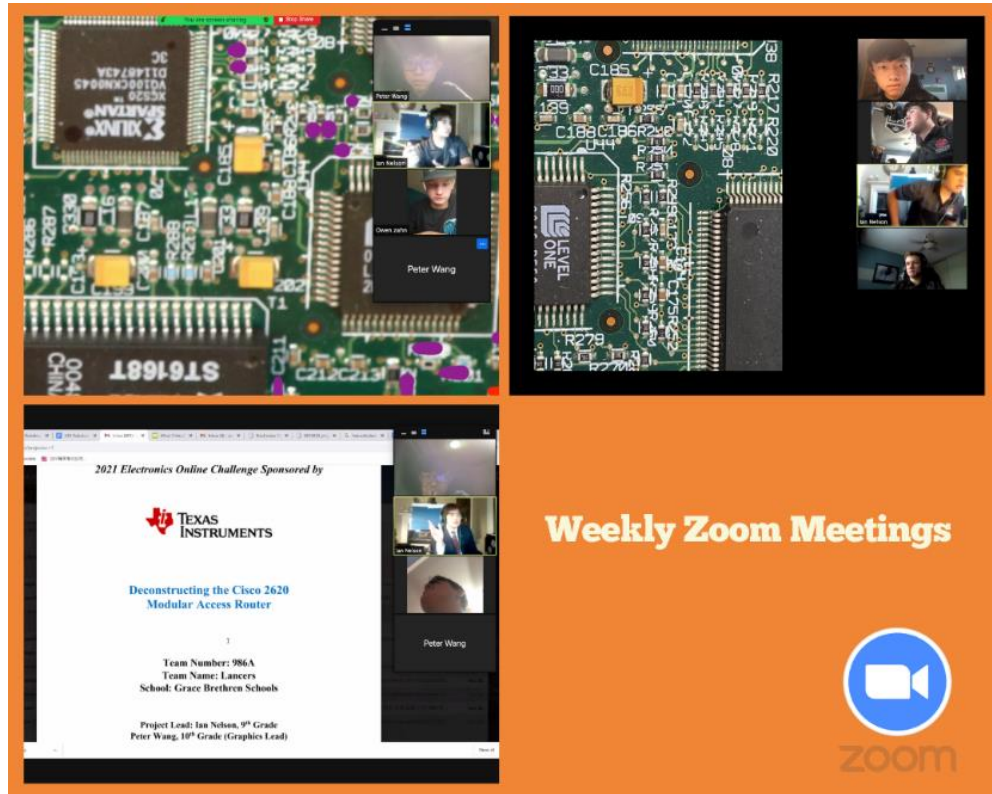
Step 5: Input data on the shared documents in Google docs.

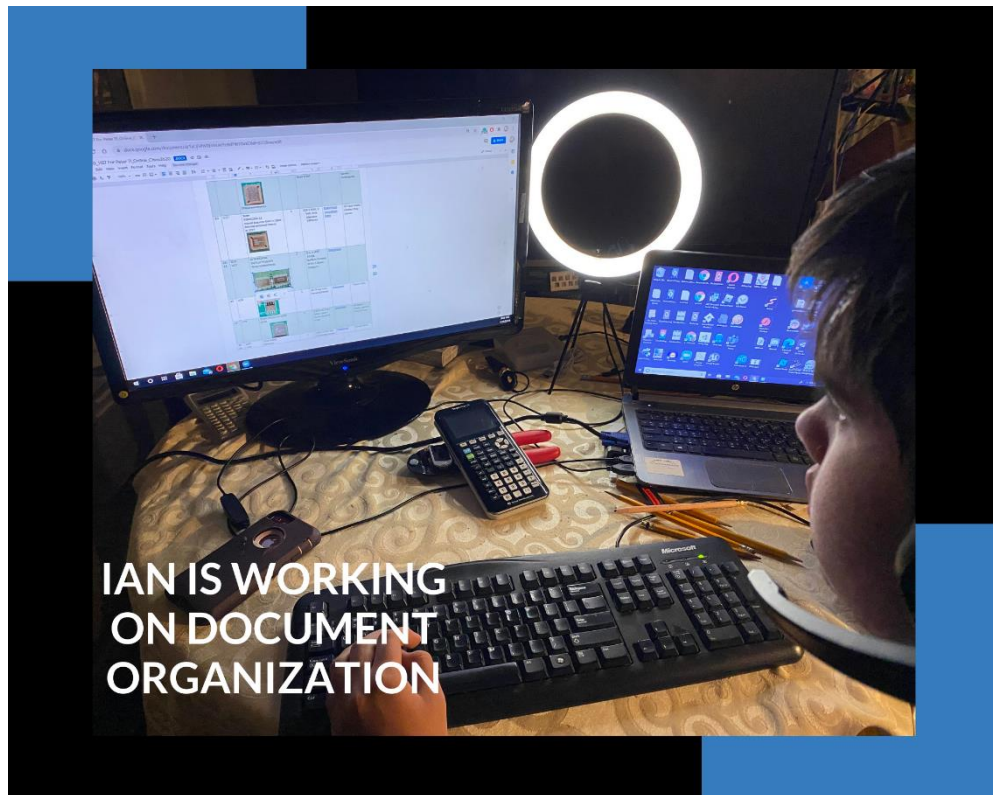


Step 6: Discuss and review findings, issues, lessons learned during Zoom status and update meeting.

Section 4: Zoom Team Meetings, Research, and Analysis Pictures







Section 5: The Router Functions, Components and Applications

A modem connects a device to the internet. The signal between the internet and the modem is called the analog signal, and the signal between the internet and a device is called the digital signal. Therefore, a router comes in between the device and the modem and transmits the digital signal from the modem to different devices. It finds the best route for information to be transferred to your device.

Figure 1: Internet Distribution through Router



A router transfers information by forwarding an IP address or packet to the device. It manages your internet system and controls the traffic within it. A router usually has at least 2 network interface cards.

The router usually chooses the fastest route to transfer information to devices, using something called the “metric value”. The information is transferred through a path with the lowest “metric value” if multiple paths are available. Paths in which information can be transferred are stored on a routing table. Once the IP address is received by the router from the internet, it is sent through the selected and fastest route according to the routing table. A routing table is especially important to a router because it allows quick diagnosis if any problem occurs. If a person knows the lookup process of the routing table and understands how it functions, then they can diagnose the routers.

Here are some major components of the router and some functions of specific parts:

- CPU, or processor, is the brain of the router. It communicates with other components on the board and executes instructions for the operating system. In the Cisco 2620 Router, the CPU is the XPC860ZP50C1, which is made by Motorola.
- ROM, or Read-Only Memory, helps the router to start, do some basic tests, and reboot. The Cisco 2620 router has a M27C4001 12C1 manufactured by STMicroelectronics which is one-time-programmable ROM built into the chip.
- RAM, or random access memory, holds the routing table and configures files, while the router is powered. It also executes the router IOS (Internet Operating System). In the Cisco Router, these were the roles of memory cards 1 and 2. Memory card 1 had 4 MT4LC4MI6R6 DRAM chips made by Micron, and memory card 2 had 16 HY51V16404A T-60 chips manufactured by Hyundai.
- NVRAM, or Nonvolatile RAM, stores the IP address and startup configuration, which basically means that it stores a backup file for when the computer shuts down and will help load the same file when you reboot the computer.

- Flash Memory stores a compressed form of IOS (Internet Operating System) and contains IOS images. Memory Card 3 is the System–Code SIMM Flash Memory. There are 8 LH28F008SAT-85 chips in the memory module.
- PLD, or programmable logic device, is a programmable element that is used to build reconfigurable electronic circuits.
- Interfaces are physical connectors that connect the router to a network. In the Cisco Router, there are 2 WAN interfaces, which are called WIC.
- Configuration register determines whether a router is going to boot IOS configuration through tftp server or load in the bootstrap image.
- The Power Supply is very important as it supplies the power to the router.

There are in total 4 slots in the Cisco router 2620, the one network module, two integrated WAN Interface Cards, and one Advanced Integration Module. In our router, we do not have the network module. Here are the specific functions of specific modules:

- WAN Interface Card, or WIC, allows the router to transfer data in a wide range of networks.
- Advanced Integration Module, or AIM, provides customers with a wide range of solutions such as video, image, and voice.

A router can be useful in many different ways. First, it allows a business to share applications within their company. Secondly, it speeds up the access to information, therefore giving customers and employees' access to information more quickly. Also, a router can save anyone a lot of money because it allows multiple devices to be connected to the internet at the same time. Last but not least, a router with built in firewall protection allows the device using the internet use to be secure and safe from hackers.

Section 6: Identification and Analysis

Table 1: Defining Key Terms and Acronyms

Key Terms & Acronyms	Definition
Bootstrap Software	The software that runs on the router when the router is turned on and is stored in the ROM.
Datasheet	A technical document released by the company that shows the characteristic, function and the performance of a device, component, product, or software program. Customers can learn more about the product through datasheets.
Discrete	Stand alone, a single component or 2 components for transistors.
Dual In-Line Memory Module or DIMM	A computer memory for fast data transfer. A DIMM contains one or more random access memory (RAM) chips on a small circuit board.
Dynamic Random Access Memory or DRAM	A DIMM is a DRAM. It consist of capacitor and a transistor to create a memory cell. Each bit of data is stored on a separate capacitor.
Enterprise Router	Enterprise means that it requires a knowledgeable network professional because these routers are complex and sophisticated. These routers are located centrally and modular. There are many enterprise routers built based on the business size and data usage.
Integrated Circuit or IC	Small electronic circuit formed by semiconductors, performed as a large circuit but minute in size. Sometimes called a chip.
Modular Access Router	A router that can plug different components like interface modules, sound processing modules to the router. In the past, you may need more routers because the interfaces were fixed.
Package Type	Integrated circuits are usually put in a housing or package (at times it is just a wafer level) to protect the device from being damaged and for easy assembly on the PCB. There are many package types for ICs and usually are in acronyms. The package types can be found in datasheets after the electrical characteristics and performance. We identified the package type that corresponds to the chips in the router.
Pin Configuration	A pin configuration is a reference to the pins of an electrical device. These can be found in datasheets. Each pin is defined in a table or sometimes in a diagram. It is sometimes referred to as Pinout.
Printed Circuit Board or PCB	A board with circuits printed on it. It is the basic building block and all semiconductors, capacitors, resistors, transistors, crystal, diodes, are mounted to the PCB so they can connect and talk to each and perform their roles in the system through the PCB. There are various sizes and depending on the application, it can be rigid or flexible. A PCB can have many layers and electrical components are linked via conductive circuits like copper. Its role is to route the electrical signals and power within different devices.
Product Lifecycle	The lifecycle of a product. A product can have different stages or milestones from inception to obsolescence. In our paper, we will only identify if it is Active or Obsolete. Active means the manufacturer is still selling the part while

Key Terms & Acronyms	Definition
	obsolete means the manufacturer is not selling parts nor offering support for that part. At times they call it EOL or end of life but they may have some inventory to sell so they announce its end of life and customer may still be able to get the parts.
Reference Designator	Letter abbreviation that identifies a circuit component. There is a standard. It aids in the identification of the component type
Router	A network device that transfers data from one device to another. It usually chooses the best route to direct the packets to reach faster. Routers allow you to share data and share resources within the local network. different
Semiconductor	It is usually made of silicon. It is in between a conductor and insulator and used in developing electronic chips. There are different types of materials used like silicon, germanium, gallium arsenide, or other pure elements. Semiconductors are sometimes referred to as an electrical chip.
Single in Line Memory or SIMM	A type of memory containing random-access memory, This is older technology than DIMMs
Surface Mount Device or SMD	An electronic device for which the components are placed on the PCB. Some example are SMD resistors, SMD capacitors or SMD inductors
Wide Area Network or WAN	A telecommunication network that goes over a large area like a country or the world. Examples are internet connections or the 4G. A WAN is made up of several computer networks that are connected together over the internet.
WAN Interface Card or WIC	A special network card made by Cisco that allows devices to connect to a WAN.

Table 2: Physical Characteristics of the Cisco Router




One Rack Unit Color: Charcoal Gray	
Manufacturer/Model Number	Cisco 2620
Dimensions (Height x Width x Depth) <i>Per Cisco's Datasheet, measurements were 1.69 inches X 17.5 inches and 11.8 inches. We used a wooden ruler which may not be as accurate as the measuring tool they have but it is close enough.</i>	1.7 inches x 17.5 inches x 11 inches 
Weight <i>Per Cisco's datasheet, the minimum weight is 8.85 lbs. We are within spec. If our router had some additional network modules, it would be heavier.</i>	 8.98 lbs.

Table 3: Board and Cards Analyzed



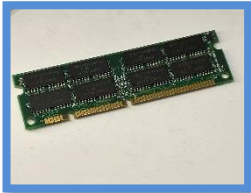
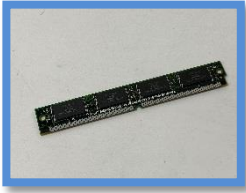


6 Board/Cards Analyzed By Team			
Motherboard			
Memory	<p>Card 1 3-5V 32MB EDO DRAM Part Number 15-2851-01 DIMM</p> 	<p>Card 2 Dual In-Line Memory Module (DIMM)</p> 	<p>Card 3 80 pin Single in-Line Memory (SIMM) Flash Memory</p> 
WAN Interface Cards	<p>WAN Interface Card 1 S/N: 16838222</p> 		<p>WAN Interface Card 2 S/N: 18715592</p> 

Table 4: Breakdown of Components Analyzed on All 6 Board/Cards

	Motherboard	Memory Card 1	Memory Card 2	Memory Card 3	WIC 1	WIC 2	Total
Resistors	239	0	4	4	59	59	365
Capacitors	184	17	24	16	27	27	295
IC	35	5	17	8	12	12	89
Inductors	28						28
Diodes	21						21
Resistor Network	13	8					21
Jack	12						12
Transistors	5						5
Crystal	3						3
Plug	1						1
Transformer	1						1
Total	542	30	45	28	98	98	841

Figure 2: Summary of Electrical Components Analyzed on All 6 Board/Cards

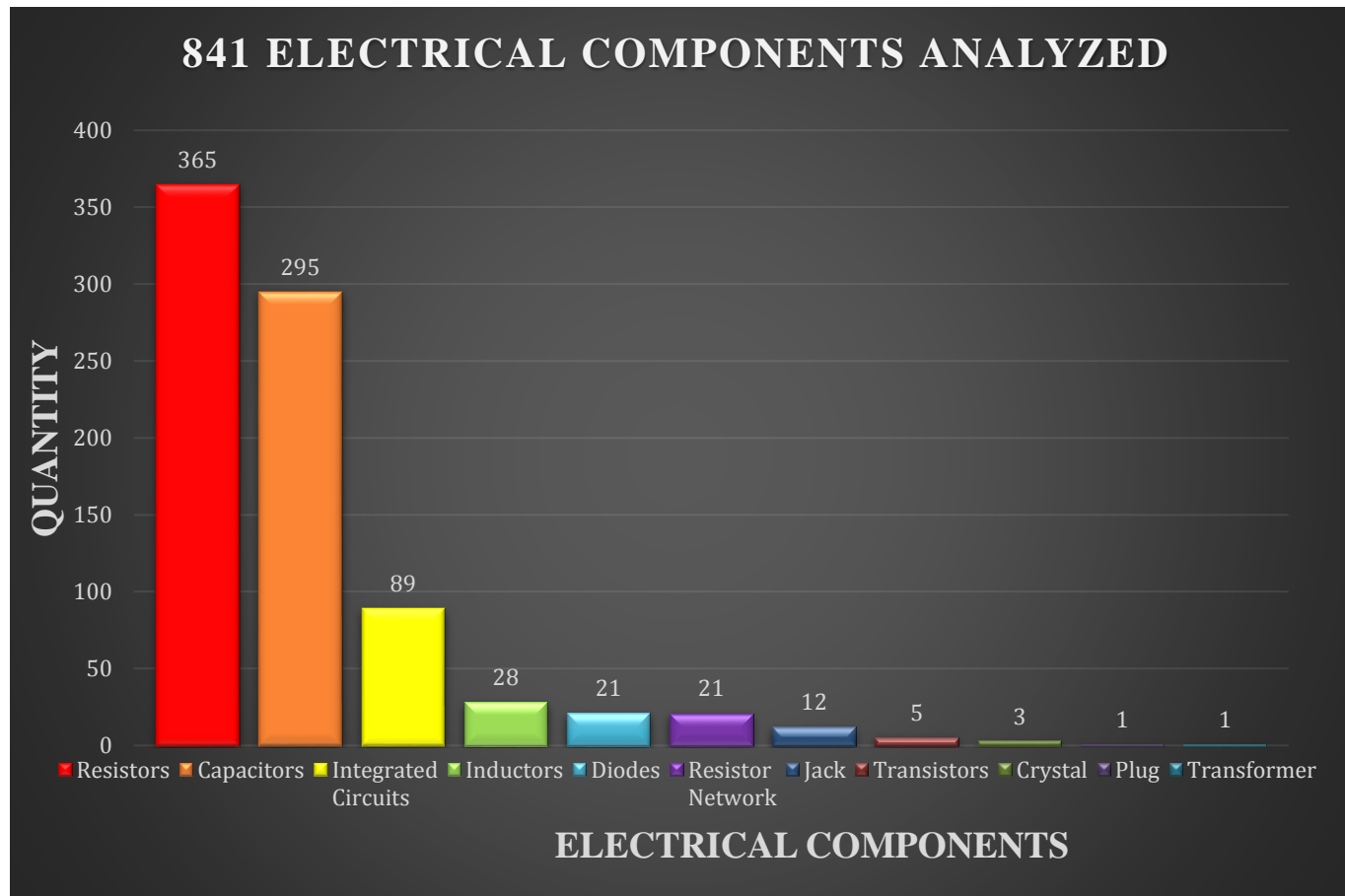
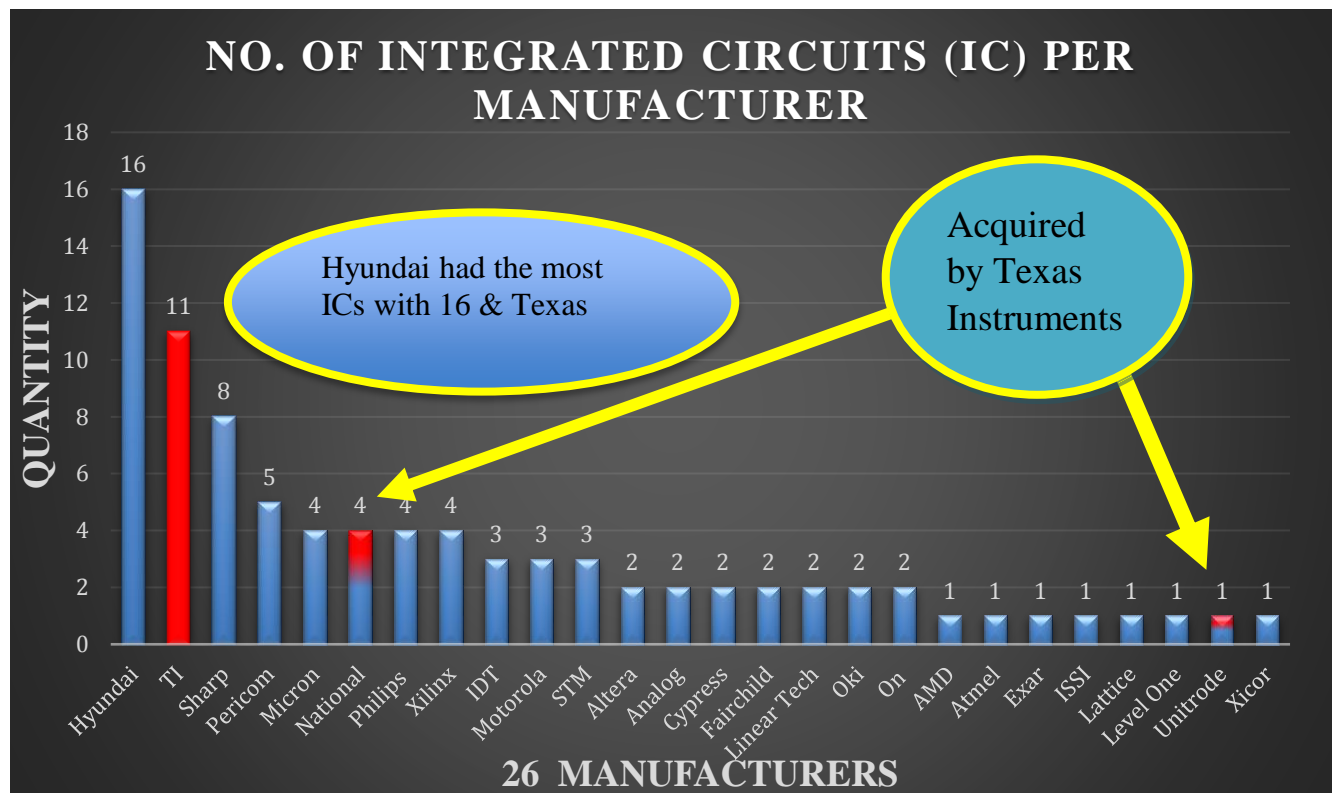


Figure 3: Summary of Manufacturers and Chip Count



- There were 89 integrated circuits and 26 manufacturers.
- Hyundai had the most number of ICs. There were 16 ICs and all found in Memory Card 2. Reference Table 14, ID#1.
- Advanced Micro Devices (AMD) also acquire Xilinx and Analog Devices acquired Linear Technology.
- **Texas Instruments** (TI) had a total of 11 ICs of the 89 ICs identified = about 12.35%
 - In 1999, Texas Instruments acquired Unitrode Corporation and in 2011, Texas Instruments acquired National Semiconductor. (see graph 2.0 half red/blue color on chart indicates these companies were bought by TI)
 - If we add, the ICs from National Semiconductor and Unitrode to the TI count, then TI would have 16 components in this Cisco 2620 router.

Table 5: Research on Semiconductor Companies

Most of our time was spent on identifying and researching the components. Most of the parts were obsolete so finding the datasheets or any information were tedious. Markings on the chips and company logos are sometimes too small and faint to read. We were also surprised that at times the datasheet showed a different manufacturer for the same part. We found out that over the years, there were mergers and acquisitions. Among the 26 manufacturers, only six U.S. companies have not been acquired by other or foreign companies and finding their datasheets were easier.

This research tells us that with the rise of intelligent machines, there are demands on integrated circuits. It takes a long time for engineers to design the chips and companies want their products out first in the market. It may be feasible for companies to buy these companies to gain expertise and get talented engineers quickly. Below is a list of our research on the company status of the integrated circuits (acquired or not, acquired by who, and its current headquarter), which will help us understand more of the parts' background.

These US companies below were never bought by another company (23% = 6/26)		Headquartered in	
1	Advanced Micro Devices (AMD)	USA	
2	Analog Devices (ADI)	USA	
3	Lattice Semiconductor	USA	
4	Micron	USA	
5	On Semiconductor	USA	
6	Texas Instruments (TI)	USA	
These non-US companies below were never bought by another company		Headquartered in	
7	Hyundai name change to SK Hynix	South Korea	
8	STMicroelectronics (2 companies SGS Italy and Thomson of France)	Switzerland	
These US companies below were bought by another US company (42% = 11/26)		These companies bought the companies on the left	Headquarter from to
9	Altera	Intel	USA to USA
10	Atmel	Microchip	USA to USA
11	Cypress Semiconductor	Infineon, Infineon then acquired by Intel	USA to USA
12	Exar Corporation	MaxLinear	USA to USA
13	Fairchild Semiconductor	On Semiconductor	USA to USA
14	Level One Communications	Intel	USA to USA
15	Linear Technology	Analog Devices	USA to USA
16	National Semiconductor	Texas Instruments	USA to USA
17	Pericom Semiconductor	Diodes Inc.	USA to USA
18	Unitrode Corporation	Microsemi then Texas Instruments	USA to USA
19	Xilinx	Advanced Micro Devices(AMD)	USA to USA

	These US or foreign companies were bought by a foreign company (27% = 6/26)	Acquired By	Headquarter from to to
20	Integrated Device Technology (IDT)	Renesas	USA to Japan
21	Motorola	Google then bought by Lenovo	USA to HongKong (CN)
22	Integrated Silicon Solutions Inc(ISSI)	In USA but owned by Chinese Consortium (we called 408-969-6600 to verify data but no response)	USA to USA
23	Oki Semiconductor	Rohm Semiconductor	Japan to Japan
24	Philips Semiconductor	NXP	US to Netherlands
25	Sharp Semiconductor	Foxconn	In Japan but owned by Taiwan
26	Xicor	Intersil then Intersil acquired by Renesas	USA to Japan

Table 6: Determining Resistor SMD Codes

We would have just counted the capacitors and resistors, instead we went above and beyond because we wanted to learn what the numbers meant on the Surface Mount Device (SMD) resistor. We did our research and identified the different values of the resistors. We learned how to decode the SMD resistor values.

SMD resistors are marked with letters and numbers. We found out that these are not the actual values of the resistor but it follows a standard. There are 3 digit codes, 4 digit codes and there is an EIA-96 code from 1 ohm to 97.6 ohm and it consists of a 2 digit and a letter. We will only cover the 3 digit and 4 digit codes. In a 3 digit code, resistance less than 10Ω, there's no multiplier, R is replaced by a decimal point. In a 4 digit code, resistance less than 100Ω, there's no multiplier, R is replaced by a decimal point

- In short, “R” is the position of a decimal point
- Resistor 0 with a 1 digit code or 000 are 0 ohms and can act as a jumper.




Image of 3 Digit Marking Code on SMD Resistor	Code on SMD Resistor	First 2 digit represents the value of the resistor	3rd digit is the power of 10 to multiply by the resistor value on the first 2 digit (the number of zeros to add)	Calculation	Resistance Value Ohms is the Unit of Measure
	103	10	3	10×10^3	10000 Ω or 10kΩ
	330	33	0	33×10^0	33 Ω
	7R7				7.7Ω




Image of 4 Digit Marking Code on SMD Resistor	Code on SMD Resistor	First 3 digit represents the value of the resistor	4th digit is the power of 10 to multiply by the resistor value on the first 3 digits (the number of zeros to add)	Calculation	Resistance Value Ohms is the Unit of Measure
	8251	825	1	825×10^1	8250Ω
	1242	124	2	124×10^2	12400Ω
	51R1				51.1Ω

Figure 4: Breakdown of All 365 Resistor Codes on All Six Boards/Cards

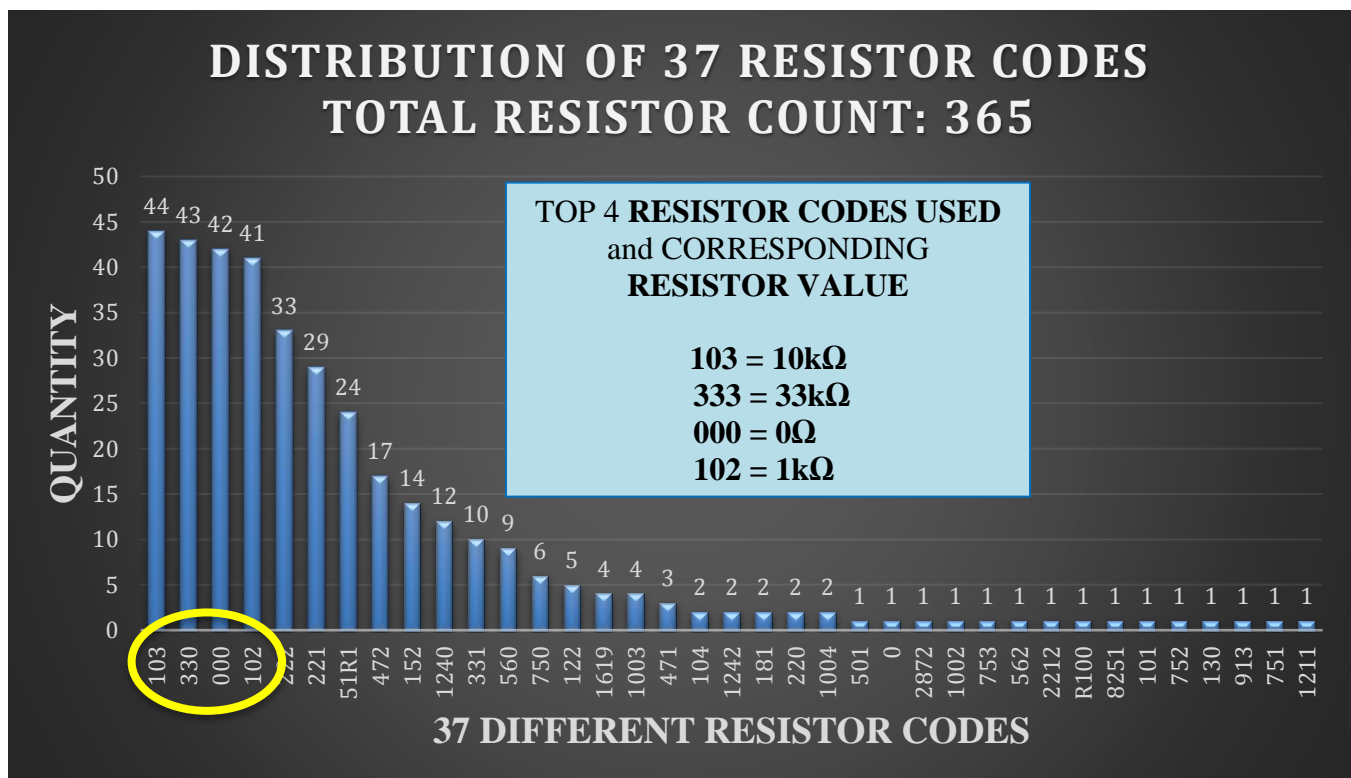


Figure 5: Breakdown of All 295 Capacitors on All Six Boards/Cards

The capacitor stores energy and when necessary, acts like a temporary battery. A capacitor starts storing an electric charge when voltage is applied. The Cisco router had 4 different kinds of capacitors based on appearance. Surface mount devices (SMD) capacitors are mounted directly onto the board. Ceramic capacitors are used in high frequency applications. Tantalum capacitors are a subtype of electrolytic capacitor made of tantalum metal. KEMET is a manufacturer of tantalum capacitors which have a K printed on the SMD. Unlike Tantalum capacitors, electrolytic capacitors use an electrolyte.

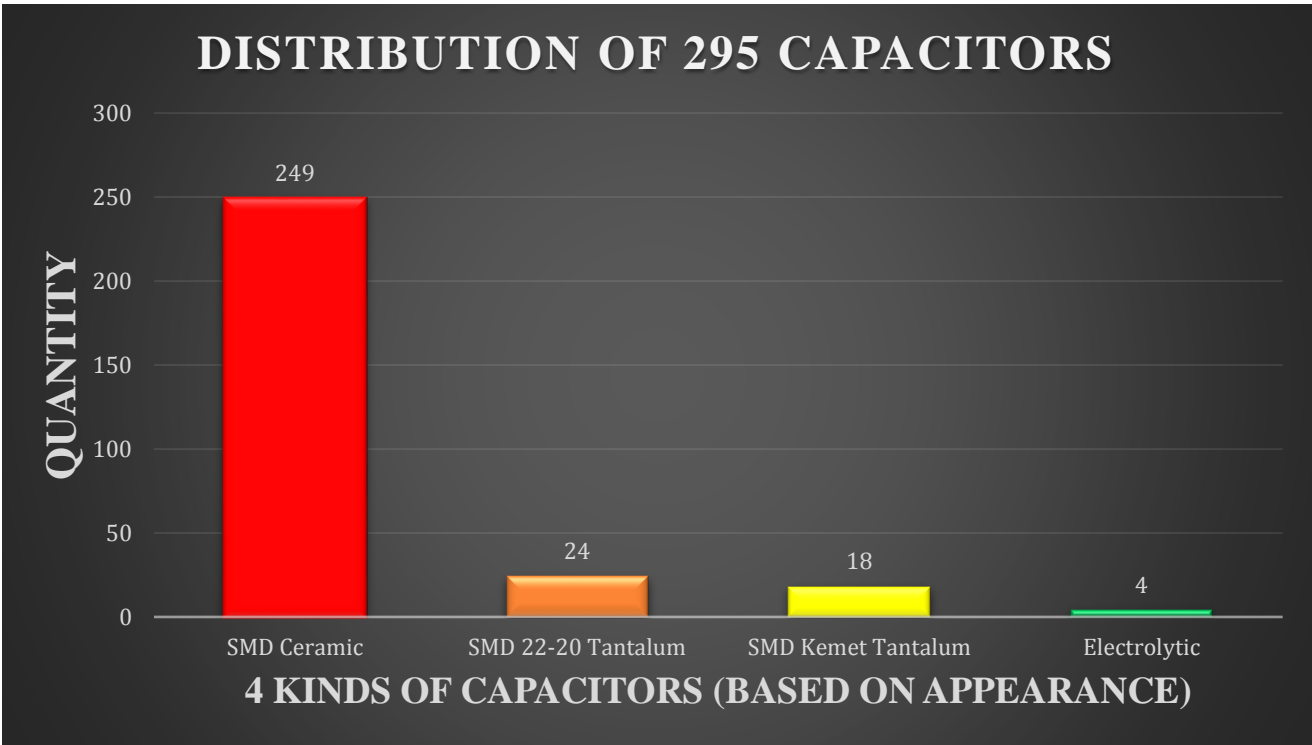








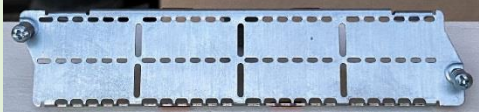





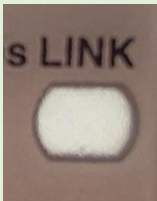

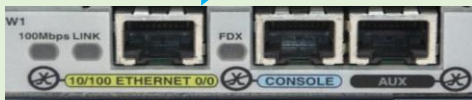
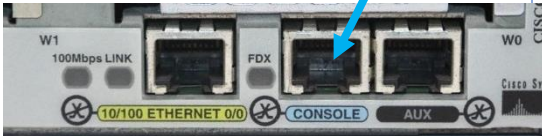
Table 7: External Components of the Cisco 2620 Router

Based on our research, the logo CISCO Systems faceplate should be covering the front panel and will indicate the LED labels but it is missing on our router.

ID	External Components and Image	Quantity	What It Does & Its Role & Additional Information
1	<div>Power LED (Light Emitting Diodes)</div> <div></div>	1	There is light when On and it means there is power to the router This shows the condition of the router. The LED acts as an indicator for the user to know there is power.

ID	External Components and Image	Quantity	What It Does & Its Role & Additional Information
2	<p>RPS (Redundant Power System) LED</p> 	1	<p>No light means RPS is off. Light on and blinking means RPS is on but there's a failure in the system. Light is on means RPS is on. The LED functions as an indicator if the system is functioning properly or not.</p>
3	<p>Activity LED</p> 	1	<p>Off means no activity. Blinking On and Off means no errors. Blinking 2 seconds on and off means there is an error. The LED functions as an indicator if there is activity in the system.</p>
4	<p>Top and Bottom Chassis</p> 	1	<p>The chassis houses the electrical components. Its function is protection of internal electrical components and prevents electrical shock to users. It is made of rigid sheet-metal.</p>
5	<p>Top Chassis Indented Guide Mark</p> 	2	<p>The user applies pressure downward and moves to the direction of the arrow in order to release the top chassis from the bottom and to expose the internal components. The guide shows direction of how to open the box.</p>
6	<p>Labels at the Bottom Chassis</p> 	1	<p>The labels inform the user caution of internal parts, place of assembly, manufacturer's part number, serial number, and shows it complies with FCC rules and the network module models. Compliance across international standards.</p>

ID	External Components and Image	Quantity	What It Does & Its Role & Additional Information
7	Perforated Cut Out in the Sheet Metal 	1	The perforation allows for generated heat by the components to be vented to the perforated cut out. It prevents overheating of the router.
8	Overall Rear Panel 	1	The blank network module panel, network interfaces, RJ-45 connections, and power supply switch reside at the rear panel. Reference ID # 9-17. The rear panel provides slots for modules.
9	Blank Network Module Panel 	1	It is a sheet metal cover for the Back Panel if no network module is installed. This provides slots for optional network modules. It is for safety for the user and protection of internal components.
10	WIC (Wan Interface Cards) Serial Port 60 Pin 5-in-1 connector 	2	The serial port provide serial connection to remote site. This provides an external connection to the interface card.
11	CONN LED – Light Emitting Diode (LED) Labelled CONN 	1	If LED is highlighted green, it indicates that the Data Set Ready, Data Carrier Detect, and Clear to Send have been detected. The LED informs user the status of the router.

ID	External Components and Image	Quantity	What It Does & Its Role & Additional Information
12	Rear Panel LEDs 100Mbps 	1	When LED is on, interface is running at 100Mbps and when off it is at 10 Mbps. The LED is an indicator to the user that Mbps state has changed.
13	Rear Panel Link LED 	1	When LED is on, there is link settled with the hub or switch at the other end of the cable. It informs that user that a continuous link exists.
14	Rear Panel Full Duplex (FDX) LED 	1	When on, Full Duplex mode is on and when this is off then it is on half-duplex mode. Full Duplex means the data can flow two ways at the same time. The LED serves informs the user the mode of the router.
15	Rear Panel 10/100BaseT Ethernet RJ45 Ports 	1	The purpose is to connect wired network hardware in an Ethernet LAN. A Registered Jack, 45 (RJ45) connects various data equipment and devices usually provided by long-distance carriers.
16	Rear Panel Console port (RJ45) 	1	This is used for local system access. Console port provides connection when you are at the same physical location with the device. You plug the console cable to the console port and you can connect the operating system by this way.

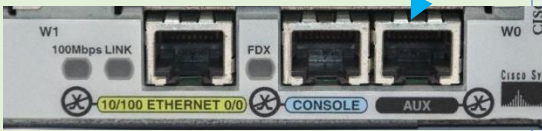




ID	External Components and Image	Quantity	What It Does & Its Role & Additional Information
17	<p>Auxiliary port (RJ-45)</p> 	1	The auxiliary port is for remote system access or dial backup by using a modem. This is commonly used as a backup console port, or a dial-up port for remote management and other functions.
18	<p>IEC C14 Plug Adapter Power Inlet Socket Connector</p> 	1	It is a recess receptacle AC power cord connector. It is a link that allows power in the system.
19	<p>Sticker Label CISCO2620 CISCO Systems</p> 	1	Identifies the model number, logo, company name of router and input voltage. The purpose is to inform user to check ratings before plugging in power.
20	<p>Toggle On/Off Switch</p> 	1	Turns the power on or off. Depress on the “1” turns on the power. Depressing on the “0”, turns off the power. This is the toggle to supply the router with power.
21	<p>Light Emitting Diode (LED) for On/Off Switch</p> 	1	There is power supplied to the router when the light is green. The LED serves as an indicator to the user that there is power supplied.

Figure 7: Internal Layout of the Integrated Circuits on the Motherboard

- 35 (highlighted yellow and red): Total Integrated Circuits on the Motherboard Only
 - 30 (highlighted yellow): Non Texas Instruments manufacturers
 - 5 ICs (highlighted red): **Texas Instruments** ICs
 - Number of Texas Instruments Integrated Circuits on the Motherboard
 - There are 6 more Texas Instruments integrated circuits on the two WAN interface cards that will be discussed in Table 18, ID#8 and ID#9

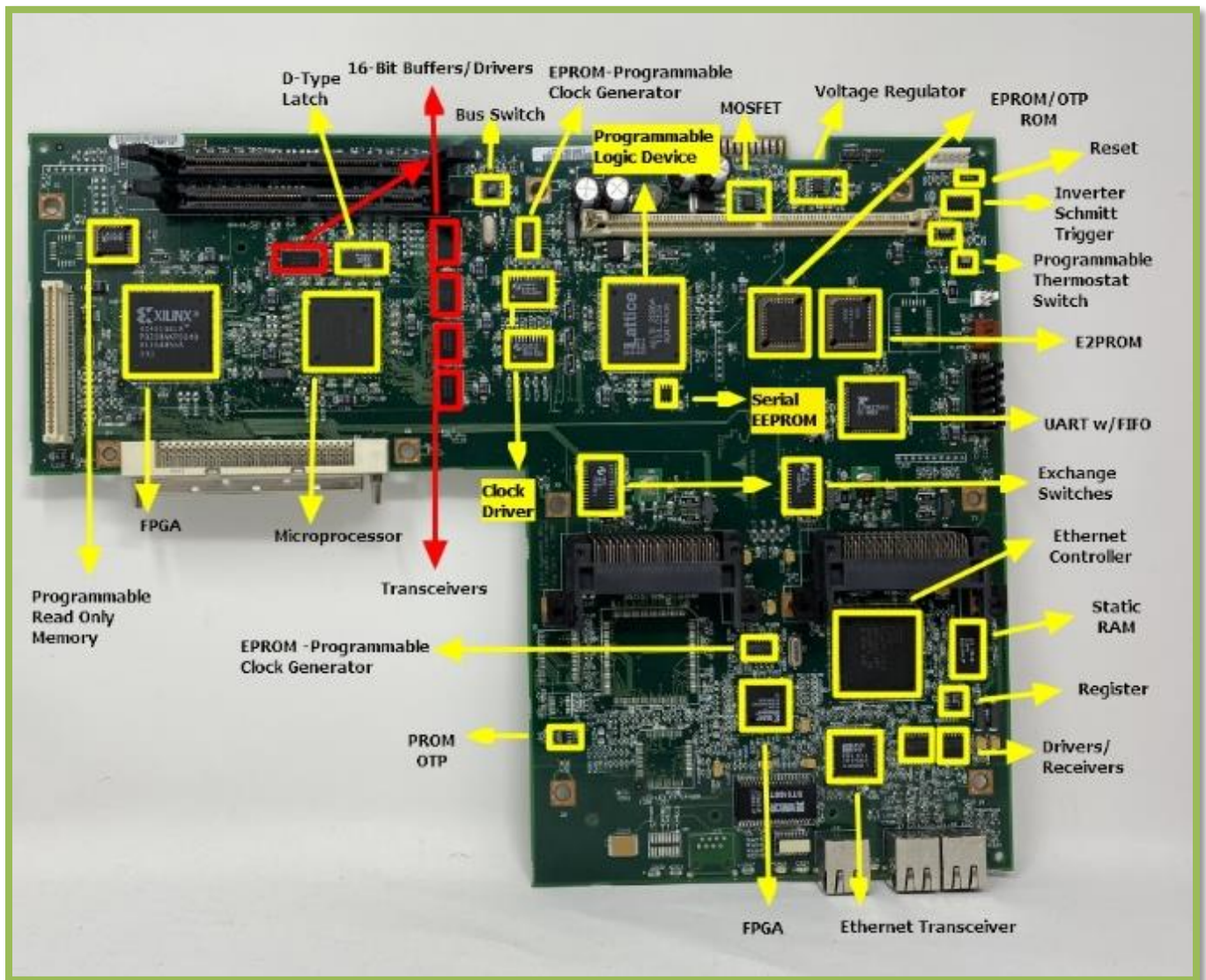


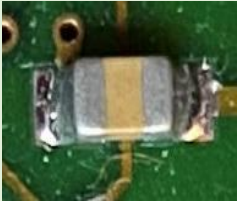

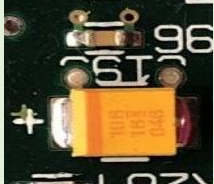

Table 8: Reference Designators

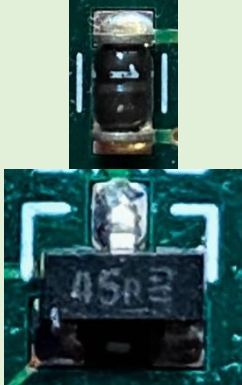


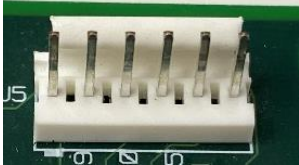
- The reference designator shows the location to place a component on the PCB.
- There are standards for reference designation.
- These immensely helped us identify the component type on the motherboard.
- The WAN Interface Cards ***did not*** have reference designators printed on the circuit board, however the components were easy to identify because there were only 2 discrete components: the capacitors and resistors.
- Below is a list of the reference designators we found on the motherboard and memory cards.



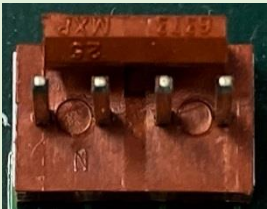


Designator	Component Type
C	Capacitor
CR	Diode
J	Jack/Jack Connector
L	Inductor or ferrite bead
P	Plug
Q	Transistor (all types)
R	Resistor
RN	Resistor Network
T	Transformer
U	Inseparable assembly – example Integrated Circuit
Y	Crystal or Oscillator

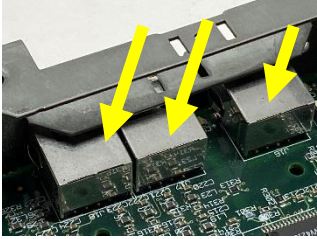




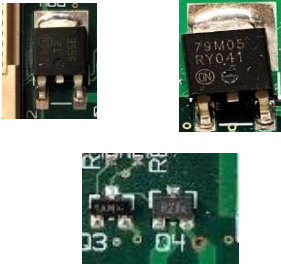
Table 9: Internal Components of the Motherboard





Only a **sample** of the reference designators are shown for some capacitors and resistors.

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
1	C1, C11, C12, C103, C108-109, C111-114, C117-119, C121-122 & more	SMD Ceramic Capacitor 	146	Ceramic capacitors are used in high frequency applications. A capacitor prevents a voltage spike. It protects the IC from static shock. It provides steady power supply.
2	C13, C14, C16, C17	Electrolytic Capacitor 	4	An electrolytic capacitor consists of 2 conductive plates, an insulating layer and an electrolyte liquid. It has a high capacitance value for its size. These are used for filtering, and smoothing out voltage and current waves.
3	C130, C132, C135-136, C139, C185, C192-193, C199, C202	SMD Tantalum Capacitor by Kemet 	10	Kemet is a manufacturer of tantalum capacitors and it is denoted by K on their chip. A tantalum capacitor provides higher capacitance value per volume because it allows for a very thin dielectric layer.
4	C31-34, C38-39, C100-102, C105-106, C110, C116, C120, C127, & more	SMD Tantalum Capacitor by Vishay 22-20 	24	Tantalum capacitors provide higher capacitance value per volume because it allows for a very thin dielectric layer. Vishay is a manufacturer of capacitors.






ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
5	CR1-CR9, CR11-CR19, CR23-CR25	SMD Diodes 	21	Diodes allows current to flow in one direction but not the other. The diode acts as a one-way switch for current. Diodes protect electronic devices from surges in voltage.
6	J2	DUART Reset Connector Pin 	1	DUART means Dual Universal Asynchronous Receiver Transmitter. This is a connector for the DUART that sets default values or baud rate, number of bits, stop bits, handshaking.
7	J3	Reset Connector Pin 	1	The Reset Connector Pin is used as a connector for resetting default values. It clears setting by powering on the electrical device.
8	J5	Connector Pin for LEDs 	1	This connects the LED to the PCB. Its role is to make sure that the LED can make a connection to the system.


ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
9	J7	Connector Pin for Fan Assembly 	1	This connects the fan cable to the PCB. It provides a base for connecting the fan assembly.
10	J8	Advanced Interface Module 	1	The AIM provides Cisco customers to use additional features like enabling voice and data traffic. This module is an additional option for customers.
11	J9	Connector Pin 	1	This is not connected to any assembly on the motherboard but can be used as a connector for other devices.
12	J11	Connector Pin for Power Supply 	1	This connects the Power Supply to the PCB. It provides a base for connecting the power supply. It can easily be mounted or unmounted from the PCB.
13	J13 J14	Edge Connectors 	2	The edge connectors connect to the WAN Interface Cards. It has traces leading to the board that are to be plugged into a socket. It provides a base for connecting the WICs and used for connecting interfaces to the system bus.

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
14	J16 J17 J18	RJ45Ports 	3	The RJ45 connector looks like a telephone jack and is used for Ethernet networking. The RJ45 port provides a connector for electronic device cables.
15	L1	SMD Power Inductor 223 Top View  Side View 	1	The power inductor stores electrical energy and controls signals. It converts the DC input voltage from high to low or vice versa to provide DC power to other circuits in the router. The inductor reduces signal loss in the system design. The power inductor can also be used for filtering noise.
16	L2-L12, L14, L16-17, L19-27, L29-32	SMD Inductor 	27	An inductor prevents changes in the voltage or current from passing through the circuit. It is sometimes referred to as the choke. It is used as a filter for the circuit.
17	P2	PCI Interface Plug 	1	This is a Plug for PCI optional network modules. This is an interconnection system between a microprocessor and the attached network device for high speed operation.
18	Q1 Q2 Q3 Q4 Q6	Transistor 	5	Transistors are used to boost a signal or switch electronic signals and electrical power. This acts as a relay to turn something on or off.

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
19	T1	Power Transformer 10/100BASE-TX XFMR CMC-DUAL ST6168T 0048-R Valor Electronics 	1	The power transformer converts alternating current from one voltage to another. The transformer function as current regulator to reduce or increase the voltage or step-up or down of an Alternating Current (AC).
20	R151	SMD Resistor 0 = Zero Ohm Resistor 	1	SMD stands for Surface Mount Device which uses the surface mount technology (a method in which components are mounted to the PCB). Resistors control the flow of current to other components. It reduces and restricts current overloading other components.
21	R18, R26, R36, R37, R38, R50, R55, R57, R60, R73, R101, R169, more	SMD Resistor 000 = Zero Ohm Resistor 	28	A resistor 0, or 000 are resistors that has almost no resistance. It connects or disconnect different traces without the need of using actual wires to jumpers.
22	R27	SMD Resistor R100 = 0.100 Ω 	1	Resistors have different values and there is a decoder for these SMD resistors.




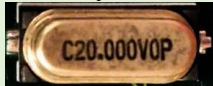

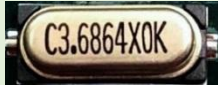

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
23	R301	SMD Resistor 101 = 100 Ω 	1	
24	R13, R97, R111, R119, R121, R125, R135, R142-144, R159, R172-175 & more	SMD Resistor 102 = 1k Ω 	33	
25	R1, R3-R7, R20, R21, R31, R43, R45-46, R91-93, R98, R103, R106-108 & more	SMD Resistor 103 = 10k Ω 	34	
26	R15, R19	SMD Resistor 104 = 100k Ω 	2	
27	R254, R264, R278, R284, R322	SMD Resistor 122 = 1.2k Ω 	5	




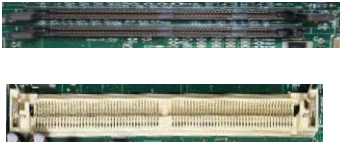
ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
28	R179	SMD Resistor 130 = 13Ω 	1	
29	R17, R105	SMD Resistor 220 = 22Ω 	2	
30	R12, R44, R58, R71, R74-75, R95-96, R102, R104, R178, R180, R216, R240, R295-298 & more	SMD Resistor 221 = 220Ω 	29	
31	R14, R84-R86, R90, R99, R110, R127, R132, R139-140, R161, R167, R168, R181 & more	SMD Resistor 222 = 2.2kΩ 	15	
32	R32, R51-54, R61-68, R77, R79-82, R115-117, R126, R152-156, R187-189 & more	SMD Resistor 330 = 33Ω 	41	

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
33	R28, R29, R30	SMD Resistor 471 = 470Ω 	3	
34	R8, R48, R56, R72, R83, R94, R118, R123, R128, R129, R136, R147-148, R150, R160, R252 & more	SMD Resistor 472 = 4.7kΩ 	17	
35	R166	SMD Resistor 501 = 500Ω 	1	
36	R249, R256-261, R270, R279	SMD Resistor 560 = 56Ω 	9	
37	R87	SMD Resistor 562 = 5.6kΩ 	1	

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
38	R312, R321, R324, R325, R326, R327	SMD Resistor 750 = 75Ω 	6	
39	R88	SMD Resistor 751 = 750Ω 	1	
40	R34	SMD Resistor 752 = $7.5k\Omega$ 	1	
41	R39	SMD Resistor 753 = $75k\Omega$ 	1	
42	R16	SMD Resistor 913 = $91k\Omega$ 	1	

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
43	R33	SMD Resistor 1002 = 10k Ω  A small, rectangular surface-mount device (SMD) resistor with a black body and gold-colored end caps. The number '1002' is printed in white on the black body.	1	
44	R165	SMD Resistor 1211 = 1.21k Ω  A small, rectangular surface-mount device (SMD) resistor with a black body and gold-colored end caps. The number '1211' is printed in white on the black body.	1	
45	R89	SMD Resistor 2212 = 22.1k Ω  A small, rectangular surface-mount device (SMD) resistor with a black body and gold-colored end caps. The number '2212' is printed in white on the black body.	1	
46	R41	SMD Resistor 2872 = 28.7k Ω  A small, rectangular surface-mount device (SMD) resistor with a blue body and gold-colored end caps. The number '2872' is printed in white on the blue body.	1	
47	R40	SMD Resistor 8251 = 8.25k Ω  A small, rectangular surface-mount device (SMD) resistor with a black body and gold-colored end caps. The number '8251' is printed in white on the black body.	1	

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
48	RN5, RN8, RN9, RN10, RN11, RN12, RN13	SMD Resistor Network 103 	7	SMD stands for Surface Mount Device which uses the surface mount technology (a method in which components are mounted to the PCB). Resistor Networks are multiple resistors connected together. It acts as a voltage divider, it splits the voltage to smaller amounts.
49	RN2, RN4	SMD Resistor Network 222 	2	
50	RN1, RN3, RN6, RN7	SMD Resistor Network 472 	4	
51	Y1 Y2 Y3	Crystal   	3	Oscillates to set a frequency like a clock. It is hard to decode the frequency because we do not know the manufacturer and each manufacturer has a different package code. Crystals provide clock signals.
52	None	Fan Assembly Delta Electronics DC Brushless Model AFB6012HH 2 Wire Leads 	1	The fan assembly cools the components. Its role is to make sure the router does not overheat. Datasheet

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
53	None	Fan Assembly Screws 	4	<p>The fan assembly screws bolt the assembly fan to the bottom chassis. Its role is to make sure the fan assembly is secure.</p> <p>Length is about 1.1875 inches long.</p>
54	None	Guides for WAN Interface Cards 	2	<p>The guiding plate helps slide the Interface card in and out the router at a specified area.</p> <p>It directs the user to properly install the WICs.</p>
55	None	LED Cable Set 	1	<p>The cable for the Light Emitting Diodes provides power to the LED when connected to the PCB and router is on. The cable is used to easily mount and unmount the LED.</p>
56	<p>U1 for Memory card 1</p> <p>U3 is for memory card 2</p> <p>U11 is for memory card 3</p>	Memory Slots for the 3 Memory Cards 	3	<p>The memory sits on to these slots and the slots are connected to the PCB. These sockets hold the memory chips. The memory cards are inserted into these slots</p>









ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role & Additional Information
57	None	47W Astec Model AA20270 Power Supply with Connector Cisco P/N 34-1617-02 	1	<p>The power supply supplies power to the motherboard and converts AC to DC.</p> <p>Feature</p> <p>The power supply turns on the router.</p> <p>For safety purposes, we did not deconstruct the power supply.</p>
58	None	Printed Circuit Board (the green board) 	1	<p>It is a basic building block and all semiconductors, capacitors, resistors, transistors, crystal, diodes, are mounted to the PCB so it can connect, talk to each, and perform their roles in the system through the PCB. Its role is to route the electrical signals and power within different devices.</p>
59	Z1-9 None for Power Supply Screw	Motherboard and Power Supply 	10	<p>There are 9 screws to secure the motherboard to the bottom chassis and 1 screw to bolt the power supply to the bottom chassis. These screws ensures motherboard is bolted motherboard and power supply are bolted to the bottom chassis to prevent damage.</p>
60	None	Top Chassis Screws 	3	<p>The top screws are used to bolt the top chassis to the frame of the bottom chassis.</p> <p>Its role is to make sure the electrical component are not exposed or damaged.</p>





Table 10: Integrated Circuits of the Motherboard





Texas Instruments ICs are highlighted in red.





ID	Reference Designator	Part Number or Marking & Part Manufacturer	Quantity	What It Does & Its Role	Information & Product Lifecycle	Package Type
1	U2	PI5C 3125Q Pericom 	1	4-Bit BusSwitch with Individual Enables The switch connects input to outputs.	Datasheet Obsolete	16 Pin Quarter-Size Small Outline Package (QSOP)
2	U4	813B = DS1813B B denotes 10% tolerance Dallas Semiconductor 	1	5V EconoReset with Pushbutton It automatically resets a microprocessor after power failure.	Datasheet Obsolete	SOT23 (Small Outline Transistor)
3	U5	UC3573 Unitrode 	1	Buck Pulse Width Modulator Stepdown Voltage Regulator It ensures sufficient input supply voltage is present before any switching activity can occur.	Datasheet Obsolete	SOIC-8 Small Outline Integrated Circuit 8 (SOIC-8)
4	U6	9430 Siliconix 	1	P-Channel 20-V (MOSFET) It is used for switching and amplifying signals.	Datasheet Obsolete	Small Outline (SO-8)

ID	Reference Designator	Part Number or Marking & Part Manufacturer	Quantity	What It Does & Its Role	Information & Product Lifecycle	Package Type
5	U7	74F14 Fairchild Semiconductor 	1	Hex Inverter Schmitt Trigger It converts various form of an input signal to a digital output signal. It removes noise from signals	Datasheet Obsolete	14-Lead Small Outline Integrated Circuit (SOIC-14)
6	U9	17512LJC Xilinx 	1	XC1700E and XC1700L Series Configuration PROMs (Programmable Read Only Memory) It is a read-only-memory that can be programmed only once after being created. Its role is to store configuration bit streams of the Xilinx FPGA.	Datasheet Obsolete	20-pin Plastic Leaded Chip Carrier PLCC
7	U10	CY2292SC-432 Cypress Semiconductor 	1	Three-PLL General-Purpose EPROM-Programmable Clock Generator This provides an accurate clock.	Datasheet Obsolete	16 pin Small Outline Integrated Circuit (SOIC)
8	U12 U14 U17	LVTH162244 Texas Instruments 	3	3.3-V ABT 16-BIT Buffers/Drivers With 3-state Outputs It supports mixed-signal operation (Input and Output voltages).	Datasheet Active	Shrink Small Outline Package (SSOP 48)

ID	Reference Designator	Part Number or Marking & Part Manufacturer	Quantity	What It Does & Its Role	Information & Product Lifecycle	Package Type
9	U13 U16	AD22105 Analog Devices 	2	Low Voltage, Resistor Programmable Thermostatic Switch It prevents rapid thermal on and off cycling.	Datasheet Active	8-Lead Small Outline Integrated Circuit (SOIC or SO-8)
10	U15	74ALVCH16260PA IDT 	1	3.3V CMOS 12-Bit to 24-BIT MULTIPLEXED D-TYPE LATCH with 3 State Outputs and Bus-Hold It stores the address and/or data information using internal storage latches.	Datasheet Obsolete	Thin-Shrink Small Outline Package (TSSOP-48)
11	U18 U26	PI49FCT805TSC Pericom 	2	3.3V Fast CMOS Buffer/Clock Driver It provides high speed clock distribution where signal quality and skew are necessary.	Datasheet We'll call it Obsolete because Diodes Inc who acquired Pericom does not carry it but 3 rd party companies and Ebay have it for sale	SOIC (Small Outline Integrated Circuit)
12	U19	XC4013XLA Xilinx 	1	Field Programmable Gate Array This is used by the designer to make changes to the configuration of the device.	Datasheet Obsolete	208-Pin Plastic Quad Flat Pack (PQFP)

ID	Reference Designator	Part Number or Marking & Part Manufacturer	Quantity	What It Does & Its Role	Information & Product Lifecycle	Package Type
13	U20	XPC860ZP50C1 Motorola 	1	One-Chip Integrated Microprocessor It communicates with other components and executes instructions for the operating system. This is the brain, the CPU.	Datasheet Obsolete	PLASTIC, All Grid Array 357 (PBGA 357)
14	U21	ispLSI 2096A-100LQ128 Lattice 	1	In-System Programmable High Density Programmable Logic Device This chip allows changes and improvements to the device without redesigning.	Datasheet Obsolete	128 Plastic Quad Flat Pack (PQFP)
15	U22	M27C4001 12C1 STMicroelectronics 	1	4 Megabit (512K x 8) UV EPROM and OTP ROM This is a One Time Programmable chip. The chip is used for boot-up, it will be the first circuit that is active while the power comes up.	Datasheet Obsolete	PLCC32 - 32 lead Plastic Leaded Chip Carrier, rectangular (PLCC)
16	U23	X28HC256J-12 Xicor 	1	32K x 8 Bit, 5 Volt, Byte Alterable E2PROM This chip retains the data when powered off. It can be programmed and erased.	Datasheet Almost Obsolete but definitely end of life	32 Lead Plastic Leaded Chip Carrier (PLCC)

ID	Reference Designator	Part Number or Marking & Part Manufacturer	Quantity	What It Does & Its Role	Information & Product Lifecycle	Package Type
17	U25 U27	LVTH16245A Texas Instruments 	2	3.3.-V ABT 16-Bit Bus Transceivers with 3 State-Outputs This chip is used for asynchronous (w/out use of an external clock) communication between data buses.	Datasheet Active	Shrink Small Outline Package (SSOP 48)
18	U28	93C46 STMicroelectronics 	1	1K Three-wire Serial EEPROM This stores small amount of data that can be erased and reprogrammed.	Datasheet Obsolete	Plastic Small Outline Integrated Circuit (SOIC)
19	U29	ST16C2552CJ-CC-0039 EXAR 	1	2.97V TO 5.5V DUAL UART WITH 16-BYTE FIFO This chip transmits and receive serial data.	Datasheet Obsolete	44-Lead Plastic Leaded Chip Carriers (PLCC)
20	U30 U31	PI5C 3401S Pericom 	2	6-Bit, 3-Port Bus Exchange Switch This switch connects inputs to outputs. It provides a zero propagation delay.	Datasheet Obsolete	24-pin Small Outline Integrated Circuit (SOIC)

ID	Reference Designator	Part Number or Marking & Part Manufacturer	Quantity	What It Does & Its Role	Information & Product Lifecycle	Package Type
21	U34	CY2292SC-612 Cypress Semiconductor 	1	Three-PLL General-Purpose EPROM-Programmable Clock Generator This chip generates up to 3 custom frequencies from one external source.	Datasheet Obsolete 2003	16 pin Small Outline Integrated Circuit (SOIC)
22	U35	PCnet Fast_AM79C971AKC Advanced Micro Devices 	1	PCnet™-FAST Single-Chip Full-Duplex 10/100 Mbps Ethernet Controller for PCI Local Bus It addresses high-performance system application requirements.	Datasheet Obsolete	Plastic Quad Flat Pack - 160 (PQFP)
23	U36	71016 IDT Integrated Device Technology 	1	CMOS Static RAM 1 Meg (64K x 16Bit) This is a fast memory chip that is used for the speed sensitive caching.	Datasheet Active with Renesas	Thin Small Outline Package TSOP Type II (SO44-2)
24	U38	XCS20 Spartan FPGA Xilinx 	1	<u>Embedded - FPGAs (Field Programmable Gate Array)</u> These provides clock rates exceeding 80Mhz.	Datasheet Obsolete	100 Plastic Very Thin Quad Flat Pack (VQFP)



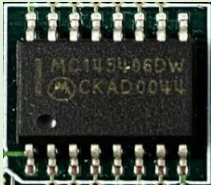

ID	Reference Designator	Part Number or Marking & Part Manufacturer	Quantity	What It Does & Its Role	Information & Product Lifecycle	Package Type
25	U39	74FCT 574ATQ IDT Integrated Device Technology 	1	FAST CMOS OCTAL D REGISTERS (3-STATE) This provides a 2 way communication between data buses	Datasheet Obsolete	Quarter-size Small Outline Package-20
26	U40	17S20VC Xilinx 	1	Spartan/XL Family One-Time Programmable Configuration PROMs OTP The purpose is to retain the memory even if power is lost.	Datasheet Obsolete	8-pin Plastic Small-Outline Thin Package
27	U42 U43	MC145406DW Motorola 	2	Driver/Receiver(EIA 232-E and CCITT V.28(Formerly RS-232-D) It is used for output switching	Datasheet Obsolete TI makes a similar product TL145406DW	Small Outline Package (SOP 16W)
28	U44	LXT970AHC Level One 	1	Dual-Speed Fast Ethernet Transceiver This chip provides analog signal physical access to the link.	Datasheet Obsolete	64-Pin Plastic Quad Flat Pack with Heat Spreader (PQFP)

Table 11: Components of the Memory Card 1: DIMM

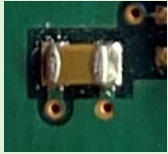
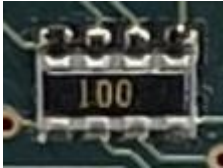

ID	Reference Designator	Component and Image	Quantity	Function What It Does & Its Role & Additional Information
1	None on the card	SMD Ceramic Capacitor 	17	Ceramic capacitors are used in high frequency applications. Capacitors are frequently used to reduce the ripple voltage or for coupling and decoupling applications.
2	None on the card	Resistor Network 100 	8	Resistor Networks are multiple resistors connected in a circuit. Its role is to split the voltage to smaller amounts
3	None on the card	Printed Circuit Board (the green board) 	1	A PCB is used to connect electronic components and also used to mechanically support the electrical components.

Table 12: Integrated Circuits of the Memory Card 1

- Part Number of the Memory Card on Sticker is MT4LDT832UG-6X Micron. This is a DIMM.
- There are no reference designators on Memory Card 1



ID	Part Number Manufacturer	Quantity	What It Does & Its Role	Information & Product Lifecycle	Package Type
1	MT4LC4MI6R6 Micron 	4	Memory Primary Memory DRAM DIMMS This chipset loads the IOS and the configuration files.	EDO DRAM Module 8X32, 60 ns 32MB EDO, 60ns Active Datasheet Obsolete	Small Outline Package (TSOP50)
2	M34C02-RDW6TP STMicroelectronics 	1	EEPROM 2K I2C 400KHZ This chip is used to store/save/update users profile.	Datasheet Obsolete	Thin Shrink Small Outline Package (8TSSOP)

Table 13: Components of the Memory Card 2


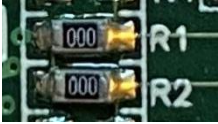

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role
1	C1-24	SMD Ceramic Capacitor 	24	Ceramic capacitors are used in high frequency applications. Capacitors are frequently used to reduce the ripple voltage or for coupling and decoupling applications.
2	R1, R2, R14, R15	SMD Resistor 	4	This is a zero ohm resistor and can be used as a jumper. Its purpose is to connect traces on a PCB.
3	NA	Printed Circuit Board (the green board) 	1	A PCB is a substrate used to connect electronic components and also to mechanically support the electrical components.

Table 14: Integrated Circuits of the Memory Card 2



ID	Reference Designator	Part Number or Marking and Manufacturer	Quantity	What It Does & Its Role	Information & Product Lifecycle	Package Type
1	U1-U4,U6-7 U9,U10-18	HY51V16404A T-60 Hyundai 	16	4M x 4-bit CMOS DRAM with Extended Data Primary Memory DRAM DIMMS This enables data to be transferred twice as fast as a SIMM.	Datasheet Obsolete	24 Pin Thin Small Outline Package (TSOP)
2	U5	CO2-3S (IS23C02) ISSI – Integrated Silicon Solution Inc. 	1	1K-bit/2K-bit/4K-bit/8K-bit/16K-bit 2-WIRE SERIAL CMOS EEPROM This stores small amount of data that can be erased & reprogrammed. It provides a write protection feature.	Datasheet Obsolete	Small Outline Integrated Circuit 8 (SOIC 8)

Table 15: Components of the Memory Card 3: System-Code SIMM


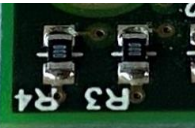

ID	Reference Designator	Component and Image	Quantity	What It Does & Its Role
1	C1-16	SMD Ceramic Capacitor 	16	Ceramic capacitors are used in high frequency applications. Capacitors are frequently used to reduce the ripple voltage or for coupling and decoupling applications.
2	R3, R4, R16, R17	SMD Resistor 000 	4	This is a zero ohm resistor and can be used as a jumper. Its purpose is to connect traces on a PCB.
3	None	Printed Circuit Board (the green board) 	1	The PCB is used to connect electronic components and also to mechanically support the electrical components.

Table 16: Integrated Circuits of the Memory Card 3


ID	Reference Designator	Part Number Manufacturer	Quantity	What It Does & Its Role	Information & product Lifecycle	Package Type
1	U5-8 U11-U14	LH28F008SAT-85 SHARP 	8	System-Code SIMM Flash Memory 8M (1MbX8) It stores a compressed form of IOS (internet Operating System) and contains IOS images.	Datasheet Obsolete	40 Lead Thin Outline Small Package (TSOP)

Figure 8: WIC1 and WIC2 Layout

- There are 2 WAN Interface Cards in this router
- The red dots ● indicate the placements of the resistors and the blue squares ■ indicates the capacitors on the board.
- There is a transistor in each board marked by a pink star ☆ on the upper left quadrant of the picture. These boards should have the same form fit and function
- We discovered that one of the integrated chips was not identical to the other card. There were 2 different manufacturer. WIC1 has a Fairchild Integrated Chip while the WIC2 has a chip manufactured by Atmel. See orange ○ circled chips on the bottom left quadrant of the picture. All other ICs were the same manufacturer for both boards.
- There are a total of 54 (46 ceramic and 8 tantalum) capacitors and 118 resistors in both of the WIC cards.

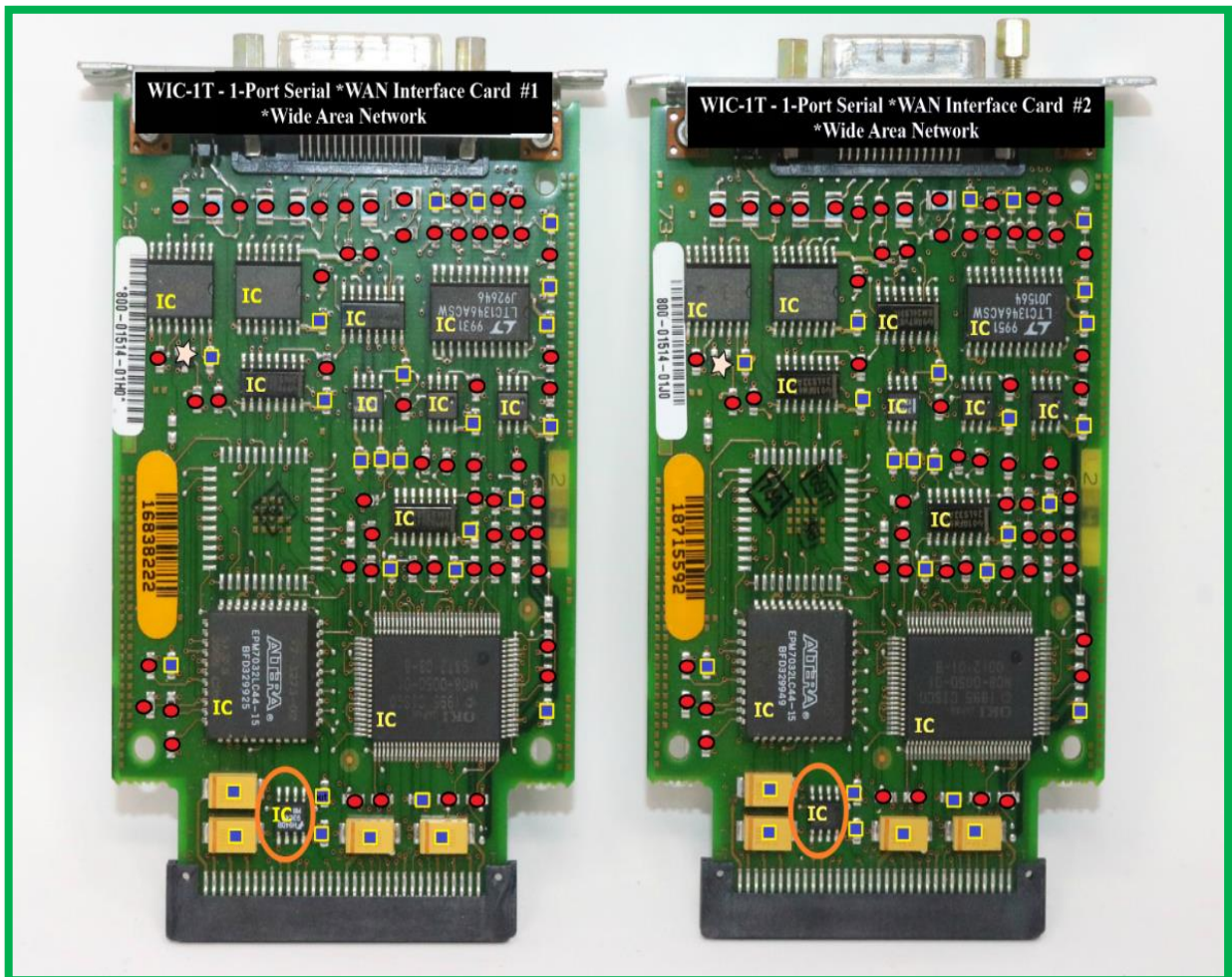












Table 17: Components of the WAN Interface Cards 1 & 2

- There are no reference designators on the WIC.
- SMD stands for Surface Mount Device. See Section 6 Table 1 for more definitions.

ID	Components and Image	Quantity on Both Cards	What It Does & Its Role & Additional Information
1	<p>SMD Ceramic Capacitor</p> 	46	Ceramic capacitors are used in high frequency applications. Capacitors are frequently used to reduce the ripple voltage or for coupling and decoupling applications.
2	<p>SMD Tantalum Capacitor by Kemet 10uF</p> 	8	Kemet is a manufacturer of tantalum capacitors and it is denoted by K on their chip. Tantalum capacitor provides higher capacitance value per volume because it allows for a very thin dielectric layer. The farad (F) is the unit of electrical capacitance.
3	<p>SMD Resistor 000 = 0Ω</p> 	6	The Resistor 000 is 0 Ω (jumper). A resistor 0, or 000 are resistor that has almost no resistance. It connects or disconnect different traces without the need of using actual wires to jumpers. Ohm or Ohms is the unit of electrical resistance and symbol is Ω
4	<p>SMD Resistor 51R1= 51.1Ω</p> 	24	Resistors control the flow of current to other components. It reduces and restricts current overloading other components.

ID	Components and Image	Quantity on Both Cards	What It Does & Its Role & Additional Information
5	SMD Resistor 102 = 1k Ω 	8	Resistors have different values and a decoder exists for the SMD resistors. The number written on the resistor is not the correct value of the resistor. There are 3 systems used for SMD resistor marking: 3 digit coding system, 4 digit coding system and the EIA96. See table 6 for details.
6	SMD Resistor 103 = 10k Ω 	10	
7	SMD Resistor 152 = 1.5k Ω 	14	
8	SMD Resistor 181 = 180 Ω 	2	
9	SMD Resistor 222 = 2.2k Ω 	18	
10	SMD Resistor 330 = 33 Ω 	2	

ID	Components and Image	Quantity on Both Cards	What It Does & Its Role & Additional Information
11	SMD Resistor 331 = 330Ω 	10	
12	SMD Resistor 1003 = 100kΩ 	4	
13	SMD Resistor 1004 = 1MΩ 	2	
14	SMD Resistor 1240 = 124Ω 	12	
15	SMD Resistor 1242 = 12.4kΩ 	2	
16	SMD Resistor 6191 = 6.19kΩ 	4	






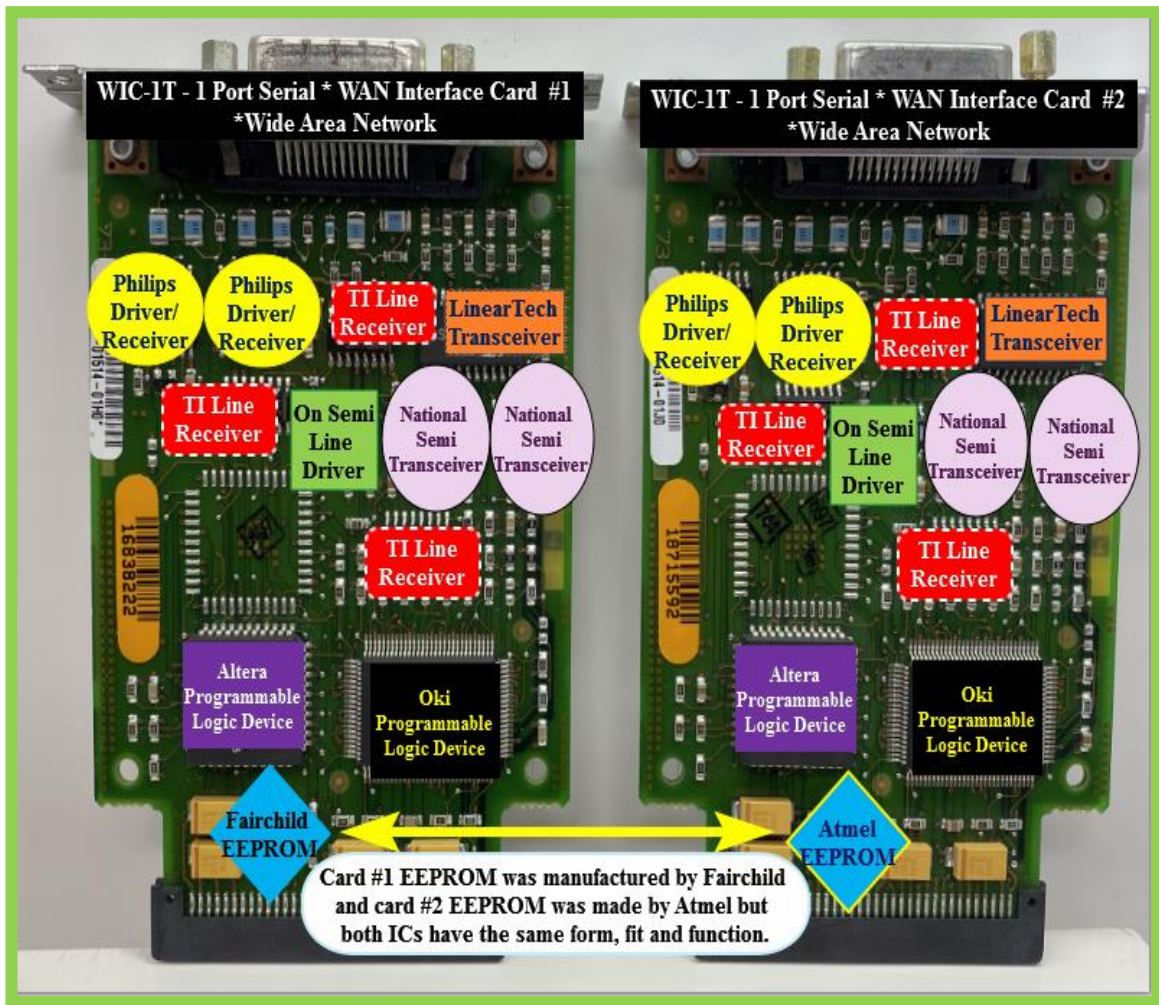
ID	Components and Image	Quantity on Both Cards	What It Does & Its Role & Additional Information
17	Transistor 1A 	1	The transistor amplifies electronic signals and power. It is used as switch that can turn the currents on and off.
18	Edge Connector 	2	The edge connector connects the WIC to the edge connector (J13 or J14) on the motherboard. The edge connectors have traces that lead to a board that are plugged to a socket that matches. Edge connectors are used because of speed and security.
19	Edge Connector 	2	This edge connector connects the Serial Port of the WIC to the WAN Interface Card Board.
20	Plastic Cover 	2	Our guess is to protect the card from touching other components or some sort of a shield and is used to stick the labels for identification. It has a small black Velcro attached to the back of the PCB
21	Printed Circuit Board 	1	The PCB is like a platform to mount electronic components. These may have several layers with traces or interconnects so electrical components can talk to each other. The PCB connects electronic components and also to mechanically support the electrical components. This is the back side of the PCB.

Figure 9: Layout of the Integrated Circuits on the WAN Interface Card

- Each WIC had 12 integrated circuits, bringing it a total of 24 integrated circuits for both cards.
- The same parts with different date codes were built on both boards with the exception of the 1024-Bit Serial EEPROM with Data Protect and Sequential Read.
- Card 1 has a Fairchild Integrated Chip while Card 2 has an Atmel Integrated Chip.















- In table 18 below, we are showing the IC on each WAN interface card, the total quantity of both cards, the function of the IC, the datasheet or comparable datasheet or information, product lifecycle (if active or obsolete) and package type.
 - Product is active if it is still being manufactured and obsolete means they do not manufacture and support the IC.
 - Package Type information are primarily taken from datasheets.

Table 18: Integrated Circuits of the WAN Interface Card 1 and 2

Texas Instruments ICs are highlighted in red.

The WICs did not have a reference designator, however we learned to identify discrete components and integrated circuits by the time we analyzed the WIC.

ID	Part Number Manufacturer WIC1	Part Number Manufacturer WIC2	Qty on Both Cards	What It does & Its Role	Datasheet & Product Lifecycle	Package Type
1	EPM7032LC44-15 Altera 	EPM7032LC44-15 Altera 	2	Programmable Logic Device The PLD is used to build digital circuits that are reprogrammable .PLDs provide less board space, and lower power requirement.	Datasheet Obsolete in 2009	44-Pin PLCC
2	93C46M8 Fairchild now ON Semiconductor Obsolete 	93C46SC Atmel now Microchip Technology 	2 Note that WIC card 1 has a Fairchild Chip while WIC card 2 has an ATMEL chip but both chips have the same form, fit and function	(MICROWIRE ™ Bus Interface) 1024- Bit Serial EEPROM with Data Protect and Sequential Read It protects select memory locations against being written by programming.	Comparable Datasheet We Can Find Both ICs obsolete Note: Texas Instruments makes a similar part called NM93C46 M8	SOP-8 Small Outline Package 8pin M8 is the Package Designator
3	LTC1346ACSW 9931 – Date Code Linear Technology 	LTC1346ACSW 9951 – Date Code Linear Technology 	2	10Mbps DCE/DTE V .35 Transceiver It provides differential clock and data signals.	Datasheet Obsolete	24 Lead Plastic Small Outline

ID	Part Number Manufacturer WIC1	Part Number Manufacturer WIC2	Qty on Both Cards	What It does & Its Role	Datasheet & Product Lifecycle	Package Type
4	DS75176BM National Semiconductor 	DS75176BM National Semiconductor 	4	Multipoint RS-485/RS-422 Transceivers This is designed for high speed and is for multipoint (provide multiple paths from a single location to multiple location) data transmission.	Datasheet Texas Instruments Obsolete 2017	Small Outline 8 (SO)
5	M08-0050-01 Oki Semiconductor 	M08-0050-01 Oki Semiconductor 	2	Programmable Logic Device. We searched for WIC1T cards for the Cisco 2620 Router and found a chip in place of the Oki which was an Altera MPM7128QC1 00A and the function was a PLD. This builds reconfigurable digital circuits.	Not available Picture of similar card but with Altera Chip Instead of Oki Obsolete	Quad Flat Pack 100 pins (QFP-100)
6	3488A XAVK On Semiconductor 	3488A XDWC On Semiconductor 	2	Dual EIA-423/EIA-232D Line Driver This chip is used where signal shaping and output load resistance greater than a 450Ω is desired.	Datasheet Obsolete	SO-8 Small Outline 8 Leads








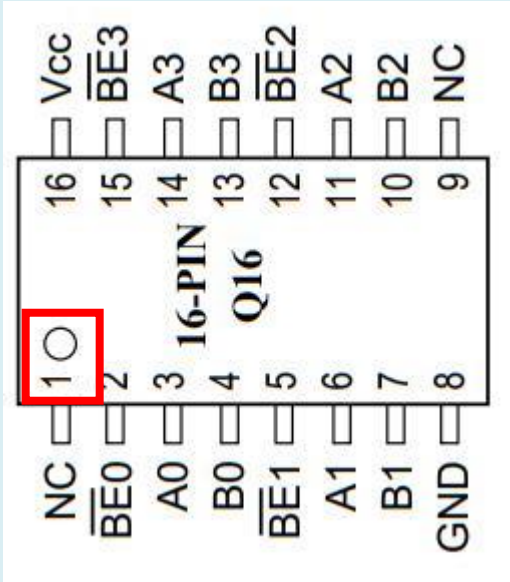
ID	Part Number Manufacturer WIC1	Part Number Manufacturer WIC2	Qty on Both Cards	What It does & Its Role	Datasheet & Product Lifecycle	Package Type
7	MC145406D Philips Semiconductor and name changed to by NXP Semiconductor 	MC145406D Philips Semiconductor and name changed to NXP Semiconductor 	4	EIA-232- D/V.28 Driver/Recvr This chip provides a low power solution for the EIA232-E and V.28 applications. This is also used for modem interface	Datasheet Philips Overview Documenta tion Obsolete	Small Outline 16 leads (SO16)
8	26LS32AC Texas Instruments 	26LS32AC Texas Instruments 	4	Quadruple Differential Line Receiver This chip is used for balanced (2 conductors of the same type) and unbalanced (conductors have an unequal impedance) digital data transmission.	Datasheet Active Everything About AM26LS3 2AC	Small Outline SOIC (16)
9	AM26LS31C Texas Instruments 	AM26LS31C Texas Instruments 	2	Quadruple Differential Line Receiver This chip id used for balanced and unbalanced digital data transmission.	Datasheet Active Everything About AM26LS3 1C Active	SOIC (16) Small Outline


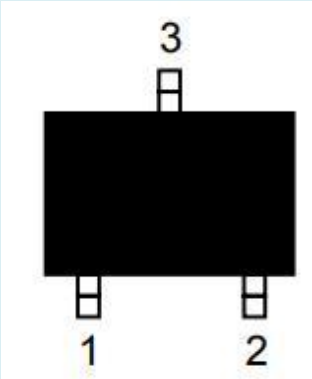

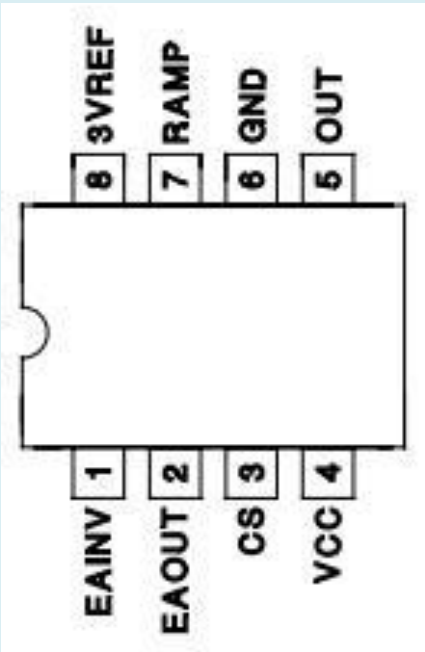
Table 19: Pin Configurations of the Integrated Circuits


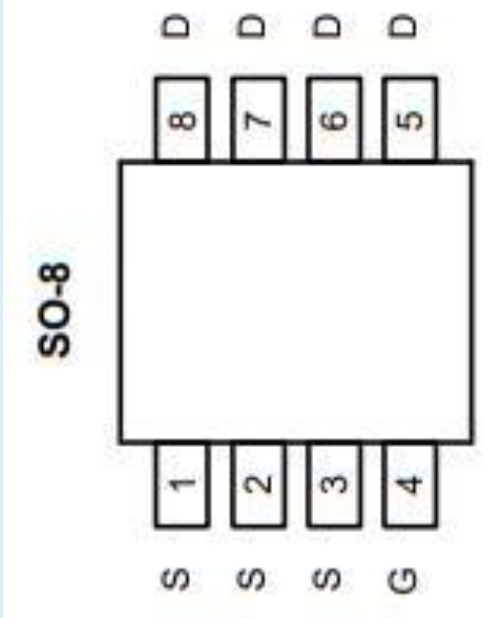

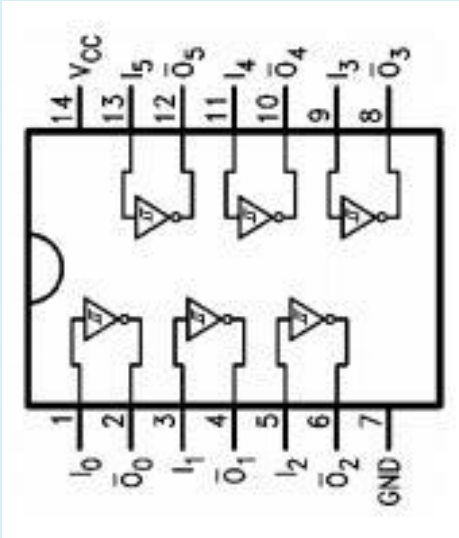
We researched the pin configurations or pinouts of all the integrated circuits. The datasheet or other information for the OKI M08-0050-01 chip made for Cisco was not available; therefore, we do not have a pinout. The pin configurations are typically found on the last few pages of the datasheet. Datasheets or specification sheets show the performance and electrical characteristics of a product, component, device, or software program. It also shows the package types available for the ICs and the pinouts.


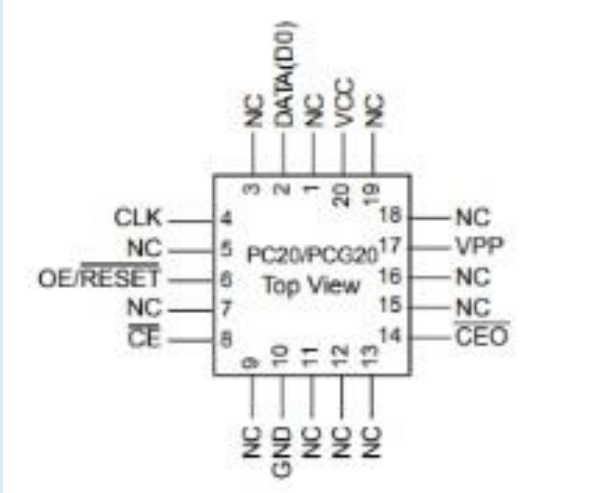

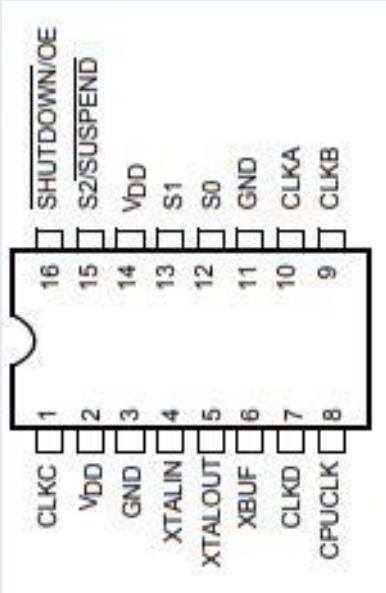
It is important to find pin 1 on your package because the user will know what pins to connect to or test and how to position the chip on the motherboard. Pin 1 is sometimes called the polarity mark. From that pin 1, number the pins counterclockwise around the integrated circuit. Each pin has a role in the IC. Pin 1 is usually next to a circle, small white dot, or half-moon shape at the end of the integrated circuit. It is often on the corner. We were able to find the pin 1 marker on most chips. In the picture below we oriented the chip identical to the pinout.




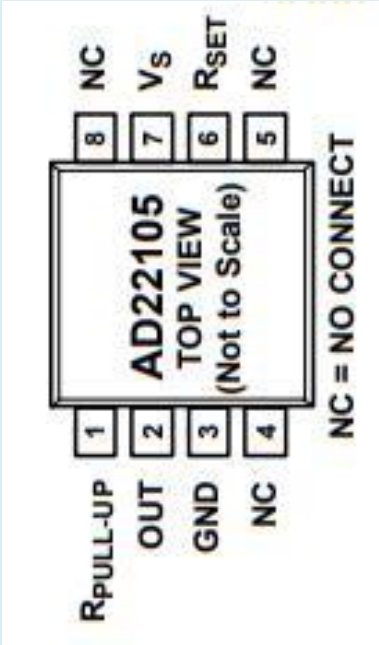
At a high level, to figure out if we have the correct pinout, we compared the image of the chip and counted the pins or balls (pins stick out like rectangles and balls are round underneath an IC), then compare it with the pinout image taken from the datasheets. The number of pins should match.

ID	Integrated Circuit	Pin Configuration Pinout Diagram
1		
	Pericom Semiconductor Corporation PI5C 3125Q	

ID	Integrated Circuit	Pin Configuration Pinout Diagram															
2		 <p>PIN DESCRIPTION</p> <table> <tr> <th>PIN</th><th>NAME</th><th>FUNCTION</th></tr> <tr> <td>SOT-23</td><td></td><td></td></tr> <tr> <td>1</td><td>$\overline{\text{RST}}$</td><td>Active-Low Reset Output</td></tr> <tr> <td>2</td><td>V_{CC}</td><td>Power Supply</td></tr> <tr> <td>3</td><td>GND</td><td>Ground</td></tr> </table>	PIN	NAME	FUNCTION	SOT-23			1	$\overline{\text{RST}}$	Active-Low Reset Output	2	V _{CC}	Power Supply	3	GND	Ground
PIN	NAME	FUNCTION															
SOT-23																	
1	$\overline{\text{RST}}$	Active-Low Reset Output															
2	V _{CC}	Power Supply															
3	GND	Ground															
Dallas Semiconductor 813B																	
3																	
Unitrode Corporation UC3573																	

ID	Integrated Circuit	Pin Configuration Pinout Diagram
4		
Siliconix 9430		
5		
Fairchild Semiconductor 74F14		

ID	Integrated Circuit	Pin Configuration Pinout Diagram
6		
Xilinx 17512LJC		
7		
Cypress Semiconductor CY2292SC-432		

ID	Integrated Circuit	Pin Configuration Pinout Diagram
8		
Texas Instruments LVTH162244		
9		
Analog Devices AD22105		

ID	Integrated Circuit	Pin Configuration Pinout Diagram
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12

Product Obsolete


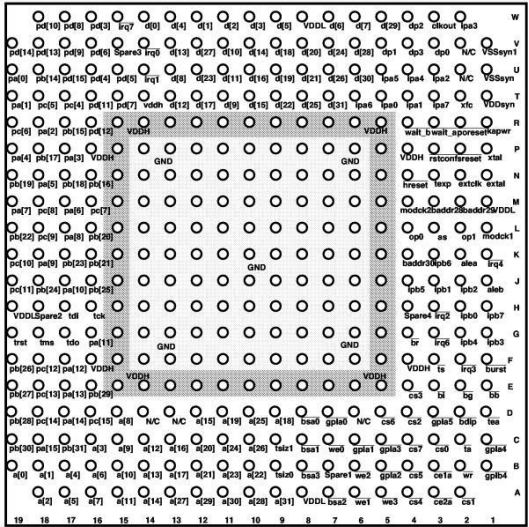
XC4000XLA Family Field Programmable

XC4013XLA Pinout Table


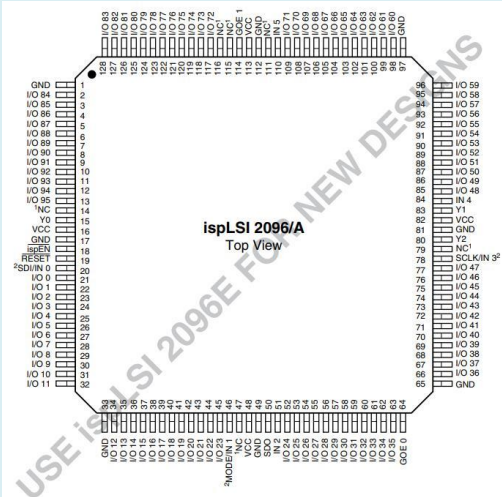

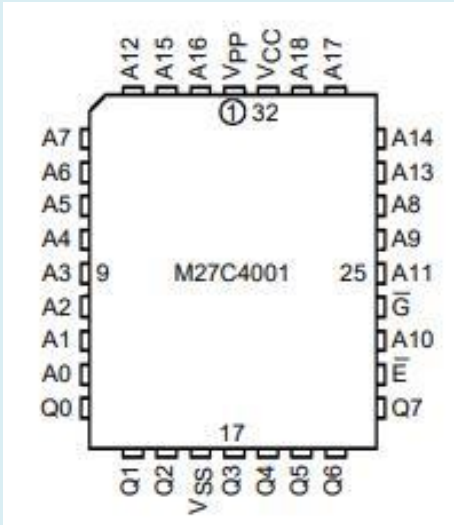
XC4013XLA Pinout Table


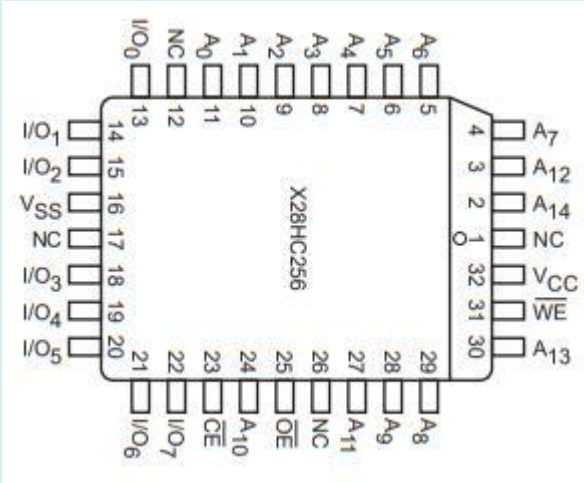

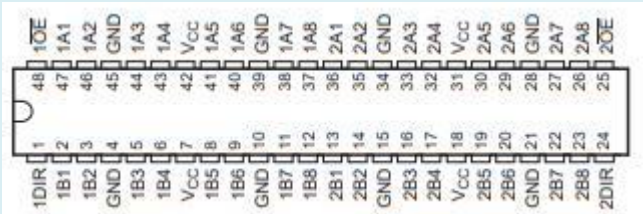
PAD NAME	PQ188	PQ238	PQ248	BG256
VCC	P142	P183	P212	VCC*
IO (A8)	P143	P184	P213	C10
IO (A9)	P144	P185	P214	D10
IO (A19)	P145	P186	P215	A8
IO (A18)	P146	P187	P216	B8
IO	-	P188	P217	C8
IO	-	P189	P218	D8
GND	-	-	P219	GND*
IO (A16)	P147	P190	P220	A8
IO (A11)	P148	P191	P221	B8
VCC	-	-	P222	VCC*
IO	-	-	P223	A6
IO	-	-	P224	C7
IO	P149	P192	P225	B6
IO	P150	P193	P226	A5
GND	P151	P194	P227	GND*
IO	-	P195	P228	C6
IO	-	P196	P229	B5
IO	P152	P197	P230	A4


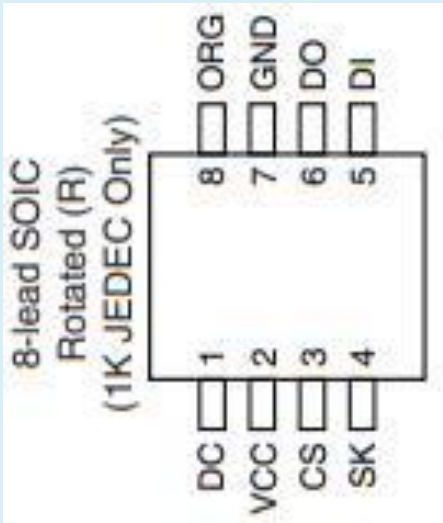

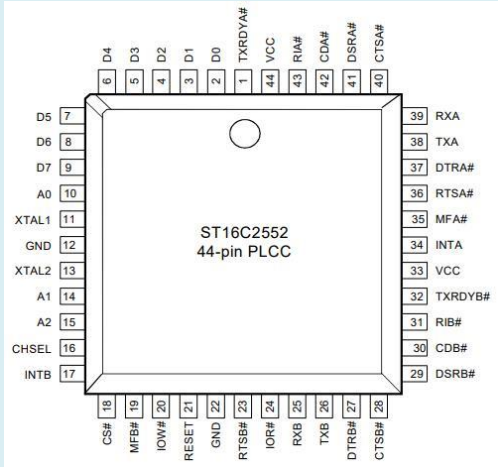
Xilinx XC4013XLA [Package Pinouts](#)


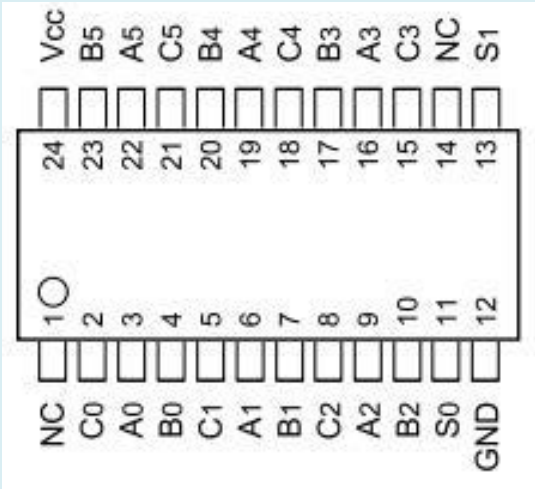

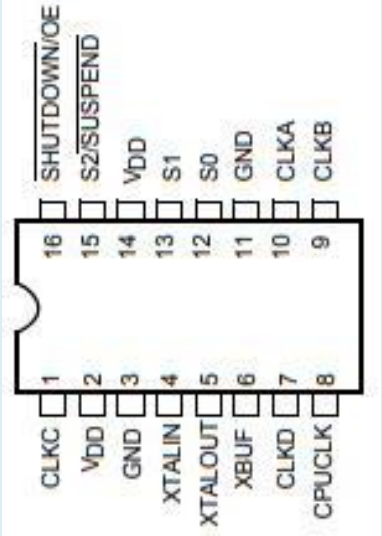
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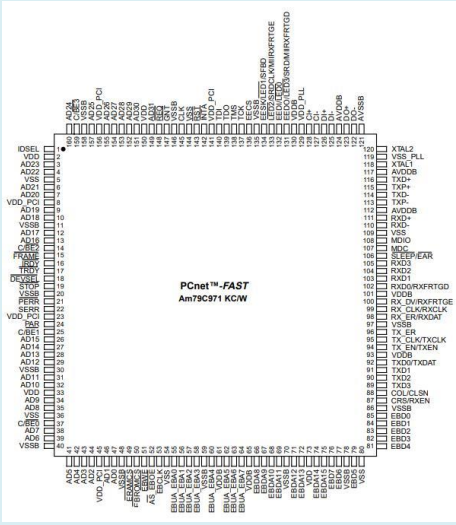

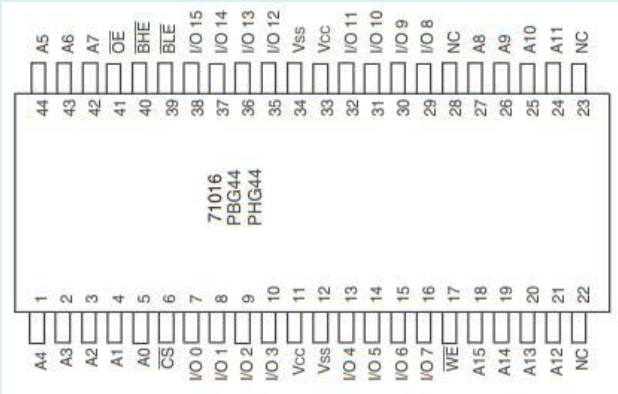
Motorola XPC860ZP50C1 - This pinout is viewed from the top surface. This package is a Plastic Ball Grid Array 357. If you flip the chip on the left, you will see an array of balls instead of pins or leads. 357 is the number of balls on the package.



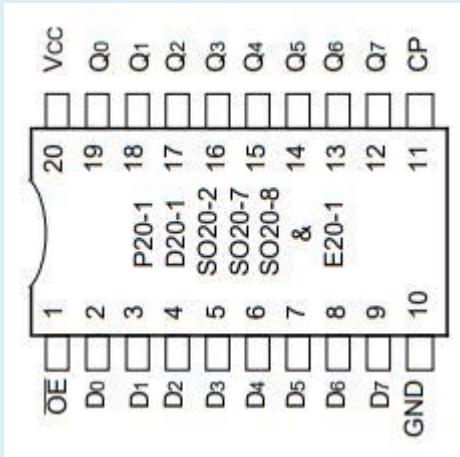
ID	Integrated Circuit	Pin Configuration Pinout Diagram
14		
	Lattice ispLSI 2096A-100LQ128	
15		
	STMicroelectronics M27C4001 12C1 – This package is a Plastic-leaded chip carrier. It is the brown rectangular housing shown on the actual chip on the left.	


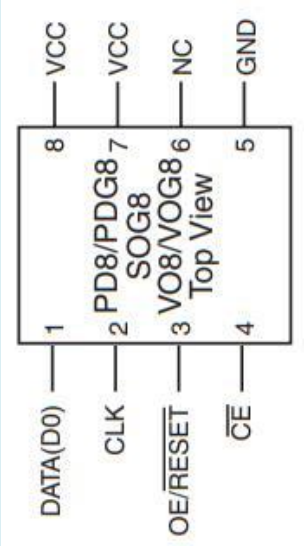
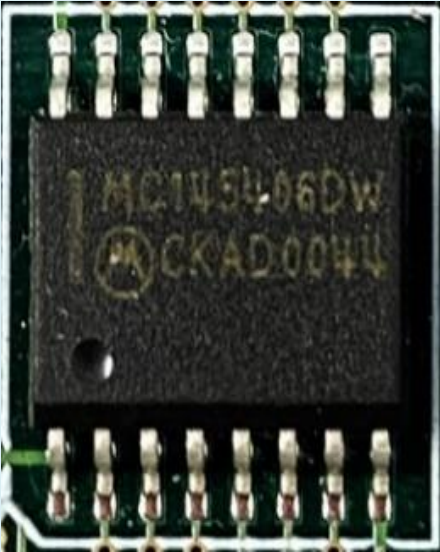
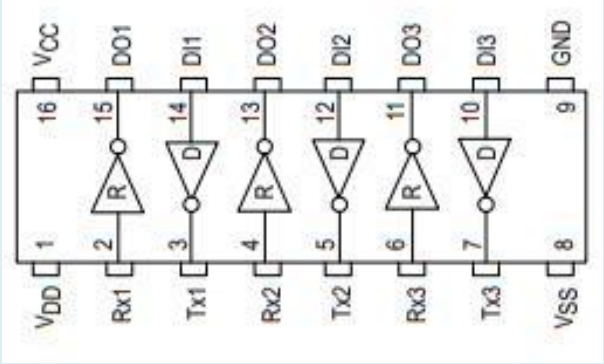
ID	Integrated Circuit	Pin Configuration Pinout Diagram
16		
	Xicor X28HC256J-12	
17		
	Texas Instruments LVTH16245A	

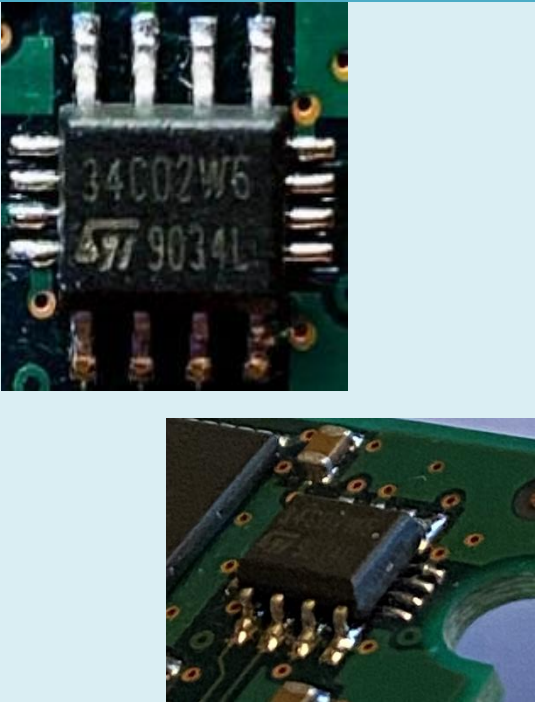
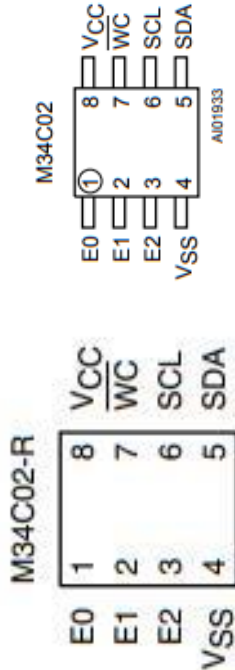

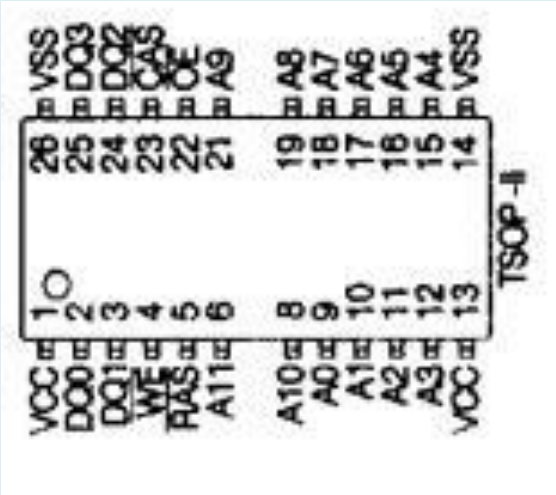
ID	Integrated Circuit	Pin Configuration Pinout Diagram
18		
	STMicroelectronics 93C46	
19		
	Exar ST16C2552CJ-CC-0039	


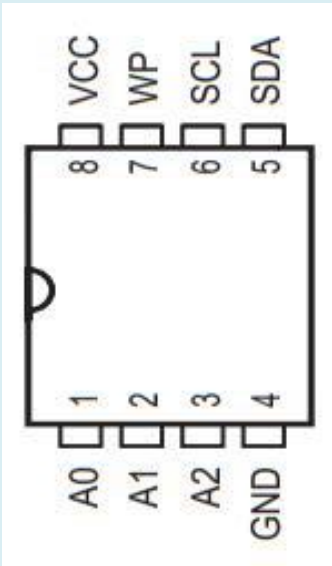

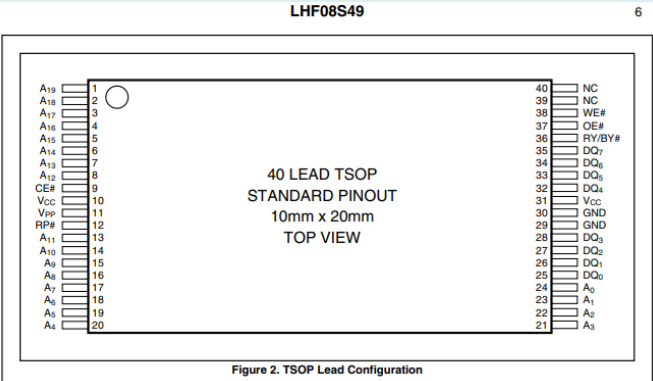
ID	Integrated Circuit	Pin Configuration Pinout Diagram
20		
Pericom Semiconductor Corporation PI5C 3401S		
21		
Cypress Semiconductor CY2292SC-612		

ID	Integrated Circuit	Pin Configuration Pinout Diagram
22		
	Advanced Micro Devices PCNet Fast_AM79C971AKC	
23		
	Integrated Device Technology 71016	


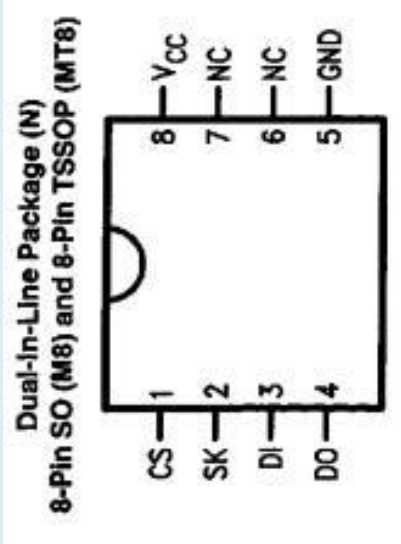

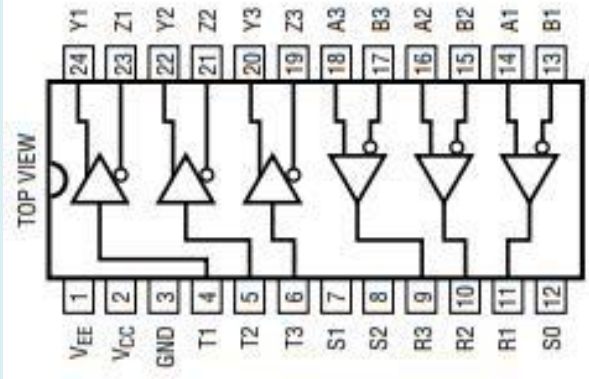
ID	Integrated Circuit	Pin Configuration Pinout Diagram																																																																																																																																																																																																									
24		<div><div>XCS20 and XCS20XL Device Pinouts</div><table><thead><tr><th>XCS20/XL Pad Name</th><th>VQ100</th><th>CS144⁽²⁾</th><th>TQ144</th><th>PQ208</th><th>Bndry Scan</th></tr></thead><tbody><tr><td>VCC</td><td>P89</td><td>D7</td><td>P128</td><td>P183</td><td>-</td></tr><tr><td>I/O</td><td>P90</td><td>A6</td><td>P129</td><td>P184</td><td>62</td></tr><tr><td>I/O</td><td>P91</td><td>B6</td><td>P130</td><td>P185</td><td>65</td></tr><tr><td>I/O</td><td>P92</td><td>C6</td><td>P131</td><td>P186</td><td>68</td></tr><tr><td>I/O</td><td>P93</td><td>D6</td><td>P132</td><td>P187</td><td>71</td></tr><tr><td>I/O</td><td>-</td><td>-</td><td>-</td><td>P188</td><td>74</td></tr><tr><td>I/O</td><td>-</td><td>-</td><td>-</td><td>P189</td><td>77</td></tr><tr><td>I/O</td><td>P94</td><td>A5</td><td>P133</td><td>P190</td><td>80</td></tr><tr><td>I/O</td><td>P95</td><td>B5</td><td>P134</td><td>P191</td><td>83</td></tr><tr><td>VCC⁽²⁾</td><td>-</td><td>-</td><td>-</td><td>P192</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>C5</td><td>P135</td><td>P193</td><td>86</td></tr><tr><td>I/O</td><td>-</td><td>D5</td><td>P136</td><td>P194</td><td>89</td></tr><tr><td>GND</td><td>-</td><td>A4</td><td>P137</td><td>P195</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td><td>-</td><td>P196</td><td>92</td></tr><tr><td>I/O</td><td>-</td><td>-</td><td>-</td><td>P197</td><td>95</td></tr><tr><td>I/O</td><td>-</td><td>-</td><td>-</td><td>P198</td><td>98</td></tr><tr><td>I/O</td><td>-</td><td>-</td><td>-</td><td>P199</td><td>101</td></tr><tr><td>I/O</td><td>P96</td><td>B4</td><td>P138</td><td>P200</td><td>104</td></tr><tr><td>I/O</td><td>P97</td><td>C4</td><td>P139</td><td>P201</td><td>107</td></tr><tr><td>I/O</td><td>-</td><td>A3</td><td>P140</td><td>P204</td><td>110</td></tr><tr><td>I/O</td><td>-</td><td>B3</td><td>P141</td><td>P205</td><td>113</td></tr><tr><td>I/O</td><td>P98</td><td>C3</td><td>P142</td><td>P206</td><td>116</td></tr></tbody></table></div> <div>XCS20 and XCS20X<table><thead><tr><th>XCS20/XL Pad Name</th><th>VQ100</th><th>C</th></tr></thead><tbody><tr><td>I/O, PGCK1⁽¹⁾, GCK1⁽²⁾</td><td>P2</td><td>-</td></tr><tr><td>I/O</td><td>P3</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td></tr><tr><td>I/O, TDI</td><td>P4</td><td>-</td></tr><tr><td>I/O, TCK</td><td>P5</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td></tr><tr><td>GND</td><td>-</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td></tr><tr><td>I/O, TMS</td><td>P6</td><td>-</td></tr><tr><td>I/O</td><td>P7</td><td>-</td></tr><tr><td>VCC⁽²⁾</td><td>-</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td></tr><tr><td>I/O</td><td>-</td><td>-</td></tr><tr><td>I/O</td><td>P8</td><td>-</td></tr><tr><td>I/O</td><td>P9</td><td>-</td></tr></tbody></table></div>	XCS20/XL Pad Name	VQ100	CS144 ⁽²⁾	TQ144	PQ208	Bndry Scan	VCC	P89	D7	P128	P183	-	I/O	P90	A6	P129	P184	62	I/O	P91	B6	P130	P185	65	I/O	P92	C6	P131	P186	68	I/O	P93	D6	P132	P187	71	I/O	-	-	-	P188	74	I/O	-	-	-	P189	77	I/O	P94	A5	P133	P190	80	I/O	P95	B5	P134	P191	83	VCC ⁽²⁾	-	-	-	P192	-	I/O	-	C5	P135	P193	86	I/O	-	D5	P136	P194	89	GND	-	A4	P137	P195	-	I/O	-	-	-	P196	92	I/O	-	-	-	P197	95	I/O	-	-	-	P198	98	I/O	-	-	-	P199	101	I/O	P96	B4	P138	P200	104	I/O	P97	C4	P139	P201	107	I/O	-	A3	P140	P204	110	I/O	-	B3	P141	P205	113	I/O	P98	C3	P142	P206	116	XCS20/XL Pad Name	VQ100	C	I/O, PGCK1 ⁽¹⁾ , GCK1 ⁽²⁾	P2	-	I/O	P3	-	I/O	-	-	I/O	-	-	I/O, TDI	P4	-	I/O, TCK	P5	-	I/O	-	-	I/O	-	-	I/O	-	-	GND	-	-	I/O	-	-	I/O	-	-	I/O, TMS	P6	-	I/O	P7	-	VCC ⁽²⁾	-	-	I/O	-	-	I/O	-	-	I/O	-	-	I/O	P8	-	I/O	P9	-
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I/O	P9	-																																																																																																																																																																																																									
	Xilinx XCS20 Spartan FPGA - In this case Xilinx’s datasheet has a list of the pinouts instead of a diagram. If you count the pins there are 100 pins – 25 on each side so you will look for the pins in the VQ100 column.																																																																																																																																																																																																										
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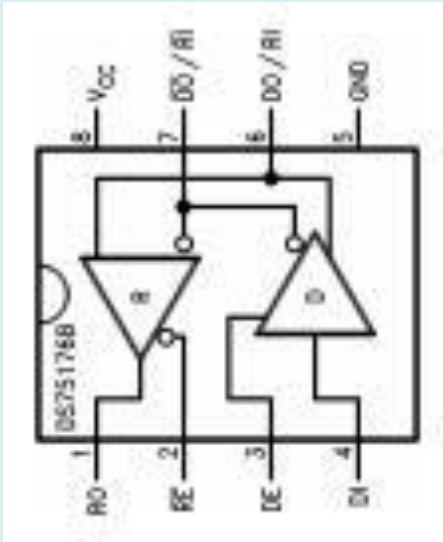

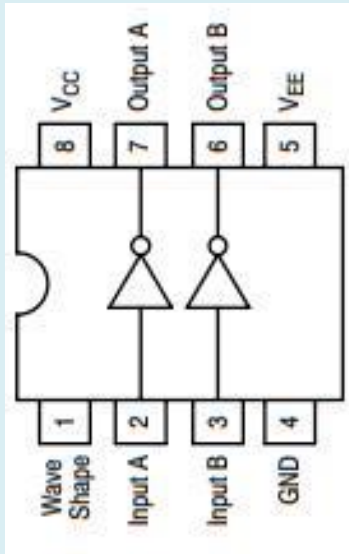
ID	Integrated Circuit	Pin Configuration Pinout Diagram
26		
	Xilinx 17S20VC	
27		
	Motorola MC145406DW	


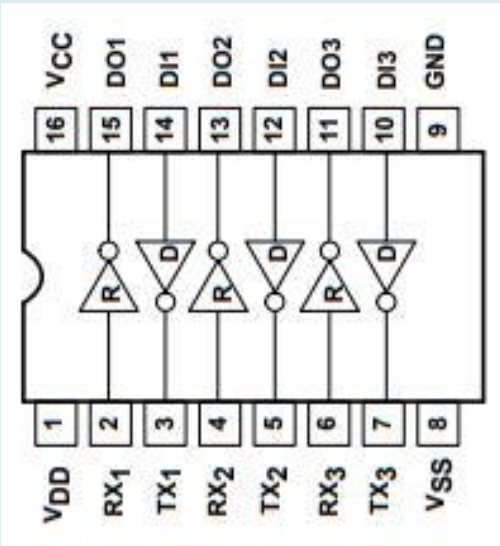

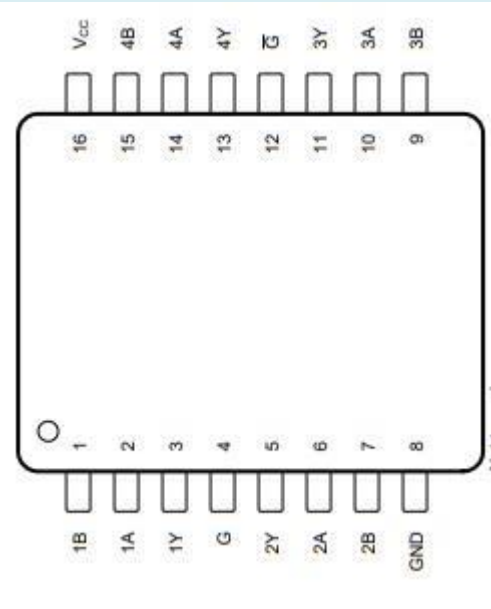
ID	Integrated Circuit	Pin Configuration Pinout Diagram
30		
STMicroelectronics M34C02-RDW6TP - The image on the left shows like it has more than 8 pins but we took additional photos and it is no attached to the IC.		
31		
Hyundai HY51V16404A T-60		


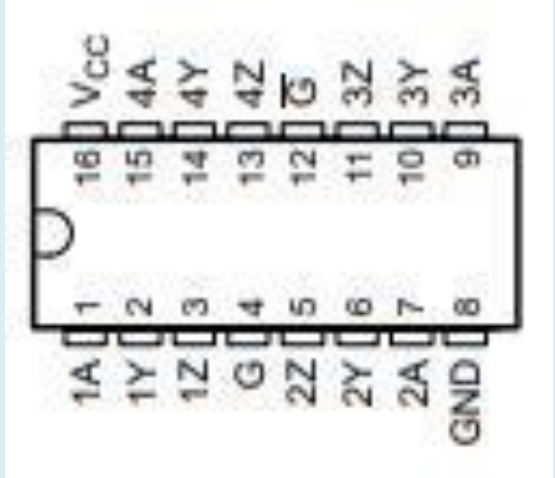
ID	Integrated Circuit	Pin Configuration Pinout Diagram
32		
Integrated Silicon Solution Inc. CO2-3S		
33		
Sharp LH28F008SAT-85		

[illegible]

ID	Integrated Circuit	Pin Configuration Pinout Diagram
36		
	Atmel 93C46SC	
37		
	Linear Technology LTC1346ACSW	

ID	Integrated Circuit	Pin Configuration Pinout Diagram
38		
National Semiconductor DS75176BM		
39		
On Semiconductor 3488		

ID	Integrated Circuit	Pin Configuration Pinout Diagram
40		
Philips Semiconductor MC145406D		
41		
Texas Instruments 26LS32AC – we could not find a notch or dot or mark to signify pin 1 on these chips but newer TI chips have the pin 1 on the lower left quadrant.		

ID	Integrated Circuit	Pin Configuration Pinout Diagram
42		
	<p>Texas Instruments AM26LS31C - we could not find a notch or dot or mark to signify pin 1 on these chips but the other TI chips in this router have the pin 1 on the lower left quadrant.</p>	

Section 7: Works Cited

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