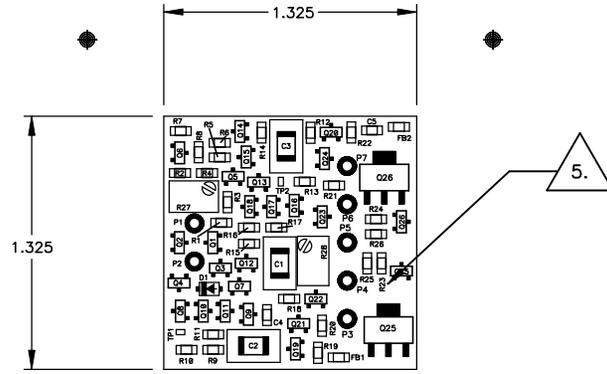


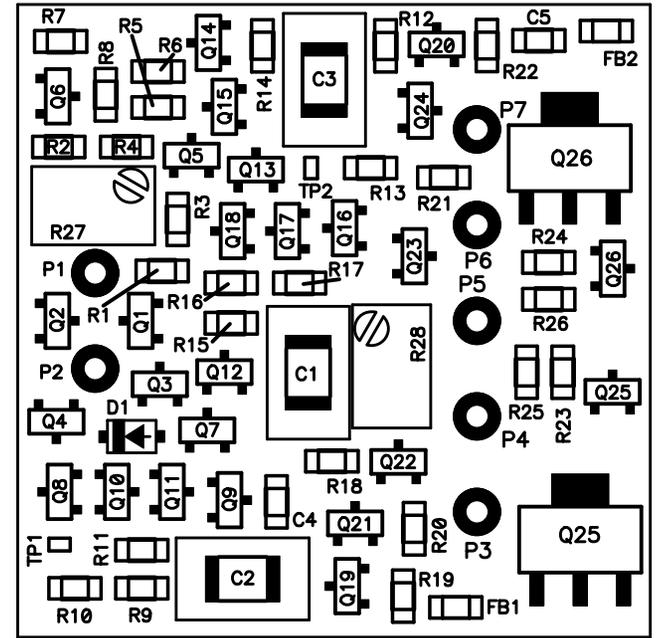
DIY AUDIO DISCRETE OPAMP  
 SW-OPA\_SMT1  
 PWB DWG SWOPA2620PWB1 REV A

OUTLINE & NOTES  
 TOP ASSEMBLY



NOTES: UNLESS OTHERWISE SPECIFIED

- ALL MATERIALS ARE TO BE ROHS COMPLIANT. FABRICATE PER ANSI/IPC-A-600, IPC-QE-605, IPC-4101, IPC-4552 AND IPC-SM-840 SPECIFICATIONS.
- MATERIAL: BASE MATERIAL LAMINATED EPOXY GLASS (COLOR GREEN) .056 THK (.062 MAX) ROHS COMPLIANT FR-4 PER IPC-4101 SLASH SHEETS #26 OR #83 OR #98 WITH MINIMUM T<sub>g</sub> 170 DEGREE C OR HIGHER, T<sub>d</sub> 340 DEGREE C OR HIGHER AND FLAME RATED UL 94V-0.
- SOLDERMASK BOTH SIDES OF BOARD OVER BARE COPPER WITH ROHS COMPLIANT MATERIAL PER ANSI/IPC-SM-840, COLOR SHALL BE GREEN.
- APPLY ROHS-APPROVED FINISH OR PLATING TO EXPOSED COPPER, BOTH SIDES. PLATING TO BE HOT AIR-LEVELED LEAD-FREE SOLDER OR PURE TIN OR SILVER OR ELECTROLESS NICKLE/IMMERSION GOLD OR OTHER MATERIAL APPROVED BY PURCHASER.
- INDICATED AREA ON BOTTOM SIDE AVAILABLE FOR APPLICATION OF PCB MANUFACTURE LOGO, UL MARKING, DATE-CODE AND ROHS COMPLIANT SYMBOL. USE OF OTHER LOCATION TO BE APPROVED BY PURCHASER.
- APPLY SILKSCREEN TO COMPONENT SIDE OF BOARD USING NON-CONDUCTIVE ROHS COMPLIANT WHITE EPOXY INK.
- SEE ARTWORK WITH SAME DRAWING NUMBER AND REVISION AS THIS DRAWING.
- HOLE LOCATIONS SPECIFIED IN SEPARATE DRILL FILE TAKE PRECEDENCE OVER THIS DWG AND ARTWORK. DIMENSIONS ON DWG TAKE PRECEDENCE OVER ARTWORK.  
TOLERANCE ARE: .XX=+/- .01; .XXX=+/- .005; ANGLES=2 DEG
- SEE SEPARATE DRILL FILE FOR HOLE LOCATIONS. SELECTED HOLE LOCATIONS SHOWN ON THIS DWG FOR REF ONLY.
- HOLE SIZES ARE SPECIFIED AS FINAL DIMENSIONS AFTER PLATING AND FINISHING. UNLESS OTHERWISE SPECIFIED ALL HOLES TO BE PLATED.
- HOLE PLATING TO BE ROHS COMPLIANT USING LEAD-FREE SOLDER OR PURE TIN OR SILVER OR ELECTROLESS NICKLE/IMMERSION GOLD OR OTHER MATERIAL APPROVED BY PURCHASER.
- DESIGN GEOMETRY MINIMUM FEATURE SIZES:  
 TRACE WIDTH 10 MILS  
 TRACE-TO-TRACE; TRACE-TO-PAD; PAD-TO-PAD 10 MILS  
 HOLE-TO-HOLE 15 MILS  
 BOARD EDGE-TO-COPPER 25 MILS  
 SILKSCREEN LINE 6 MILS SILKSCREEN-TO-BARE COPPER 6 MILS



Component Placement Detail

Drill Table			
Hole Dia (inch)	Symbol	Quantity	Plated
0.016	+	14	Yes
0.029	X	12	Yes
0.043	⊗	7	Yes

REVISION HISTORY

- A. WORKING DWG FOR PRELIMINARY DEVELOPMENT. NOT RELEASED.

Title SW-OPA DISC OPAMP SMT(1) PWB		
Size	Number SWOPA2620PWB1	Rev A
Date	Sun Jan 27, 2013	Drawn by D. Chisholm
SW-OPA-Discrete_Opamp01_alt1.pcb	Sheet	of

A

B

C

D

1

1

2

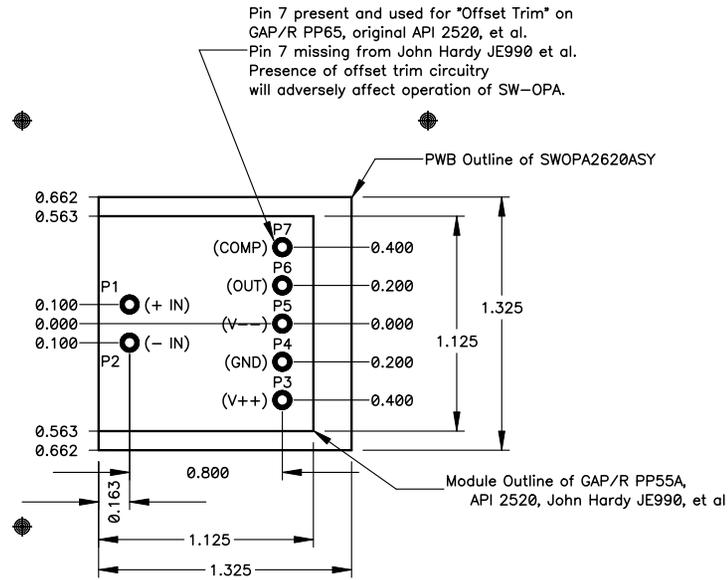
2

3

3

4

4



**Outline & Interface Dimensions  
(Comparison to API 2520 et al.)**

**NOTE!! TOP VIEW!!**

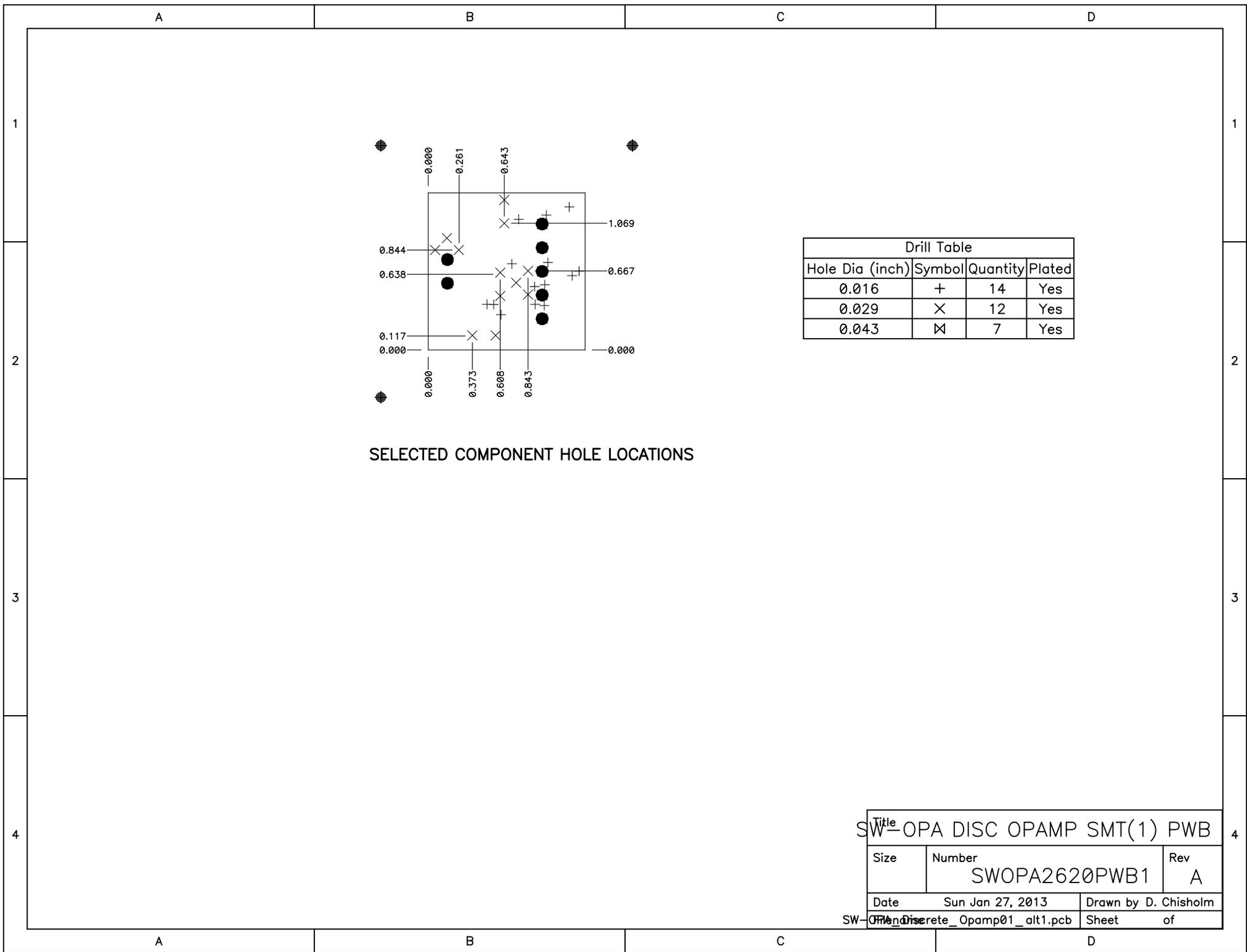
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Size	Number SWOPA2620PWB1	Rev A
Date	Sun Jan 27, 2013	Drawn by D. Chisholm
SW-OPA DISC Opamp01_Discrete_Opamp01_alt1.pcb	Sheet	of

A

B

C

D



SELECTED COMPONENT HOLE LOCATIONS

Drill Table			
Hole Dia (inch)	Symbol	Quantity	Plated
0.016	+	14	Yes
0.029	X	12	Yes
0.043	⊗	7	Yes

Title SW-OPA DISC OPAMP SMT(1) PWB			
Size	Number SWOPA2620PWB1		Rev A
Date	Sun Jan 27, 2013	Drawn by D. Chisholm	
SW-OPA DISC	Discrete_Opamp01_alt1.pcb	Sheet	of

A

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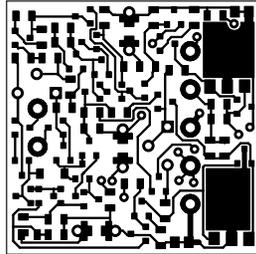
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TOP CIRCUIT LAYER

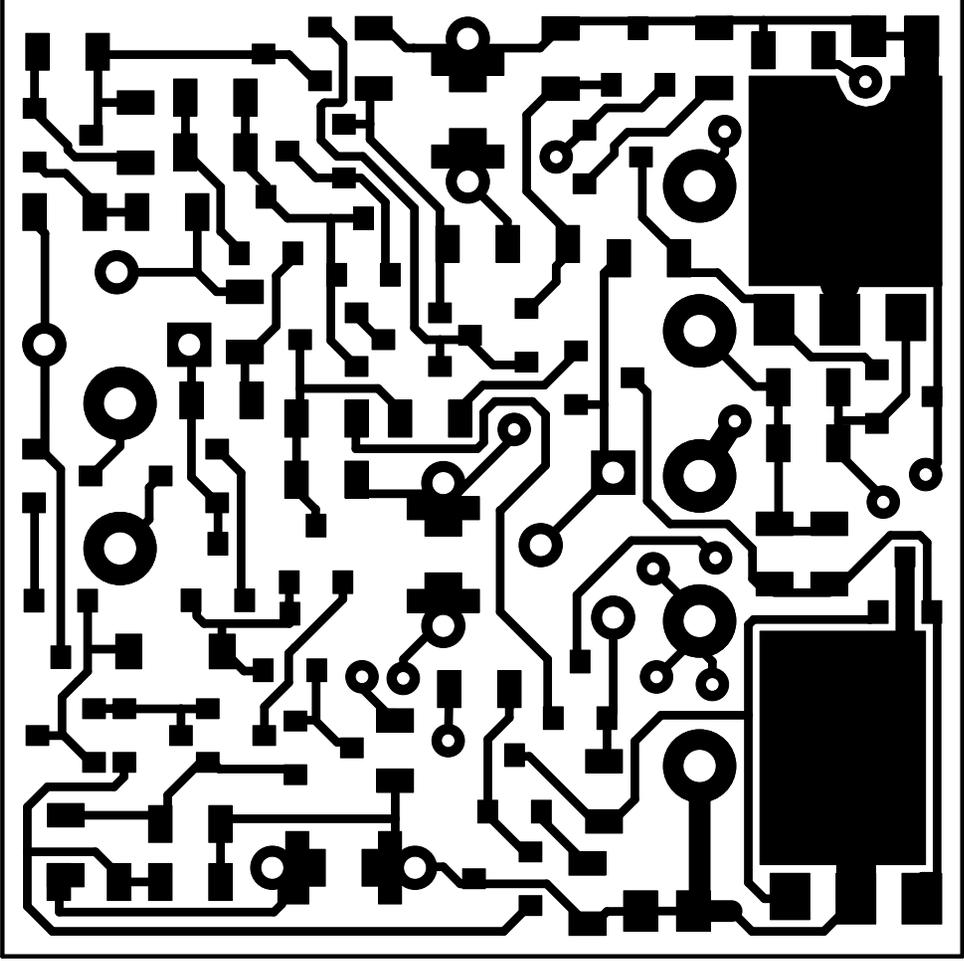
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Size	Number SWOPA2620PWB1	Rev A
Date	Sun Jan 27, 2013	Drawn by D. Chisholm
SW-OPA DISC Discrete_Opamp01_alt1.pcb	Sheet	of

A

B

C

D



TOP CIRCUIT LAYER

A

B

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D

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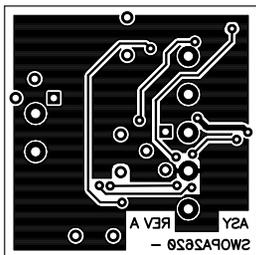
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BOTTOM CIRCUIT LAYER

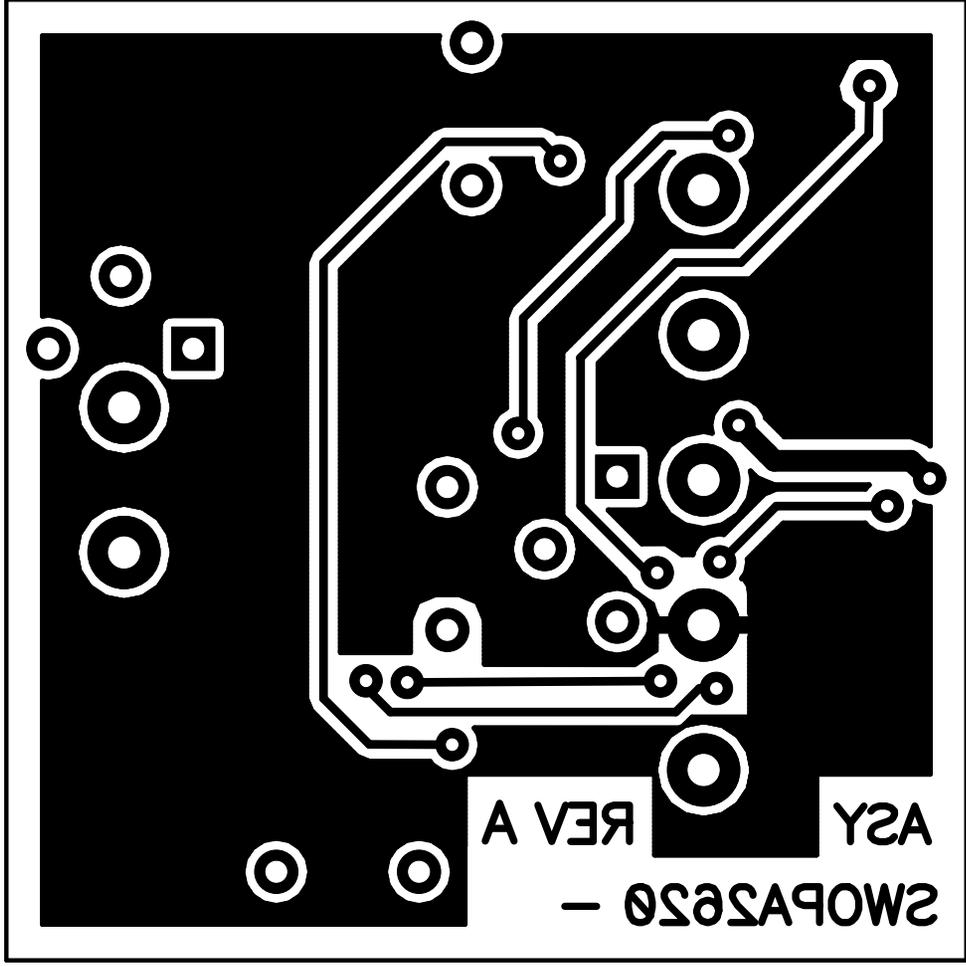
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Size	Number SWOPA2620PWB1	Rev A
Date	Sun Jan 27, 2013	Drawn by D. Chisholm
SW-OPA DISC Opamp01	_alt1.pcb	Sheet of

A

B

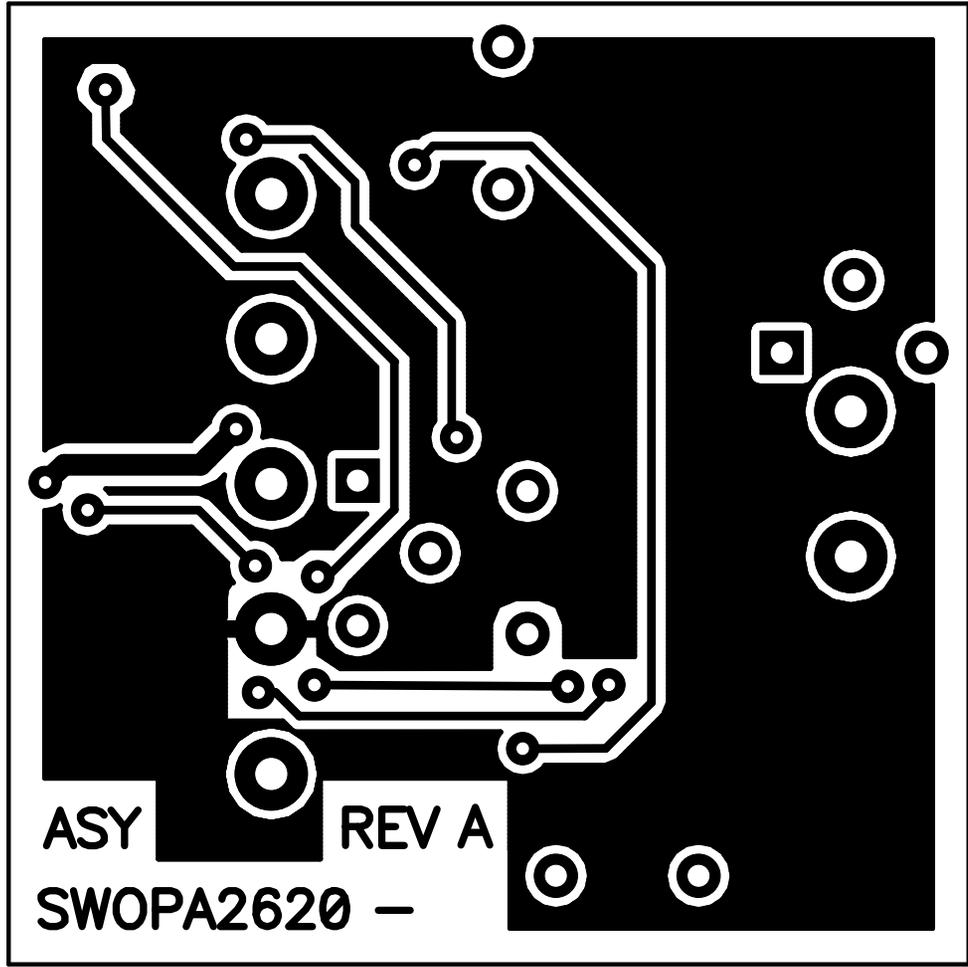
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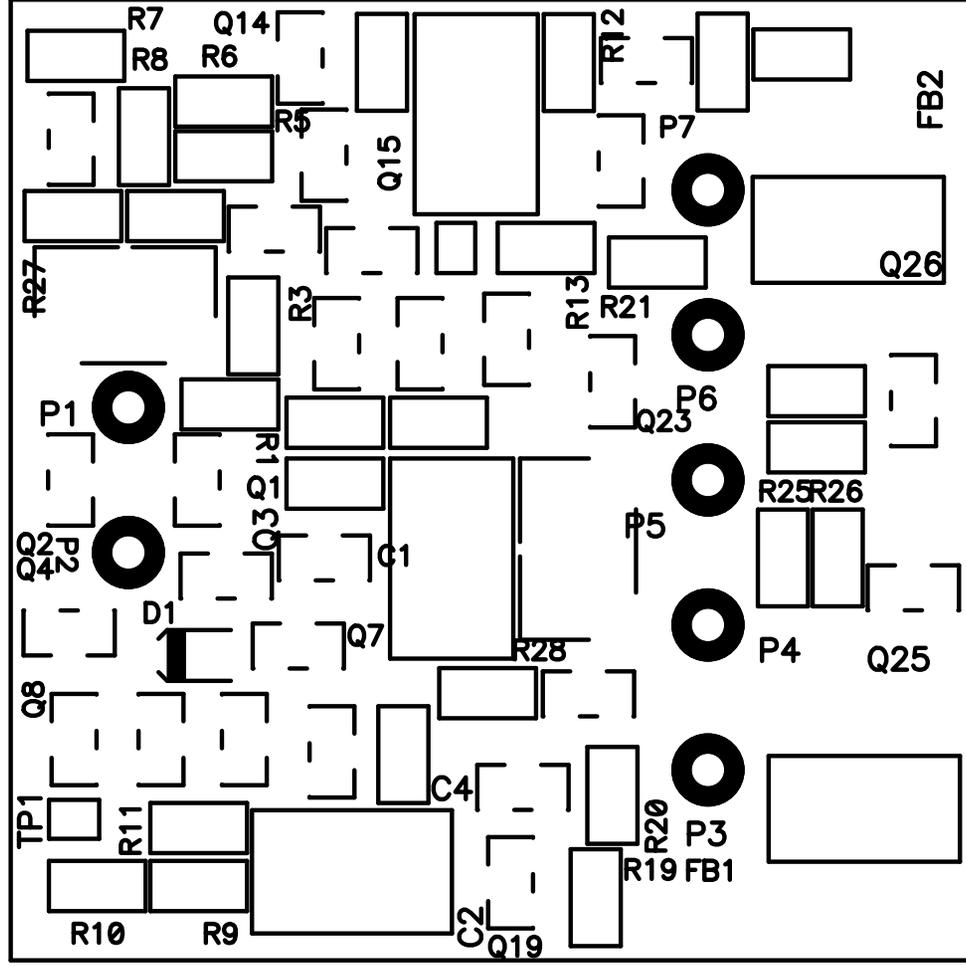
# BOTTOM CIRCUIT LAYER

# BOTTOM CIRCUIT LAYER





# SILK SCREEN TOP



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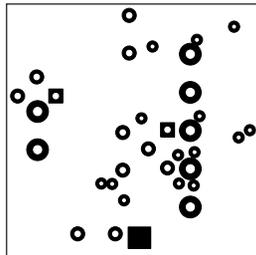
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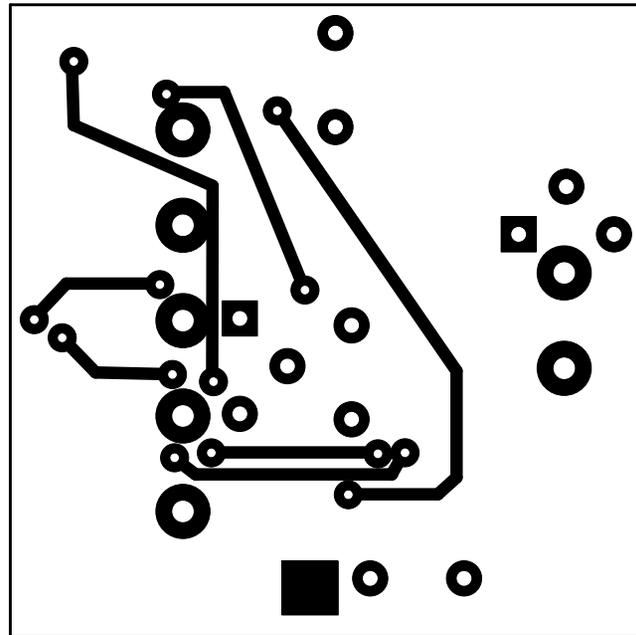
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SOLDER MASK BOTTOM



**JUMPER CONNECTIONS – BOTTOM SIDE**

Connect jumpers as shown when placed on the **BOTTOM** side of a one-sided PWB. Use AWG #30 or #28 insulated wire. Install jumpers in drilled-through VIA's. (Pad sizes exaggerated for clarity; component mounting holes shown for reference only.)

Title SW-OPA DISC OPAMP SMT(1) PWB		
Size	Number SWOPA2620PWB1	Rev A
Date	Sun Jan 27, 2013	Drawn by D. Chisholm
SW-OPA DISC Opamp01_alt1.pcb	Sheet	of

A

B

C

D

A

B

C

D

1

1

2

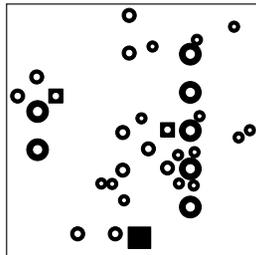
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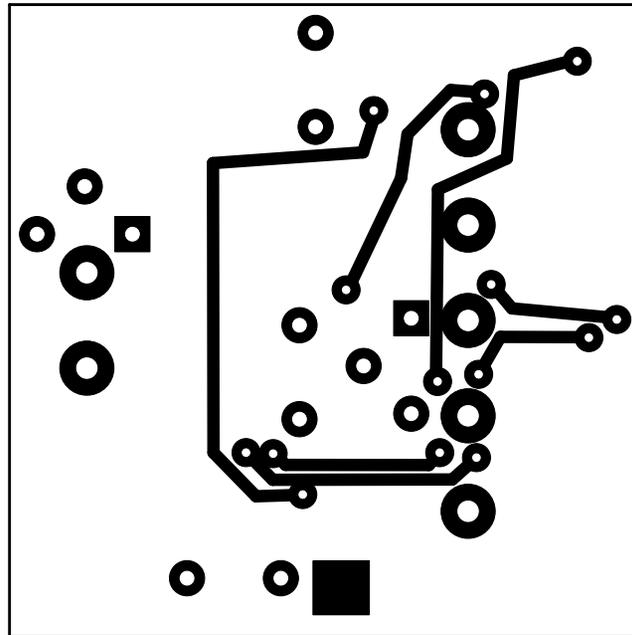
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4

4



SOLDER MASK BOTTOM



**JUMPER CONNECTIONS – TOP SIDE**

Connect jumpers as shown when placed on the TOP side of a one-sided PWB.  
 Use AWG #30 or #28 insulated wire.  
 Install jumpers in drilled-through VIA's.  
 (Pad sizes exaggerated for clarity; component mounting holes shown for reference only.)

Title SW-OPA DISC OPAMP SMT(1) PWB

Size	Number	Rev
	SWOPA2620PWB1	A

Date	Sun Jan 27, 2013	Drawn by	D. Chisholm
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SW-OPA DISC Opamp01_alt1.pcb	Sheet	of
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A

B

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D

## PWB Drawing Sheet Index

The printed wiring board (PWB) human-readable drawing (filename: SWOPA2620PWB1\_ALL.pdf) includes sheets described below. Print at 1:1 scale ("Actual Size", not "Fit to Page") on 8.5" x 11.0" (US "Letter" size) paper in "Landscape" orientation.

Sheet 1: SWOPA2620PWB1\_BRD Overview of the PWB as used in the intended assembly. Magnified component placement view. Fabrication notes used by the PWB etching house.

Sheet 2: OUTLINE\_INTERFACE Overall dimensions. Identification and location of interface pins. Comparison to footprint and interface of "traditional" discrete opamp module. Note that this is the view looking DOWN through the board from the top (component) side. (It is NOT a view looking at the bottom side.) The significance of this sheet can be summarized as: A PCB assembly based on this PWB can be installed in an existing chassis or manifold designed to accept API 2520, or John Hardy JE990, modules ONLY if there is at least 0.200" clearance on the output-pin end of the module, AND at least 0.100" clearance on the two sides adjacent to the output-pin end, AND there is a socket for pin 7 but no offset adjustment circuitry connected to it.

Sheet 3: DRILL\_LOCATIONS View showing all holes. Locations of selected component mounting holes. (Locations of the remaining component mounting holes can be derived using pinout drawings of the components.) Hole locations are actually defined in the Excellon drill file, included in the "Gerbers" folder. This sheet is most likely used as a check-print for sample inspections to verify that boards were manufactured correctly.

Sheet 4: TOP\_COPPER Pads and traces on the top (component) side of the PWB.

Sheet 5: TOP\_COPPER\_ONLY Same as sheet 4, but the drawing title block and border has been removed and the top circuit layer has been magnified to fit the page (magnification factor approx 3.8:1). Of particular interest to masochists wanting to replicate this layout in a different PWB program. May also be used for home etching of PCB's (using, e.g., toner transfer) if you spend enough time finagling the printer scale factor.

Sheet 6: BOTTOM\_COPPER Pads and traces on the bottom side (traditionally called the "solder side") of the PWB. Note that this is a view "looking through" the PWB from the top side, which is a de-facto standard for the PCB fabrication industry.

Sheet 7: BTM\_COPPER\_ONLY Same as sheet 6, but the drawing title block and border has been removed and the bottom circuit layer has been magnified to fit the page.

Sheet 8: BTM\_COPPER\_MIRROR A "mirror image" of sheet 7. (Note that the etched copper drawing number reads correctly from left to right.) This is the image a home constructor might use for the bottom side of his board - if he's willing to not only finagle the scale factor, but also wrestle with top/bottom registration.

Sheet 9: TOP\_SILK Component outlines, reference designators, and other information printed in ink on the top side of the board. (Traditionally called the "silkscreen" or "legend" layer.) As you can see, there isn't room on this

board for all reference designators - refer to the component placement diagram on sheet 1.

Sheet 10: TOP\_SILK\_ONLY            Same as sheet 9, but the drawing title block and border has been removed and the silkscreen layer has been magnified to fit the page.

Sheet 11: BOTTOM\_JUMPERS            Approximate placement of jumpers on the BOTTOM side of a PCB assembly using a SINGLE\_SIDED PWB, to replace the connections that would be made on the bottom side of a two-sided PWB. Bottom-side jumpers will probably be easier to install than top-side jumpers, but may be more susceptible to damage. Insert suitable lengths of AWG #30 or AWG #28 insulated wire in the via holes and solder in place. Secure the jumpers with suitable adhesive (e.g., electronics-grade silicone rubber, cyanoacrylate, polystyrene coating ("Q-Dope"), etc). Note that jumpers are NOT used when you have a TWO-SIDED PWB!

Sheet 12: TOP\_JUMPERS            Approximate placement of jumpers on the TOP side of a PCB assembly using a SINGLE\_SIDED PWB, to replace the connections that would be made on the bottom side of a two-sided PWB. Insert suitable lengths of AWG #30 or AWG #28 insulated wire in the via holes and solder in place. Top-side jumpers will probably be more difficult to install than bottom-side jumpers, but may be better protected from damage. Note that jumpers are NOT used when you have a TWO-SIDED PWB!