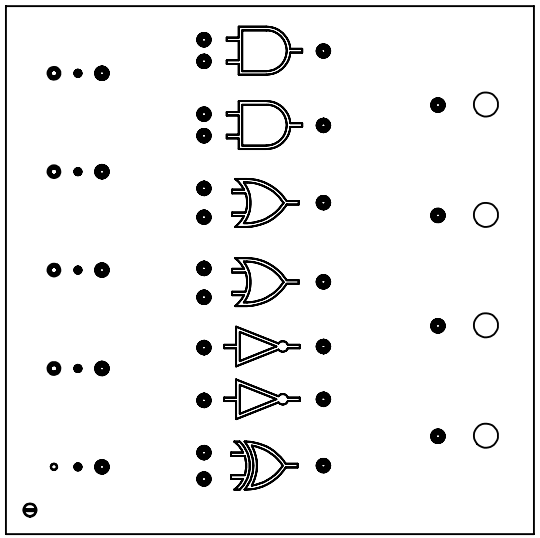
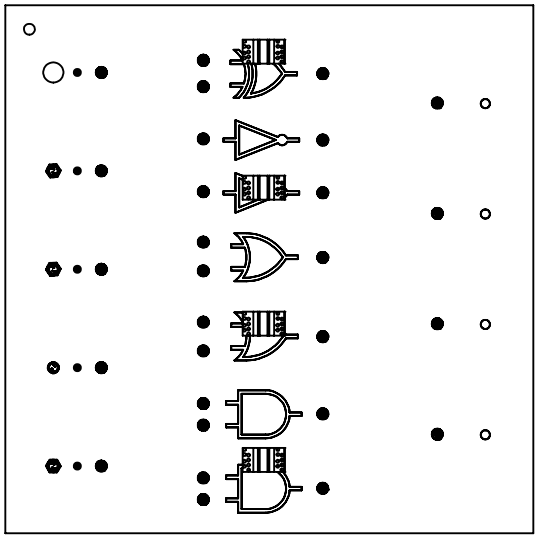
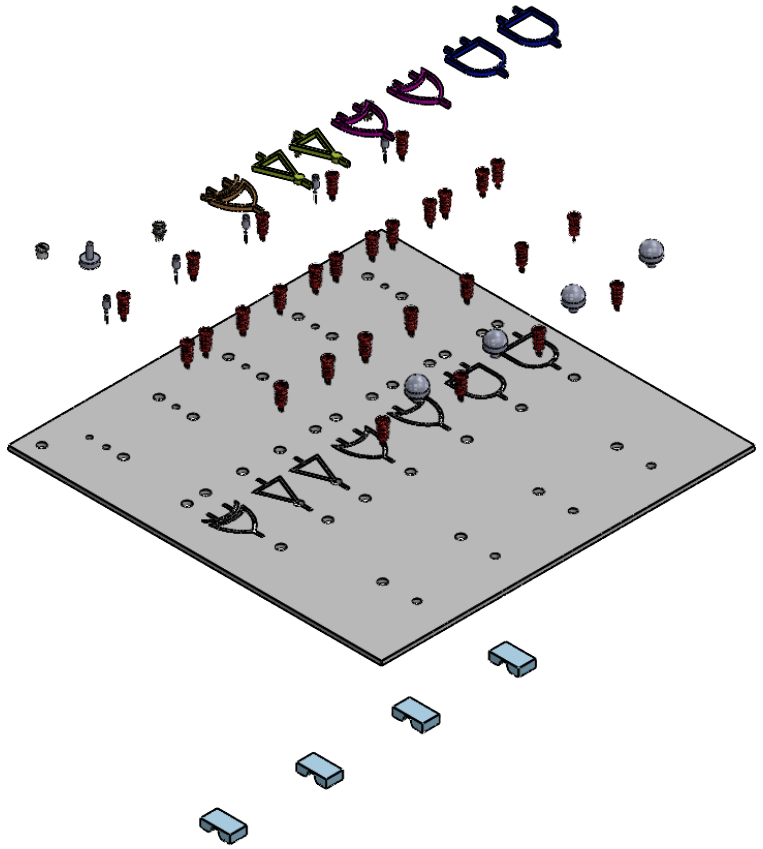




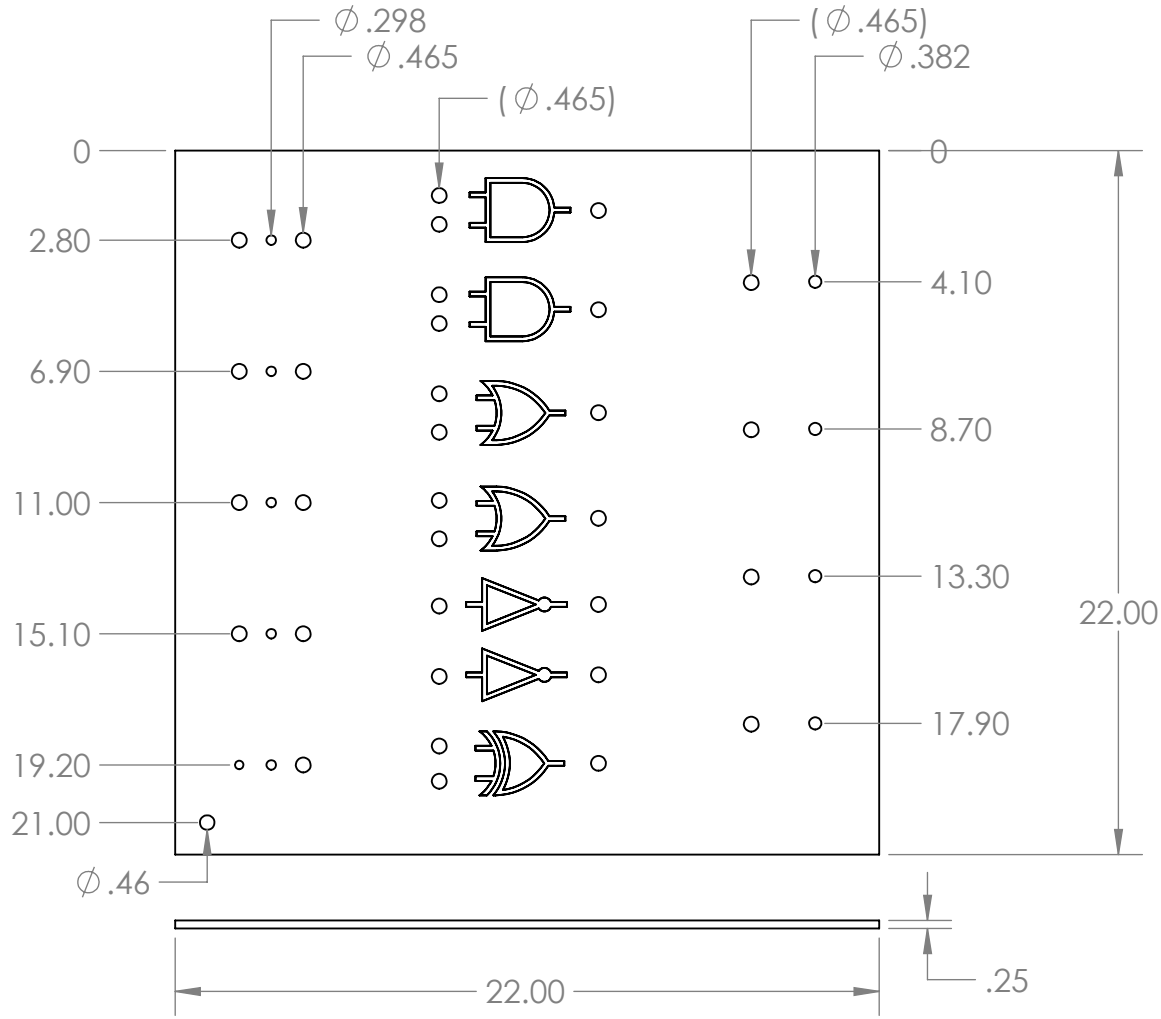


		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:

Assembly

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawir	
SCALE: 1:8	WEIGHT:	SHEET 1 OF 13



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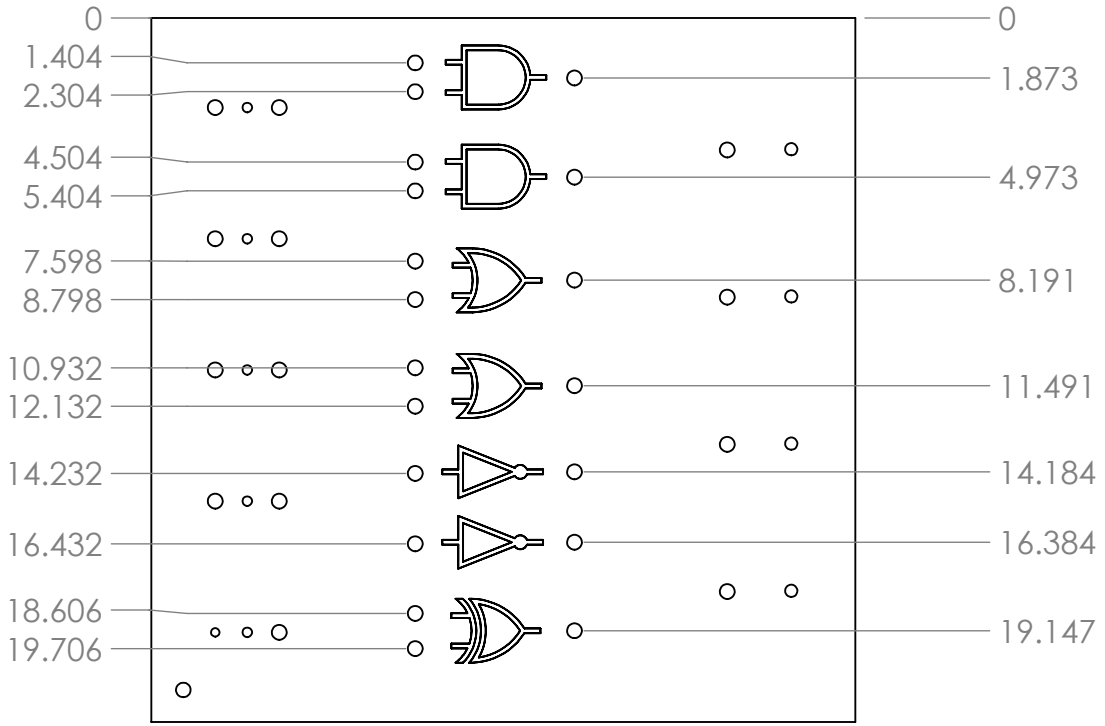
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 1/4 inch plywood	COMMENTS:		
NEXT ASSY	USED ON	FINISH 3 layers spray paint			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:

Board

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawir	
SCALE: 1:8	WEIGHT:	SHEET 2 OF 13



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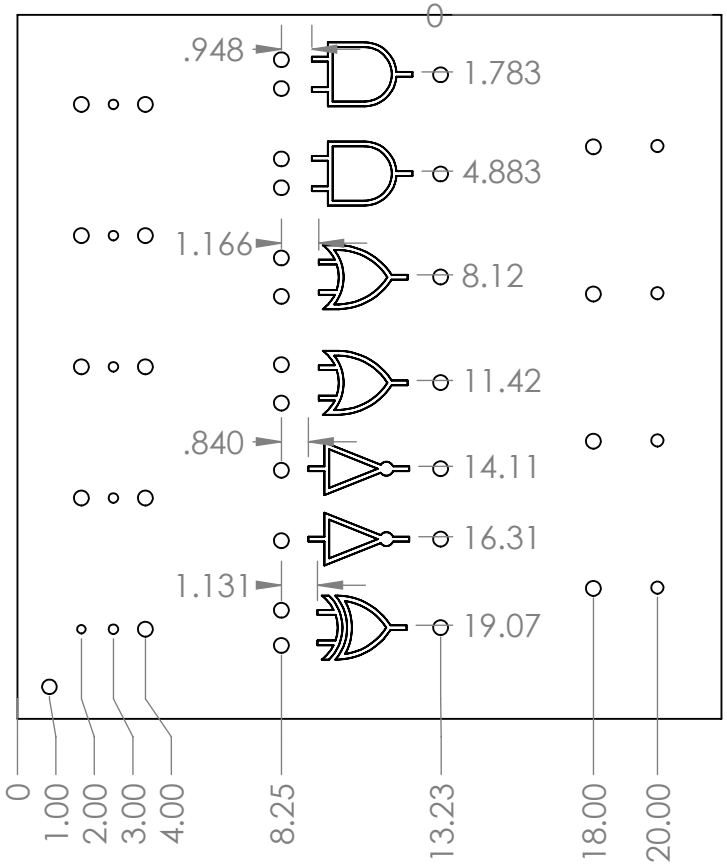
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 1/4 inch plywood	COMMENTS:		
NEXT ASSY	USED ON	FINISH 3 layers spray paint			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawin	
SCALE: 1:8	WEIGHT:	SHEET 3 OF 13



		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
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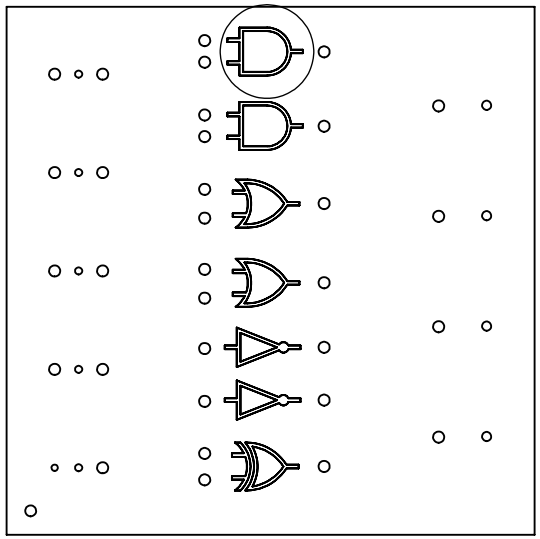
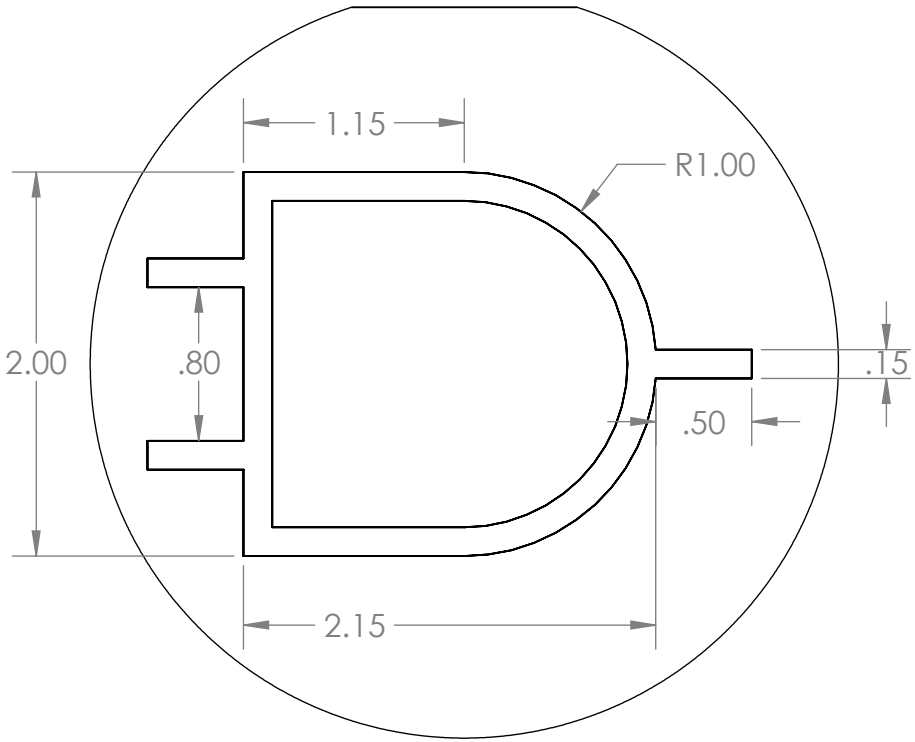
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 1/4 inch plywood	COMMENTS:		
NEXT ASSY	USED ON	FINISH 3 layer spray paint			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:

Board

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawir	
SCALE: 1:8	WEIGHT:	SHEET 4 OF 13



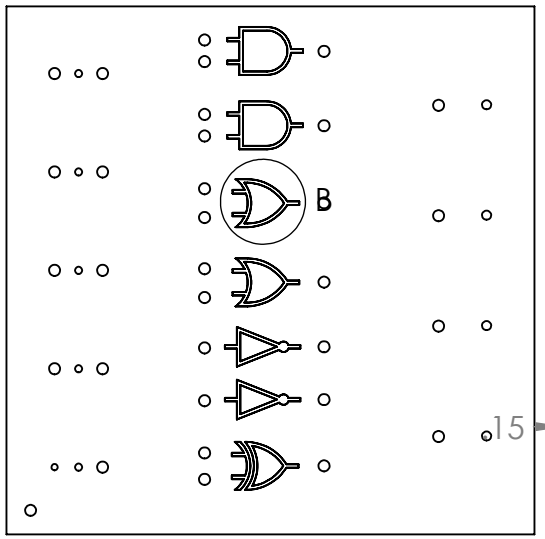


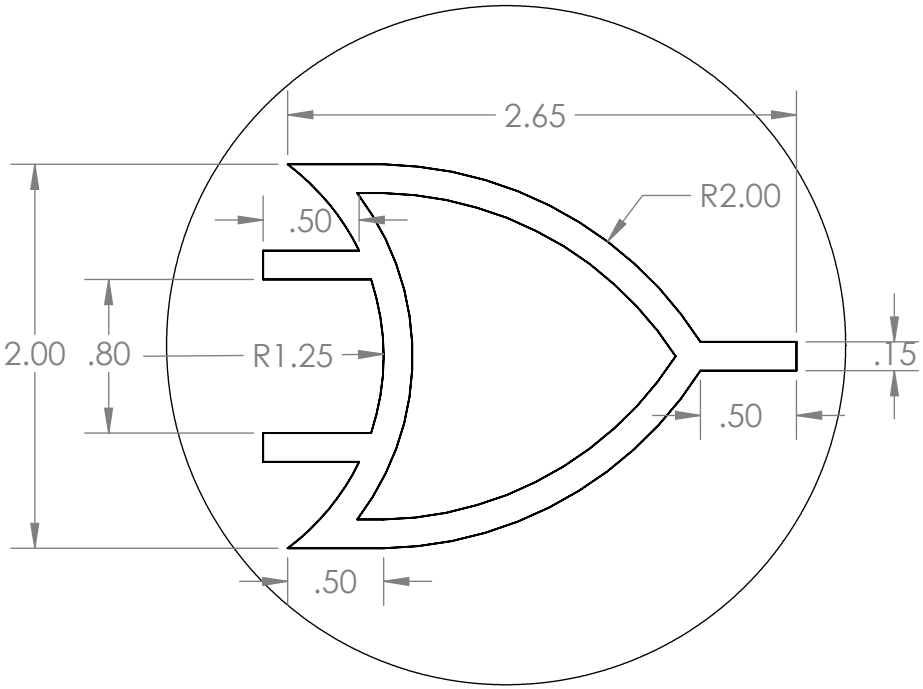
DETAIL A
SCALE 1 : 1

		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ±0.015 THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 1/4 inch plywood	COMMENTS:		
NEXT ASSY	USED ON	FINISH 3 layer spray paint			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:
AND - cut out

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawir	
SCALE: 1:8	WEIGHT:	SHEET 5 OF 13





DETAIL B
SCALE 1 : 1

		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
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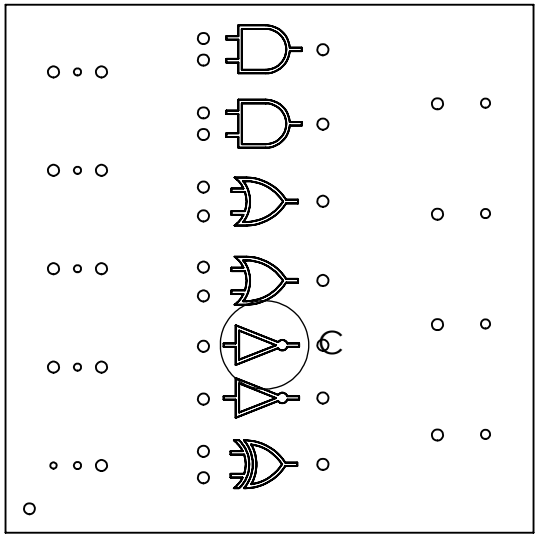
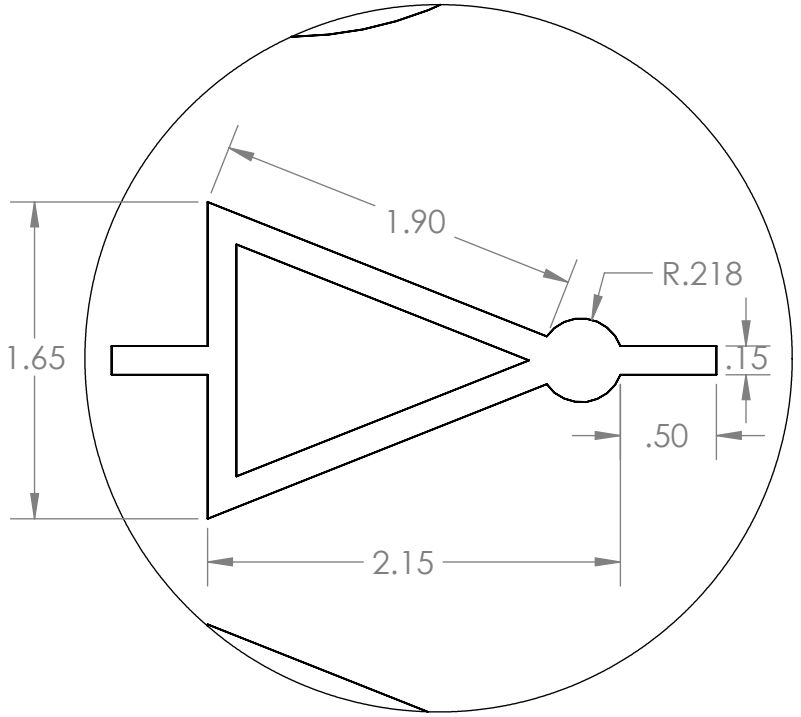
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 1/4 inch plywood	COMMENTS:		
NEXT ASSY	USED ON	FINISH 3 layers spray paint			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:
OR - cut out

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawir	
SCALE: 1:8	WEIGHT:	SHEET 6 OF 13





DETAIL C
SCALE 1 : 1

		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
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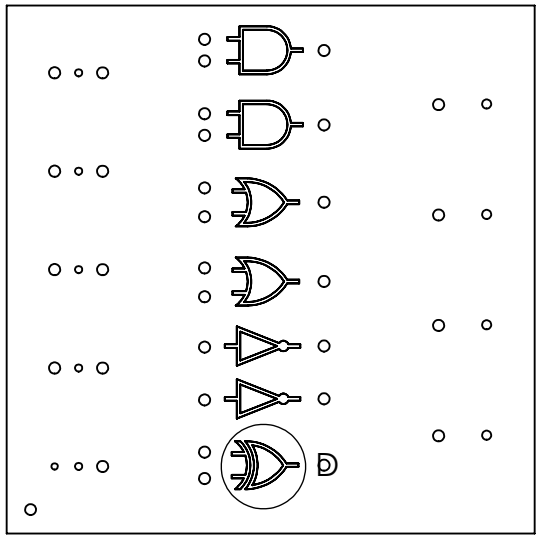
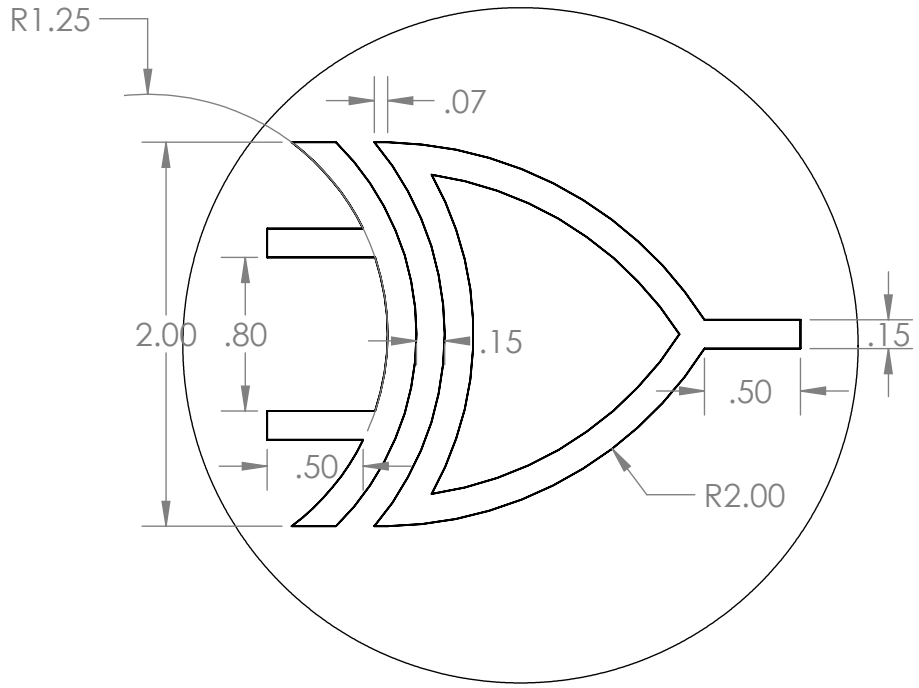
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 1/4 inch plywood	COMMENTS:		
NEXT ASSY	USED ON	FINISH 3 layers spray paint			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:
NOT - cut out

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawir	
SCALE: 1:8	WEIGHT:	SHEET 7 OF 13





DETAIL D
SCALE 1 : 1

		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
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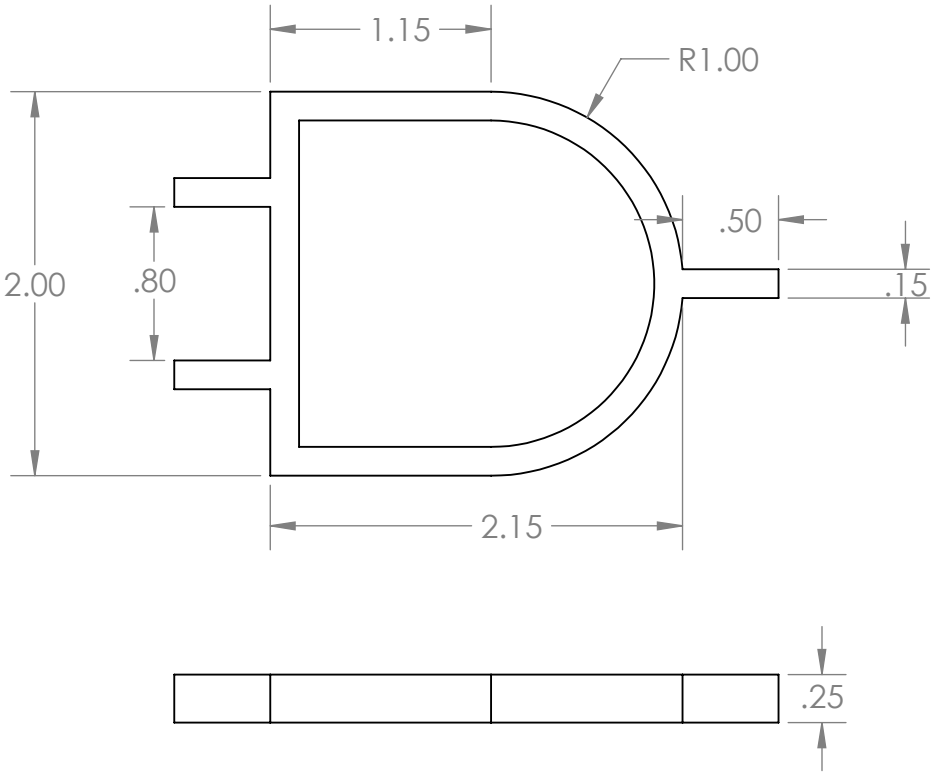
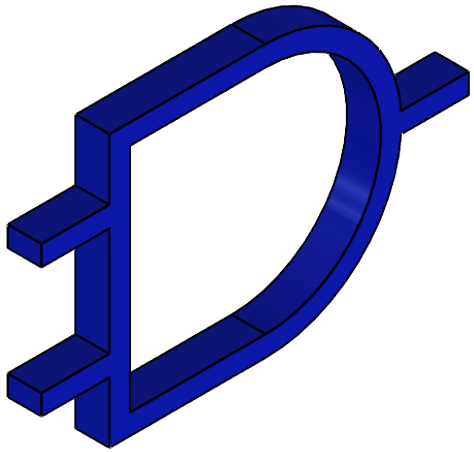
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL 1/4 inch plywood	COMMENTS:		
NEXT ASSY	USED ON	FINISH 3 layers spray paint			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:
XOR - cut out

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawir	
SCALE: 1:8	WEIGHT:	SHEET 8 OF 13





		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
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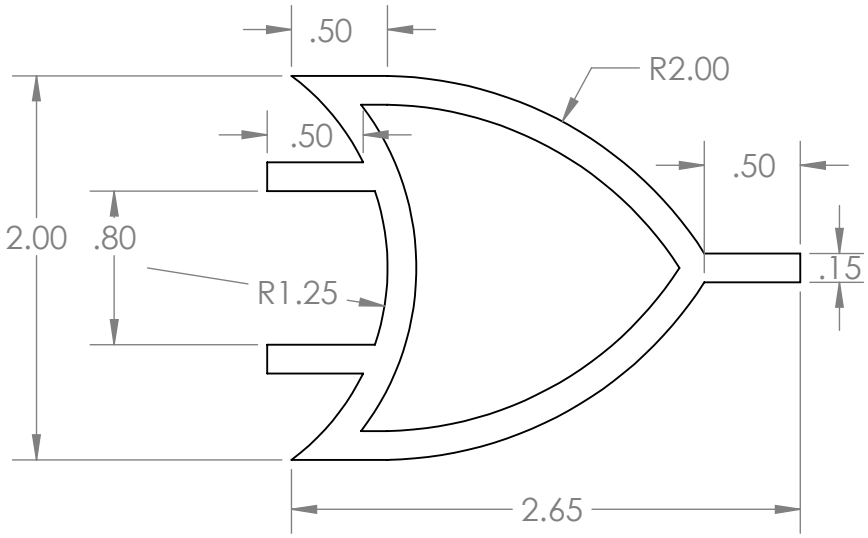
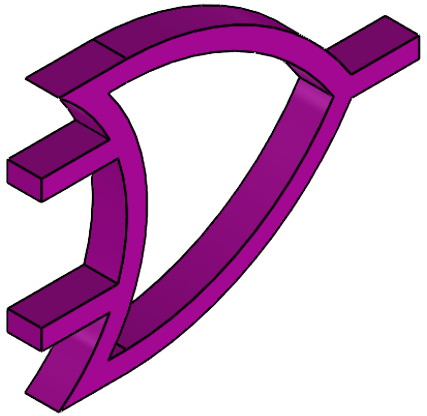
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL PLA	COMMENTS:		
NEXT ASSY	USED ON	FINISH AS MACHINED			
APPLICATION		DO NOT SCALE DRAWING			

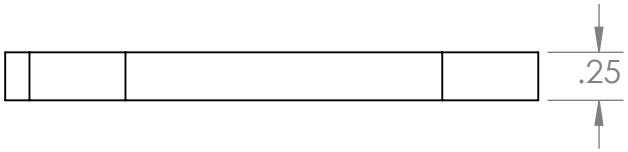
TITLE:

AND - inlay

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawing	
SCALE: 1:1	WEIGHT:	SHEET 9 OF 13





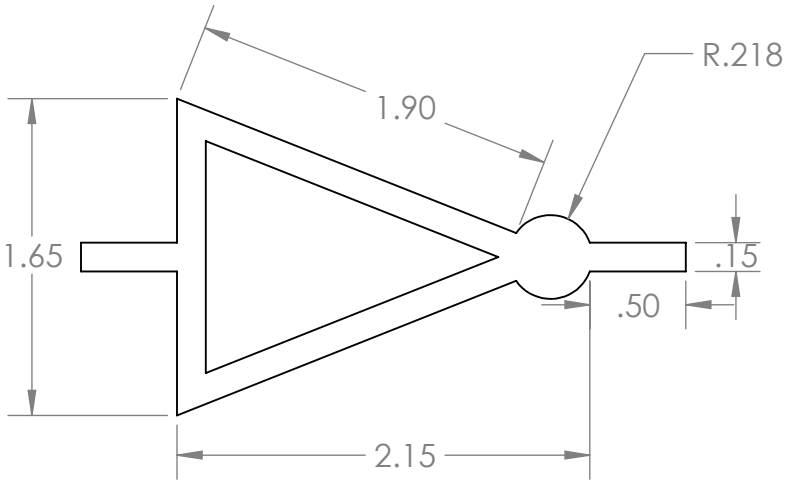


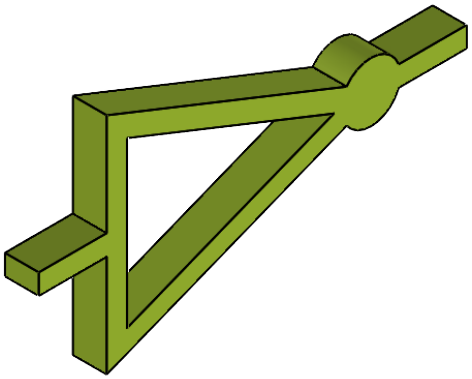
		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ±0.01 THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL PLA	COMMENTS:		
NEXT ASSY	USED ON	FINISH AS MACHINED			
APPLICATION		DO NOT SCALE DRAWING			

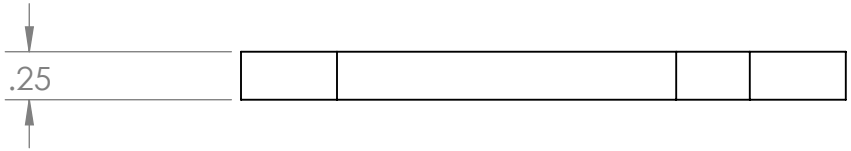
TITLE:

OR - inlay

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawing	
SCALE: 1:1	WEIGHT:	SHEET 10 OF 13







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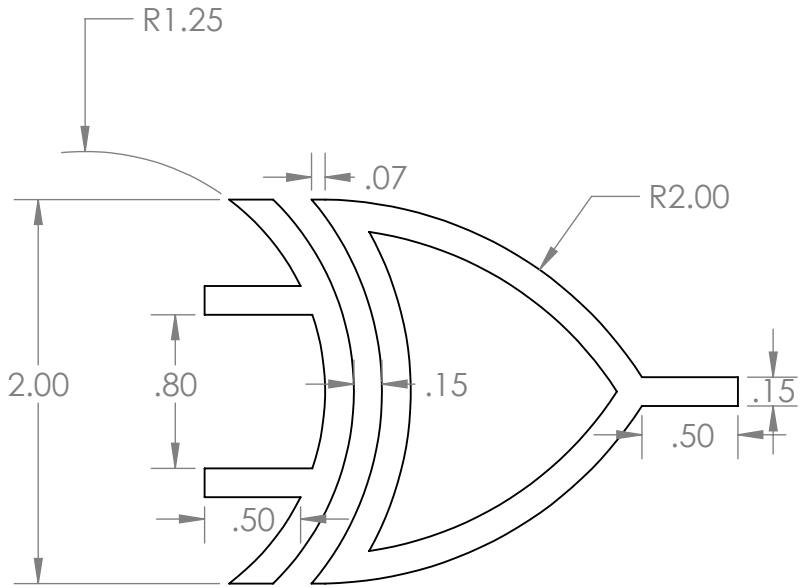
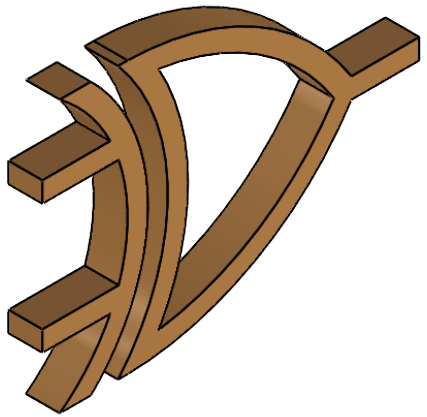
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL PLA	COMMENTS:		
NEXT ASSY	USED ON	FINISH AS MACHINED			
APPLICATION		DO NOT SCALE DRAWING			

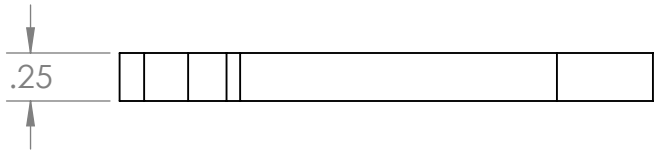
TITLE:

NOT - inlay

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawir	
SCALE: 1:1	WEIGHT:	SHEET 11 OF 13







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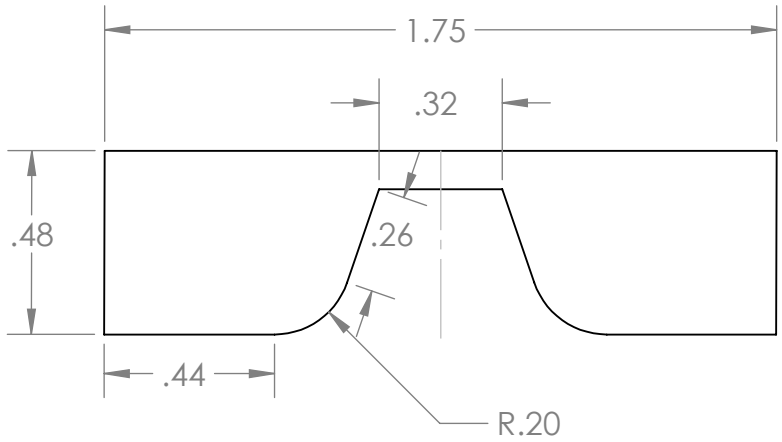
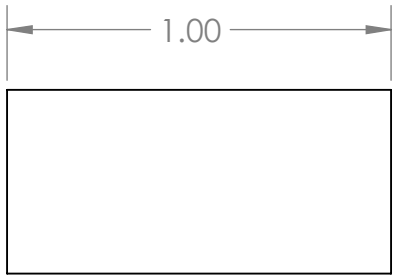
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL PLA	COMMENTS:		
NEXT ASSY	USED ON	FINISH AS MACHINED			
APPLICATION		DO NOT SCALE DRAWING			

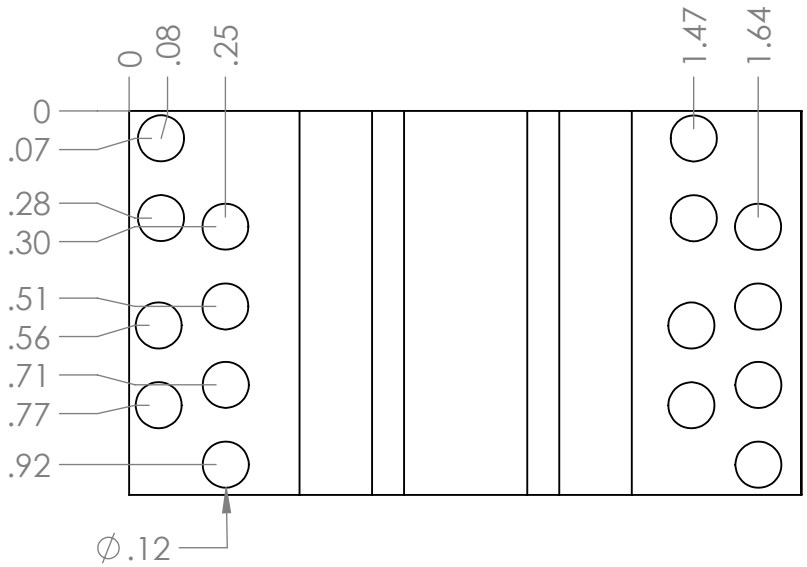
TITLE:

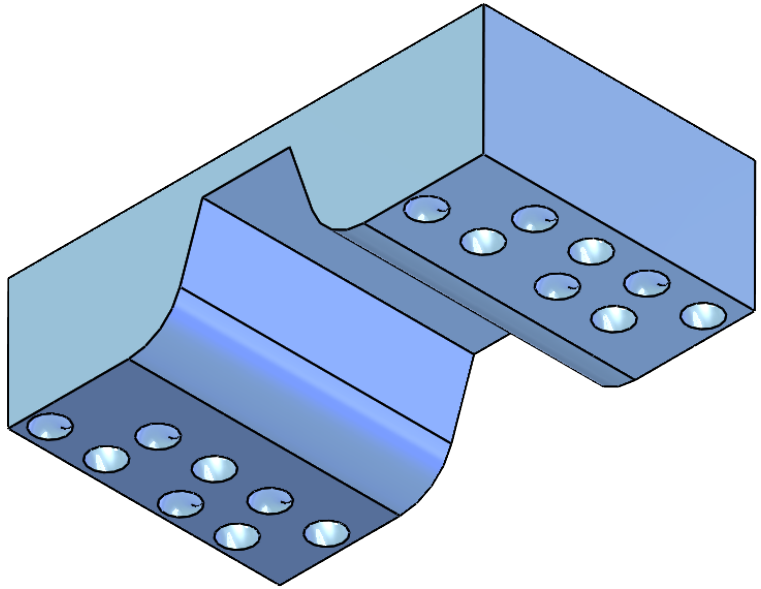
XOR - inlay

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawir	
SCALE: 1:1	WEIGHT:	SHEET 12 OF 13









		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
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			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL PLA	COMMENTS:		
NEXT ASSY	USED ON	FINISH AS MACHINED			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:

IC holder

SIZE	DWG. NO.	REV
A	LogicForgeTechnicalDrawir	
SCALE: 2:1	WEIGHT:	SHEET 13 OF 13

Bill of Materials

Item	Part Number	Manufacturer	Quantity	Price per unit ($)	Total cost for part ($)
2 by 2 feet 1/4" Plywood	300810	Home Depot	1	$9.50	$9.50
555 Clock Integrated Circuit	NE555P	Texas Instruments	1	$0.69	$0.69
Hex Inverter IC	74HC04	Texas Instruments	1	$0	$0
Quad 2-input AND Gate IC	74HC08	Texas Instruments	1	$0	$0
Quad 2-input NOT Gate IC	74HC32	Texas Instruments	1	$0	$0
Quad 2-input XOR Gate IC	74HC86	Texas Instruments	1	$0	$0
5mm Green LED	WP7113SGD5V	DigiKey	5	$0	$0
5mm LED Holder Mount	B08FBVRL8V	RTNLIT	5	0.25$	1.25$
LED Latching Push Button	B083QMF2HW	APIELE	4	$4.50	$18.00
Type C power input	B0BZVLX6JJ	XIITIA	1	$0.69	$0.69
4mm Banana Jack Socket Female	4348281332	Bei Qian	15	$1	$15
5V LED Spotlight	ASTGY009	JIUWU	6	$2.17	$13.02
Stackable Banana to Banana Plugs	4330119086	Goupchn	10	$1.29	$12.90
White Spray Paint Primer Plus	331181	Rust-Oleum	1	$0	$0
Bottle of J-B Weld Epoxy	50114H	J-B Weld	1	$0	$0
Hot Glue Stick	B000PCY91O	AdTech	1	$0	$0
Bottle of Hot Glue	GM-160	Surebonder	1	$0	$0
Roll of Gaffer's Tape	OP-6344	Pro-Tapes	1	$0	$0
Roll of Lead Solder	JF850	MAIYUM	1	$0	$0
Roll 22 AWG Stranded Wire	B089D29FHC	Fermerry	1	$0	$0
220 uF Capacitor	25YXJ220M6.3X11	DigiKey	1	$0	$0
1 uF Capacitor	ESE105M100AC3EA	DigiKey	1	$0	$0
150 Ohm Resistor	CF14JT1M00	DigiKey	4	$0	$0
10K Ohm Resistor	CF1/4CT52R103J	DigiKey	4	$0	$0
6K Ohm Resistor	MFP50SCRD52-6K	DigiKey	1	$0	$0
4mm Heat Shrink	asd-123	DigiKey	1	$0	$0
B10K Potentiometer	P160KN-0QC15B10K	SMRAZA	1	$0	$0
Small Black Zip Ties	GT-100MCB	Home Depot	5	$0	$0
3D Printed PLA "NOT GATE"	X1C	Bambu 3D Printer	2	$0	$0
3D Printed PLA "AND GATE"	X1C	Bambu 3D Printer	2	$0	$0
3D Printed PLA "OR GATE"	X1C	Bambu 3D Printer	2	$0	$0
3D Printed PLA "XOR GATE"	X1C	Bambu 3D Printer	1	$0	$0
3D Printed PLA "IC HOLDER"	X1C	Bambu 3D Printer	9	$0	$0
				Total cost for prototype:	**$71.05**

LOGIC GATE CIRCUIT BOARD PROCESS ROUTER

Board

Process	Machine/Tool	Comments
Laser cut board	Full Spectrum PS48 Laser Cutter	Place the board on the bed of the laser cutter making sure it is level and not laying at an angle. Turn on the exhaust fan and enable the water cooler and air pump. Upload your file to the laser cutter computer and run the perimeter, adjusting the position of the board on the bed accordingly. Settings should be set to: 100% speed, 100% power, 100% current, 2 passes. Laser cut board. Remember to save the wood from the center of the gates!
Spray paint board	Spray Paint	Hang the laser cut board before painting so all sides are displayed. Evenly paint the whole board with one coat of white spray paint. Once the board is dried, recoat it 2 more times.
Spray paint cutouts from the center of the gates	Spray paint	Place cutouts flat and paint each with one coat of white spray paint.

Logic Gate Inlays and IC Holders

Process	Machine/Tool	Comments
3D print and gates	Bambu Lab X1-Carbon 3D Printer	Slice the STL file using 3DPrinterOS, a slicing software that converts files to be printed on the Bambu. Set the nozzle settings to the Bambu Lab X1 Carbon 0.4 Nozzle and the bed settings to Textured PEI Plate. Select 15% for your infill density. Slice then print your plate. Repeat for the second gate. Use blue filament for both gates.
3D print or gates	Bambu Lab X1-Carbon 3D Printer	Repeat printing steps. Use pink filament for both gates.
3D print not gates	Bambu Lab X1-Carbon 3D Printer	Repeat printing steps. Use green filament for both gates.
3D print exclusive or gate	Bambu Lab X1-Carbon 3D Printer	Repeat printing steps. Use orange filament for the gate. Remember to only print one exclusive or gate!
3D print IC holders	Bambu Lab X1-Carbon 3D Printer	Repeat printing steps.

Board Assembly

Process	Machine/Tool	Comments
Attach 3D printed inlays to the board	Epoxy	Apply a thin even layer of epoxy to the inner edges of the gate cut outs on the board. Place in each 3D printed inlay. Allow time to dry.
Attach wooden cutouts to the board	Epoxy	Apply a thin layer of epoxy to the inner edges of the 3D printed inlays. Place in each wooden cutout to its corresponding gate. Allow time to dry.
Screw in output LEDs	Wrench/By Hand	First screw in screw attachment to the back of each bulb. Then secure to board with the respective bolts.
Screw in banana sockets	Wrench/By Hand	Ensure that the thin lock washer is on the front of the board and ridges on the nut are screwed on facing away from the back of the board. Secure sockets to board with the washer and nut. Red sockets should be used for the inputs and the clock.
Screw in input buttons	Wrench/By Hand	Secure buttons to the board with the respective hex nut.
Screw in input LEDs	Wrench/By Hand	Slide the LED into the front of the housing fastening it in with the

plastic cap on the back. Secure to the board with respective nuts.

Circuit Assembly

Process	Machine/Tool	Comments
Solder input and output wires to each chip	Soldering Iron, solder	Use a small amount of solder to solder input and output wires to the pins of each chip.
Heat shrink chip connections	Heat shrink, heat gun	Using a small piece of heat shrink and the heat gun, cover each pin and wire connection for each gate and heat shrink the connection.
Attach chips to chip holders	Hot glue, zip ties	Add a small amount of hot glue to the valley portion of the chip holder and place and hold the chip. Thread zip ties through the holes on the chip holder to secure the wires in place.
Attach the chip holders to the board	Hot glue	Add a small amount of hot glue to the board and adhere each holder one at a time. Holding the holder in place afterwards to allow time to dry.
Solder wire connections	Soldering Iron, solder	Solder wire connections according to the schematic, making sure to strip and thread wires through the holes on the sockets to ensure conduction. Remember to thread through heat shrink before soldering all connections. Wires can be taped

		down to the board in the process to maintain organization.
Heat shrink soldered connections	Heat shrink, heat gun	Heat shrink each soldered connections.
Tape down wires	Gaffer tape	Tape down loose wires across the back of the board to ensure security.

Banana Plugs

Process	Machine/Tool	Comments
Cut short banana cables	Wire Cutters	Cut out the middle section of each cable leaving enough cable next to each plug that when connected can reach from the output of the top AND gate to the bottom most input of the first OR gate. Make sure to leave enough room to strip and solder wires. Do not cut too close to close to either plug, leaving about ¼'' of wire next to each. Repeat steps for all five cables!
Cut long banana cables	Wire cutters	Repeat cutting steps leaving enough cable next to each plug that when connected can reach from the output of the top AND gate to the input of the first NOT gate. Take the same precautions when cutting as the short cables. Repeat steps for all five cables!
Strip wire	Wire strippers	Strip the about ⅛'' of the wire connected to each plug. Repeat for all twenty cut plugs.
Add heat shrink	Heat shrink	Thread one piece of heat shrink onto each cut plug.

Solder connections	Soldering iron, solder	Solder each corresponding connection effectively creating five short cables and five long cables.
Heat shrink soldered connections	Heat gun	Heat shrink each connection with the two pre placed pieces of heat shrink. Make sure the first layer is cooled before threading the next layer on to avoid any unnecessary bumps!