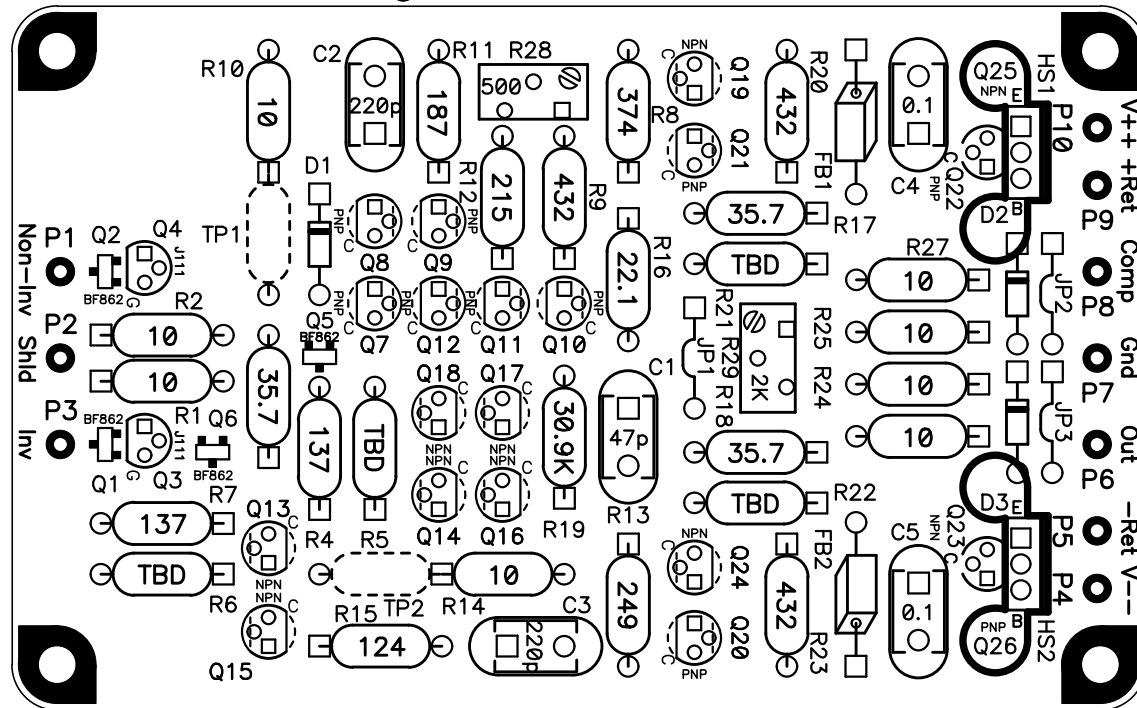
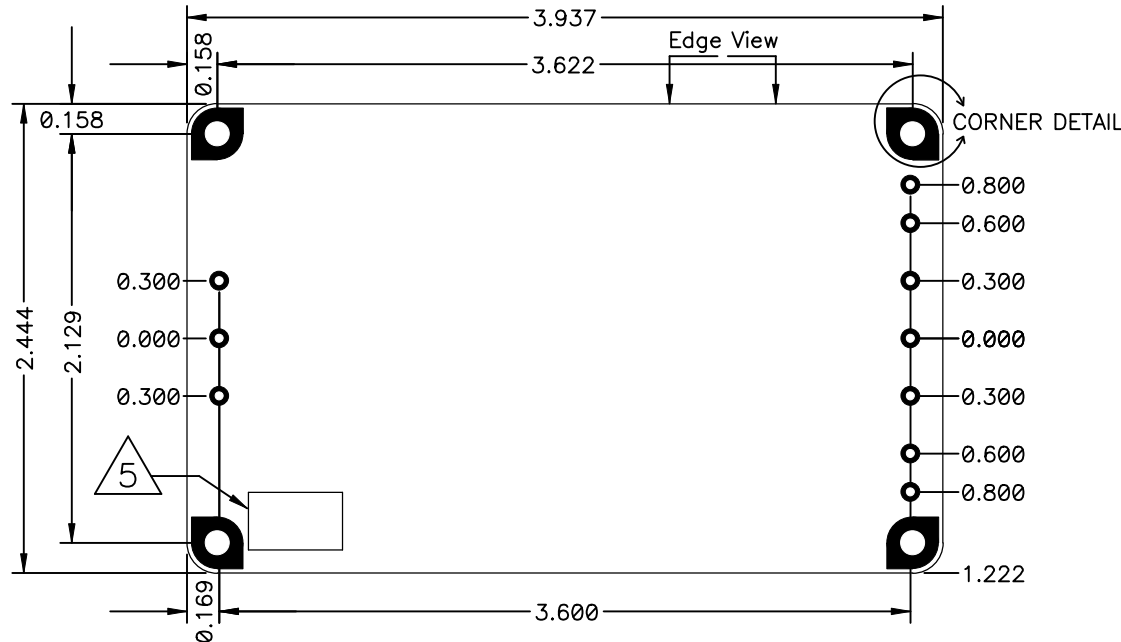
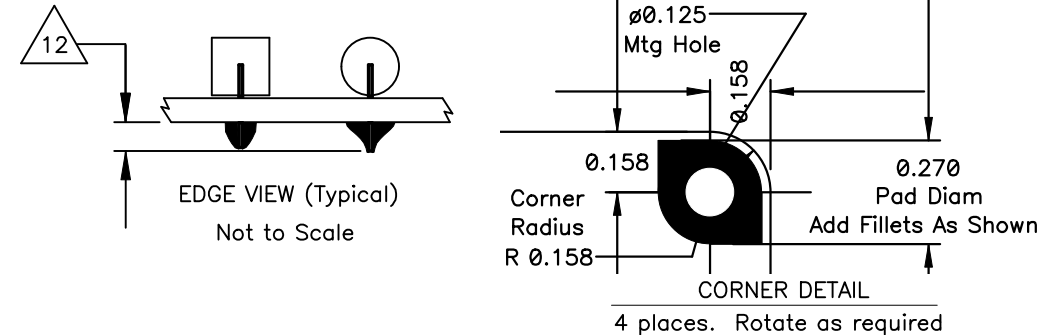


DIY AUDIO DISCRETE OPAMP
SWOPA Disc Opamp THD1
PWB DWG SWOPA2885PWB1 REV B



COMPONENT PLACEMENT

Solid transistor outlines for EBC pinout; dashed outlines for CBE pinout.
Component values shown for ref only. See Parts List for correct values.



NOTES: UNLESS OTHERWISE SPECIFIED

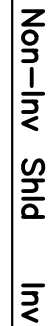
- ALL MATERIALS ARE TO BE ROHS COMPLIANT. FABRICATE PER ANSI/IPC-A-600, IPC-QE-605, IPC-4101, IPC-4552 AND IPC-SM-840 SPECIFICATIONS.
- MATERIAL: BASE MATERIAL LAMINATED EPOXY GLASS (COLOR GREEN) .056 THK (.062 MAX) ROHS COMPLIANT FR-4 PER IPC-4101 SLASH SHEETS #26 OR #83 OR #98 WITH MINIMUM Tg 170 DEGREE C OR HIGHER, Td 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 FINISH OR PLATING TO EXPOSED COPPER, BOTH SIDES AS SPECIFIED IN PURCHASE DOCUMENTS.
- 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 AS SPECIFIED IN PURCHASE DOCUMENTS.
- TRIM SOLDER FILLETS AND COMPONENT LEADS TO 0.100" (MAX) BEYOND BOARD SURFACE ON BACK SIDE.
- DESIGN GEOMETRY MINIMUM FEATURE SIZES:
TRACE WIDTH 10 MILS
HOLE-TO-HOLE 15 MILS
SILKSCREEN LINE 8 MILS
TRACE-TO-TRACE; TRACE-TO-PAD; PAD-TO-PAD 10 MILS
BOARD EDGE-TO-COPPER 20 MILS
SILKSCREEN-TO-BARE COPPER 8 MILS

REVISION HISTORY

- B. DEFAULT TRACE WIDTH INCREASED TO 25 MILS;
SOME TRACE WIDTHS FURTHER INCREASED. TRACE AND
COMPONENT LOCATIONS ADJUSTED TO MAINTAIN SPACING.

A. WORKING DWG FOR PRELIMINARY DEVELOPMENT.
NOT RELEASED.

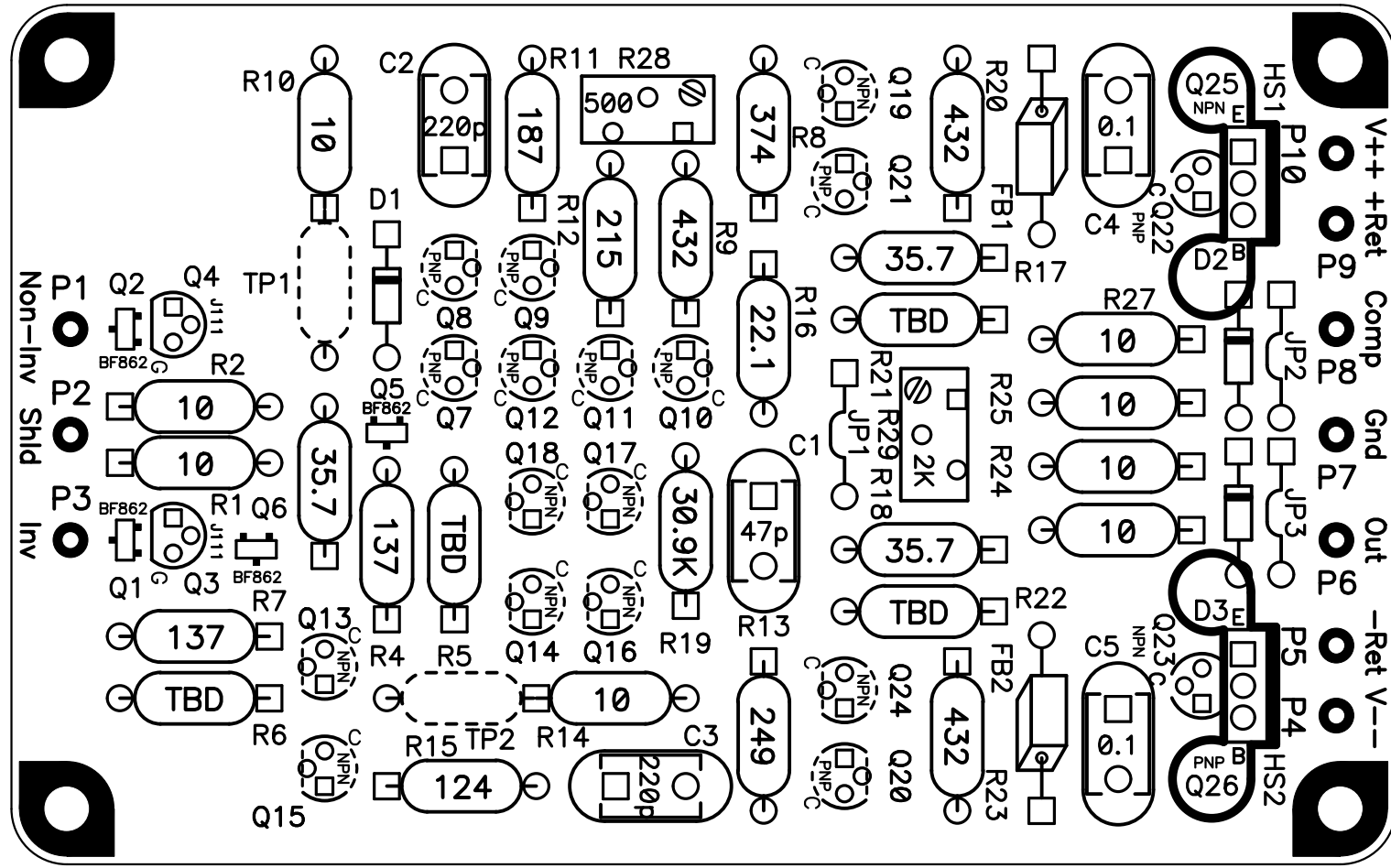
Title		
SWOPA DISC OPAMP THD(1) PWB		
Size	Number	Rev
8.5x14	SWOPA2885PWB1	B
Date	Thu May 09, 2013	Drawn by D. Chisholm
File	SWOPA_Post2885PWB_B.pcb	Sheet of



Component outlines shown for transistors with EBC pinout, such as 2N4401/2N4403.

Component values shown for ref only. See Parts List for correct values according to variant & Dwg Rev level.

Title SWOPA DISC OPAMP THD(1) PWB		
Size 8.5x14	Number SWOPA2885PWB1	Rev B
Date Thu May 09, 2013	Drawn by D. Chisholm	
File Name SWOPA Post2885PWB B.pcb	Sheet	of

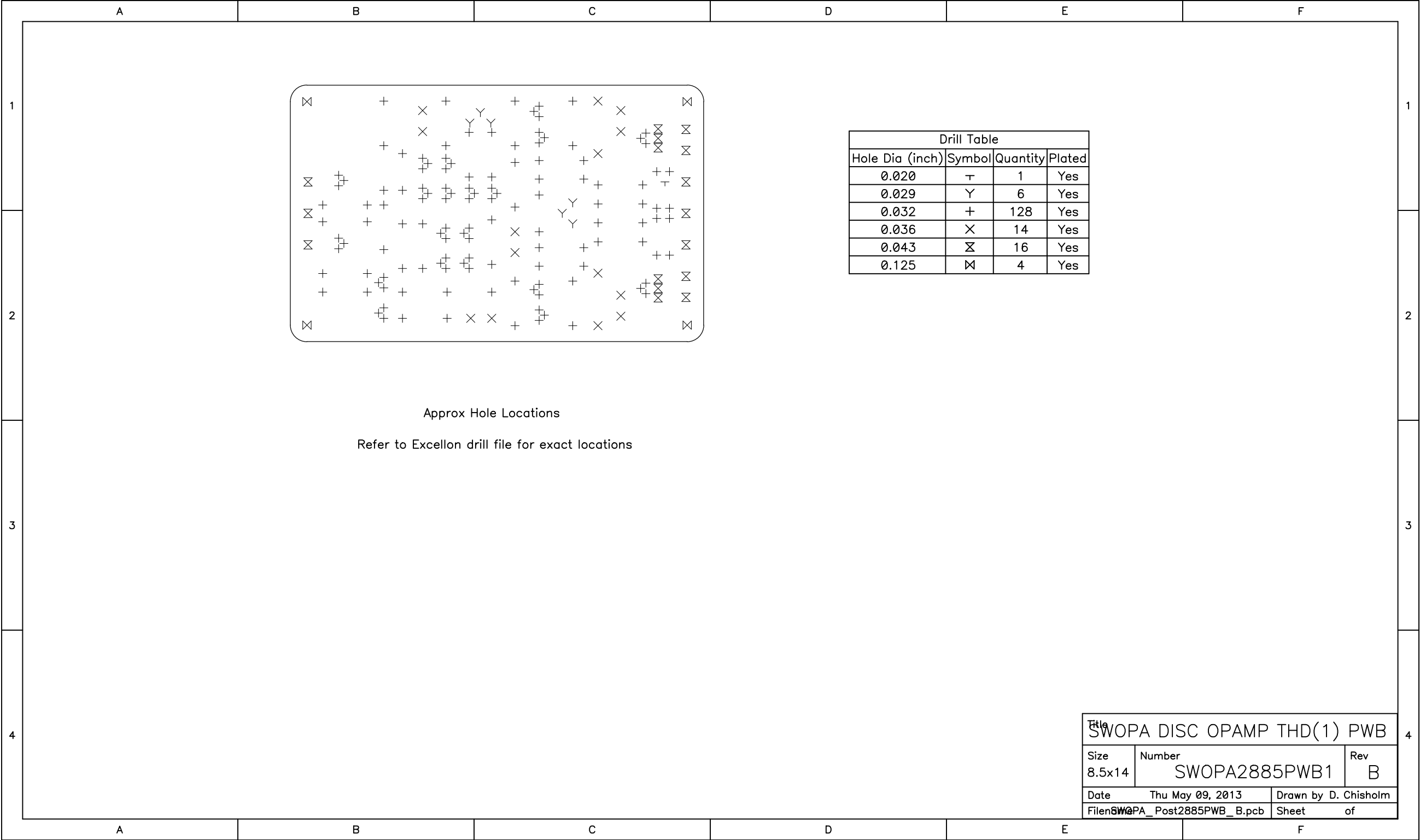


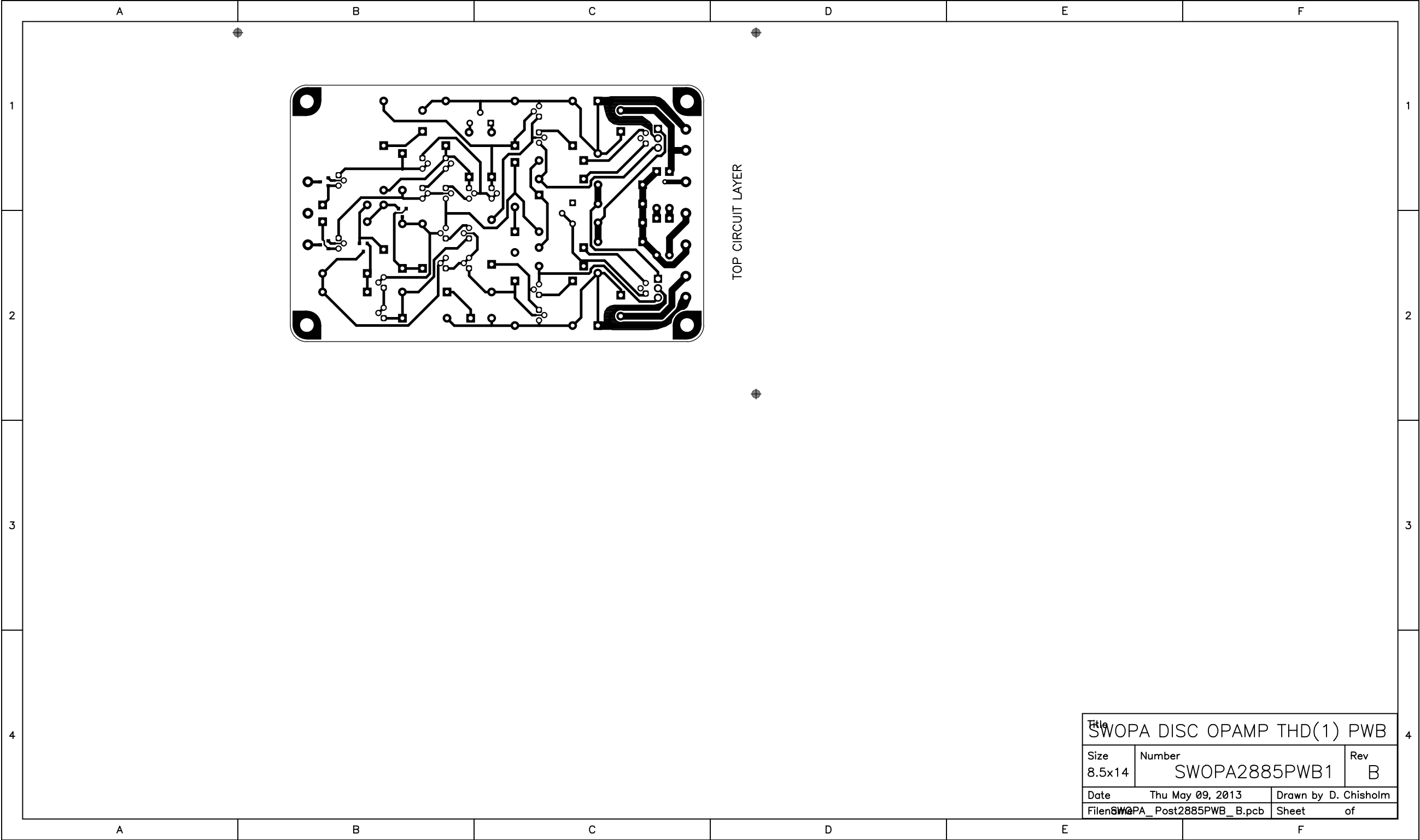
PARTS LOCATIONS FOR TRANSISTORS WITH CBE PINOUT

Component outlines shown for transistors with CBE pinout, such as BC550/BC560.

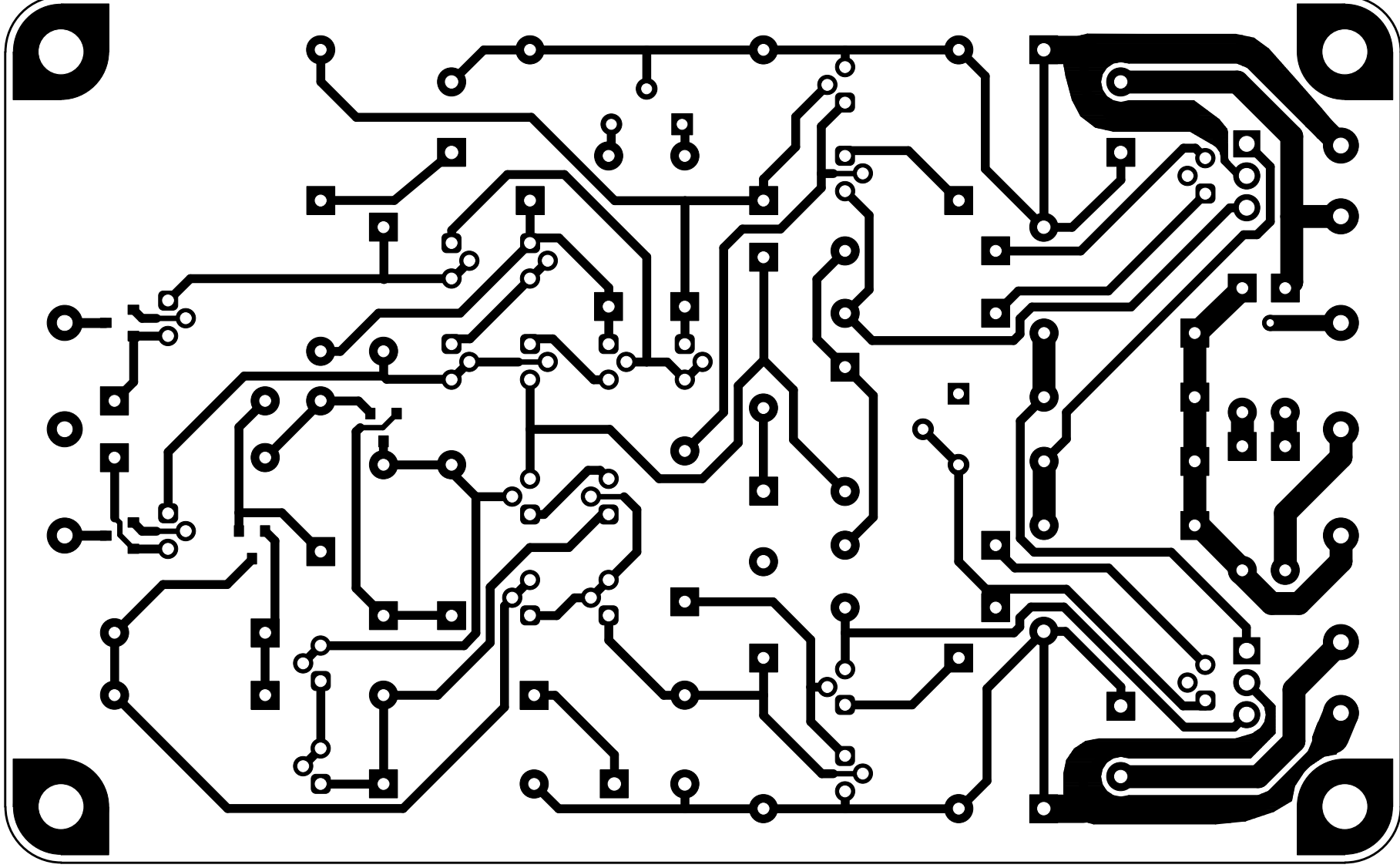
Component values shown for ref only. See Parts List for correct values according to variant & Dwg Rev level.

Title SWOPA DISC OPAMP THD(1) PWB		
Size 8.5x14	Number SWOPA2885PWB1	Rev B
Date Thu May 09, 2013	Drawn by D. Chisholm	
File SWOPA_Post2885PWB_B.pcb	Sheet	of

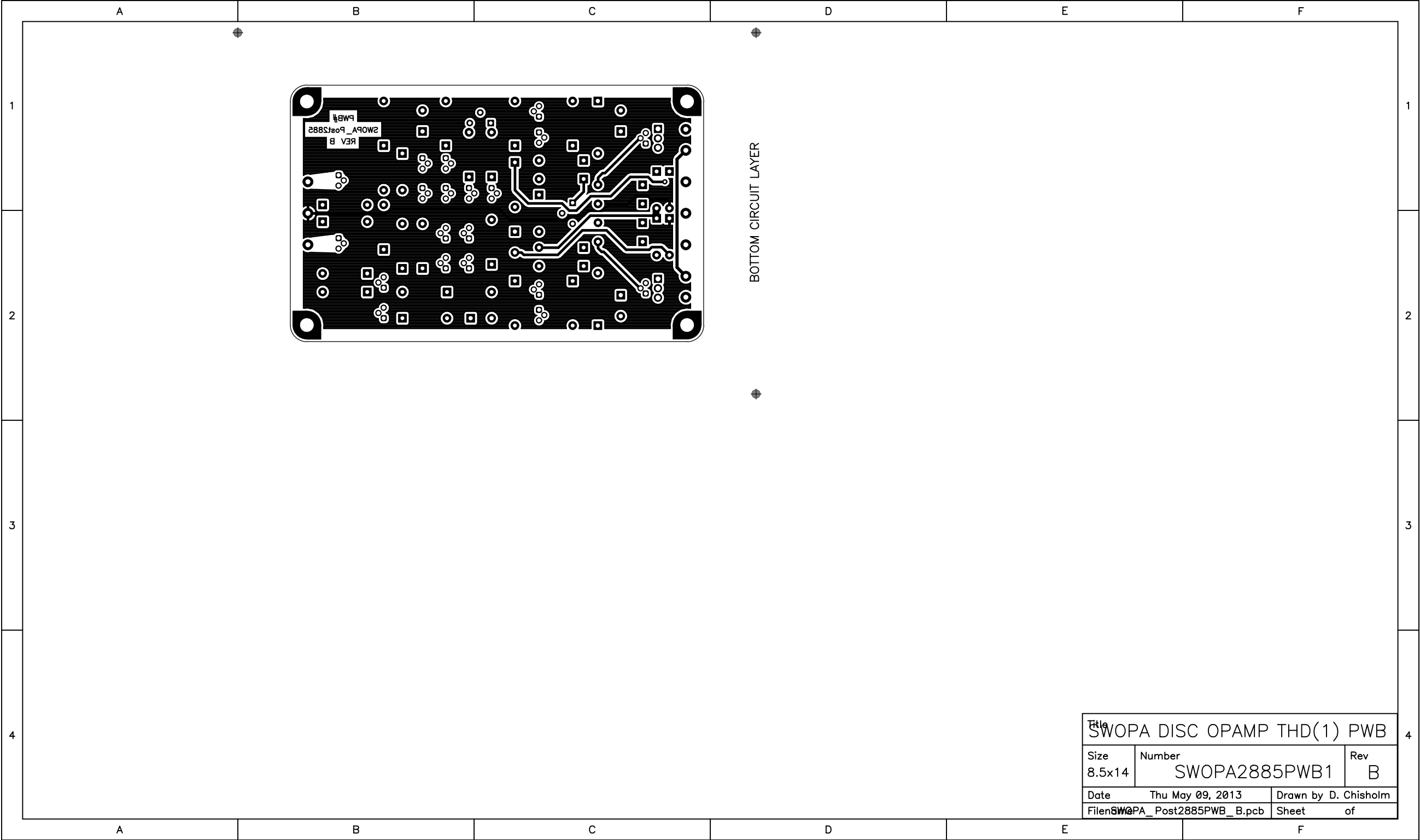


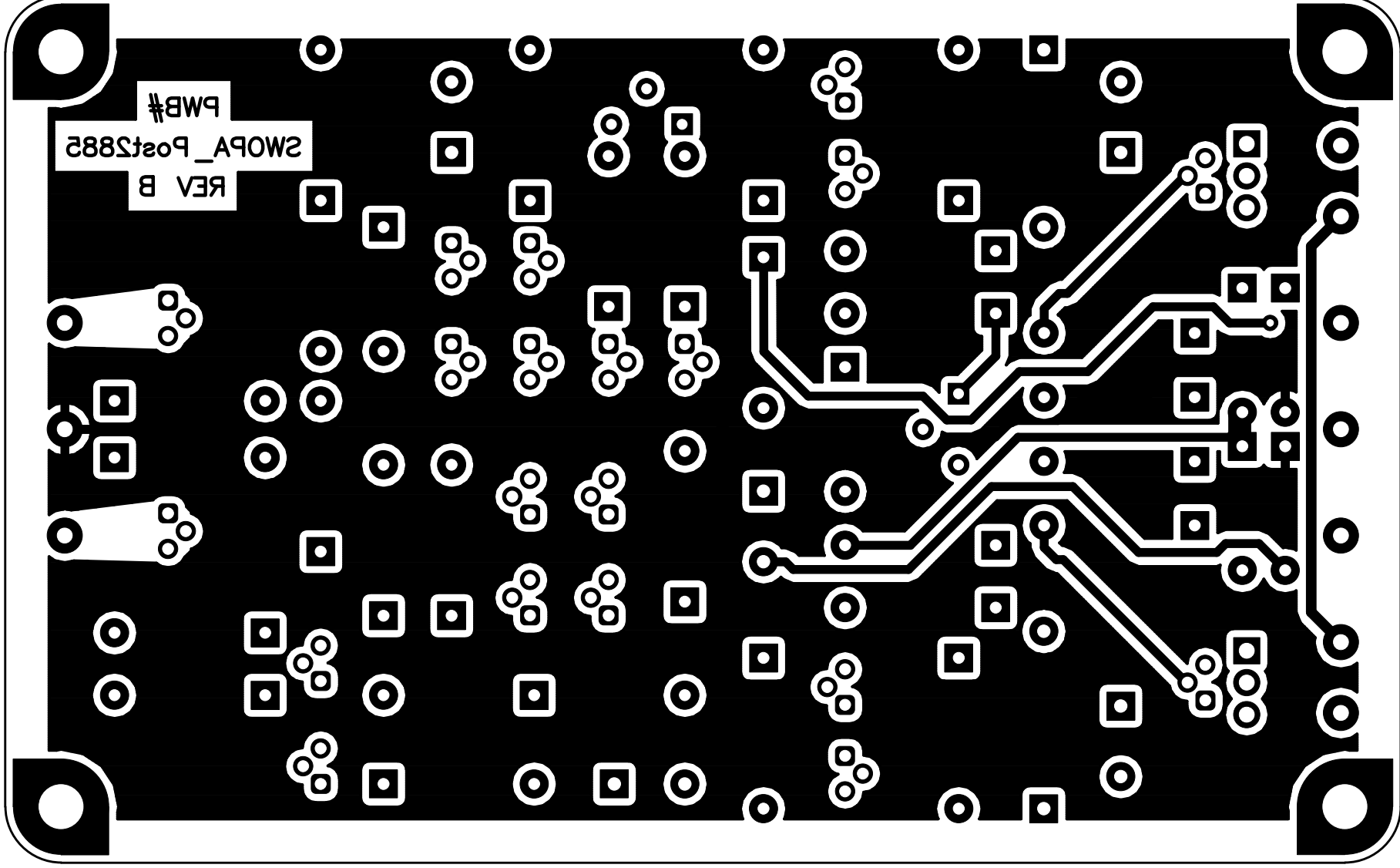


Title SWOPA DISC OPAMP THD(1) PWB			
Size 8.5x14	Number SWOPA2885PWB1		Rev B
Date Thu May 09, 2013	Drawn by D. Chisholm		
File SWOPA_Post2885PWB_B.pcb	Sheet of		



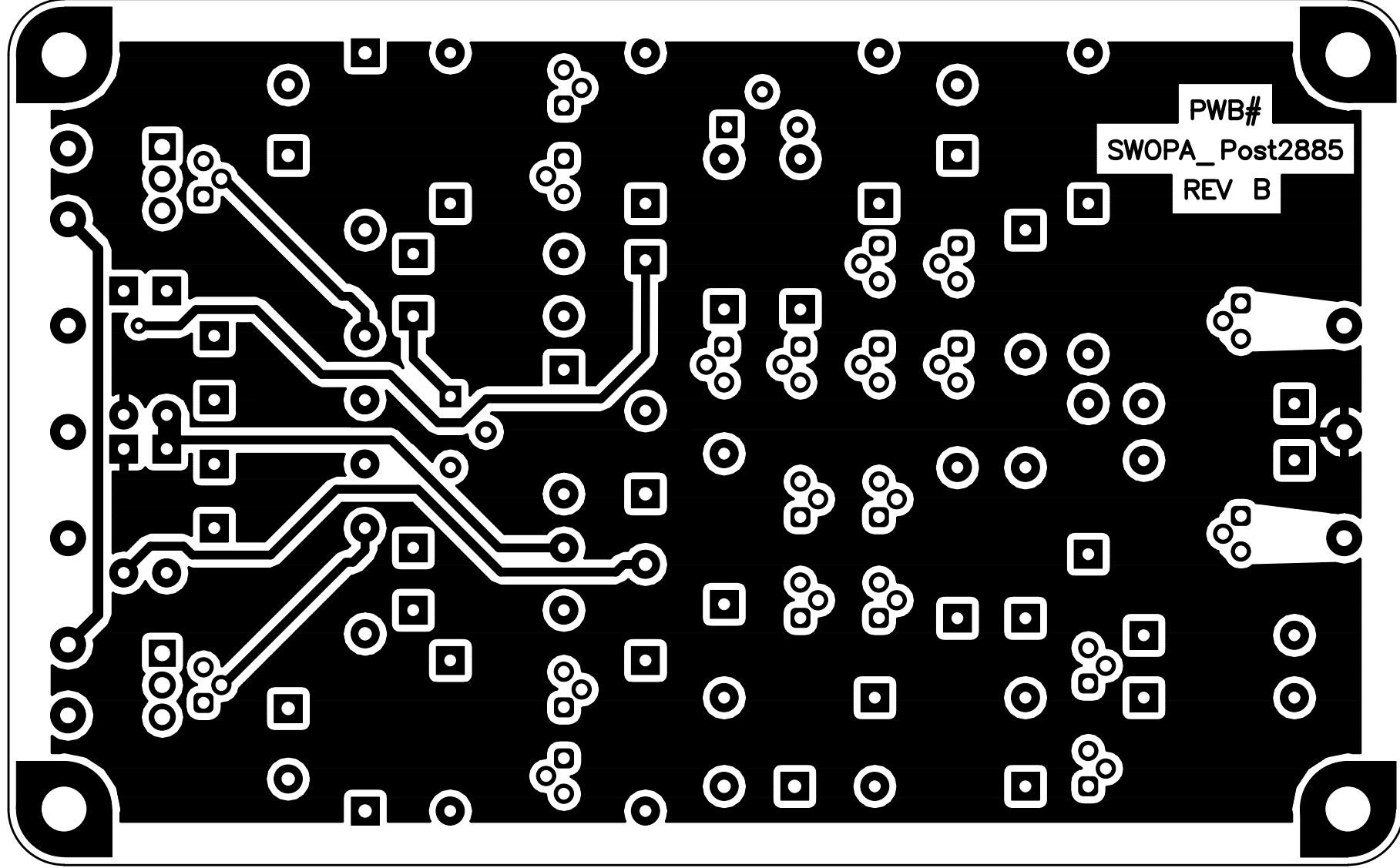
TOP CIRCUIT LAYER

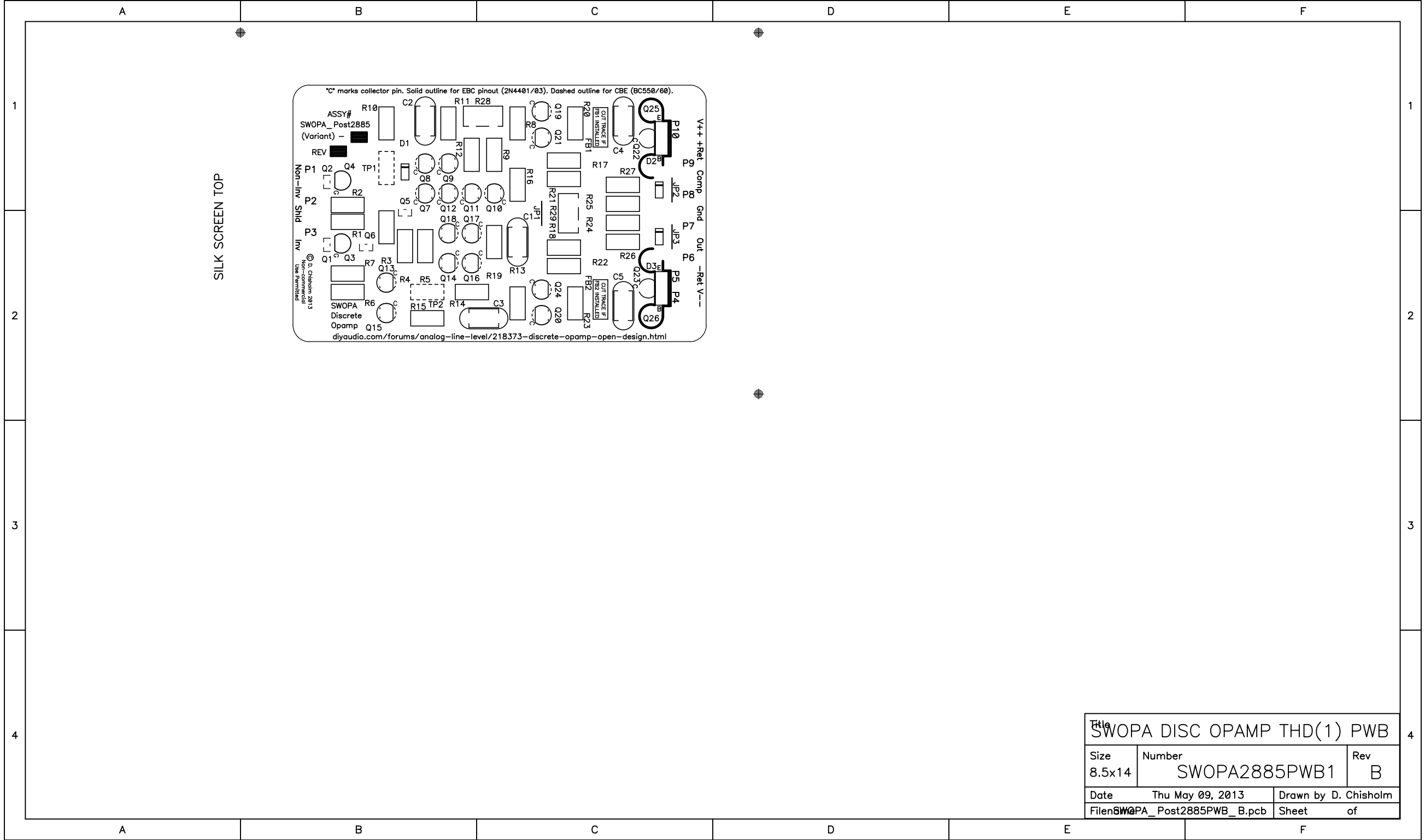




BOTTOM CIRCUIT LAYER

БОТТОМ СИРКУИТ ЛАЙЕР





C marks collector pin. Solid outline for EBC pinout (2N4401/03). Dashed outline for CBE (BC550/60).

ASSY#
SWOPA_Post2885
(Variant) -
REV
Non-Inv Shld Inv
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For commercial use permitted

R10 C2 R11 R28
D1 R12 R9 R16 R17 R27 R25 R24 R22 R26
Q19 Q21 R20 FB1 C4 Q22 D2 Q25
Q2 Q4 TP1 R2 Q8 Q9 Q12 Q11 Q10 Q18 Q17 Q16 R13 Q24 Q20
Q1 Q3 R7 R3 Q13 R4 R5 Q14 Q16 R19 R15 TP2 R14 C3 Q23
R6 Q15

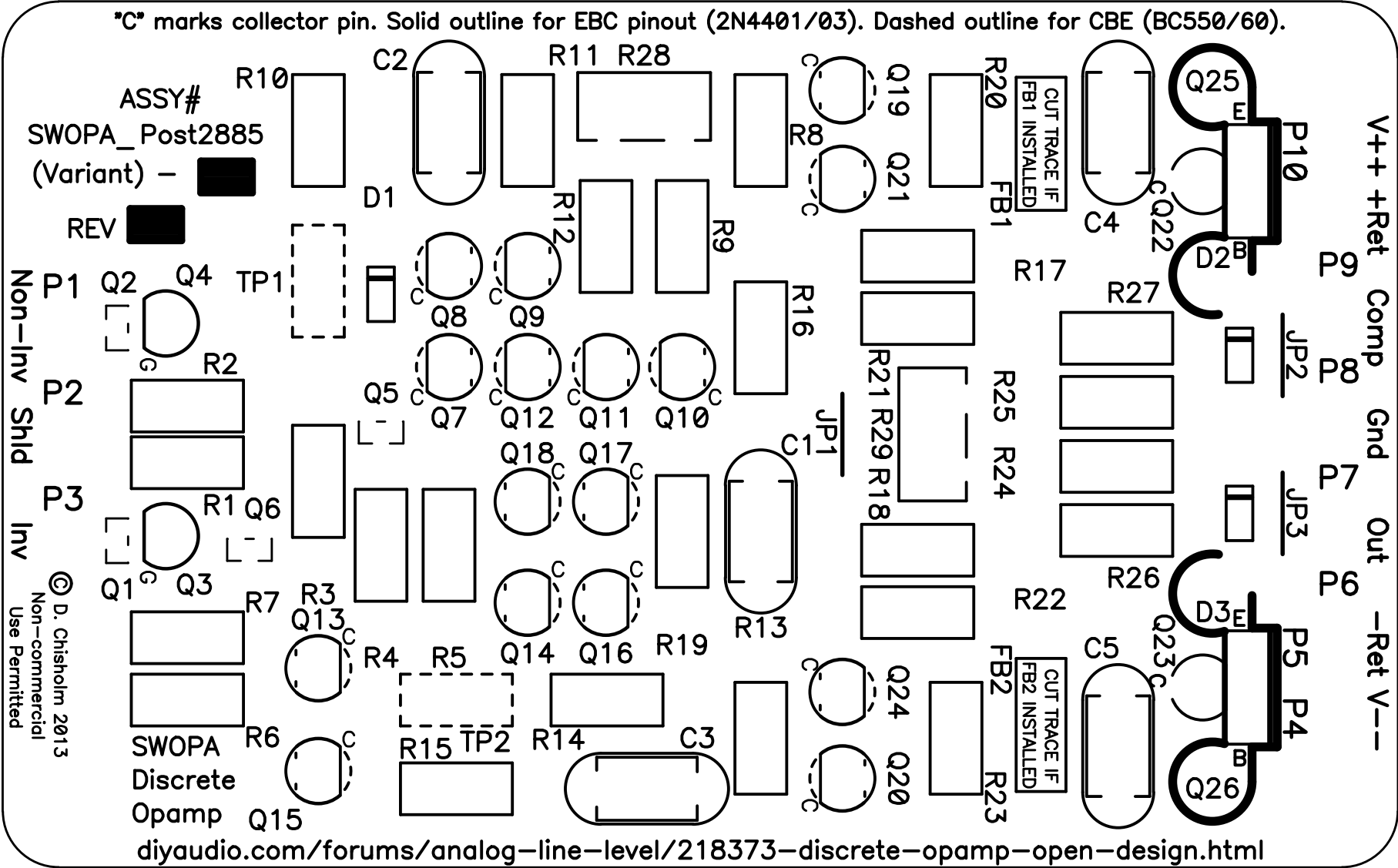
CUT TRACE #1 FB1 INSTALLED
CUT TRACE #2 FB2 INSTALLED

V++ +Ret Comp Gnd Out -Ret V--

SWOPA Discrete Opamp

diyaudio.com/forums/analog-line-level/218373-discrete-opamp-open-design.html

Title SWOPA DISC OPAMP THD(1) PWB		
Size 8.5x14	Number SWOPA2885PWB1	Rev B
Date Thu May 09, 2013	Drawn by D. Chisholm	
File SWOPA_Post2885PWB_B.pcb	Sheet	of



"C" marks collector pin. Solid outline for EBC pinout (2N4401/03). Dashed outline for CBE (BC550/60).

ASSY#
SWOPA_Post2885
(Variant) -

REV

P1 Q2 Q4 TP4
P2 R2
P3 R1 Q5
Q1 Q3 R1 Q3
R6
SNOPA
Discrete
Opamp
Q15

R10 C2 R41 R39
R17 R16 R21 R24 R25 R26
R23 R24 R25 R26
R27 R28 R29 R30 R31 R32 R33 R34 R35 R36 R37 R38 R39 R40 R41 R42 R43 R44 R45 R46 R47 R48 R49 R50 R51 R52 R53 R54 R55 R56 R57 R58 R59 R60 R61 R62 R63 R64 R65 R66 R67 R68 R69 R70 R71 R72 R73 R74 R75 R76 R77 R78 R79 R80 R81 R82 R83 R84 R85 R86 R87 R88 R89 R90 R91 R92 R93 R94 R95 R96 R97 R98 R99 R100

Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29 Q30 Q31 Q32 Q33 Q34 Q35 Q36 Q37 Q38 Q39 Q40 Q41 Q42 Q43 Q44 Q45 Q46 Q47 Q48 Q49 Q50 Q51 Q52 Q53 Q54 Q55 Q56 Q57 Q58 Q59 Q60 Q61 Q62 Q63 Q64 Q65 Q66 Q67 Q68 Q69 Q70 Q71 Q72 Q73 Q74 Q75 Q76 Q77 Q78 Q79 Q80 Q81 Q82 Q83 Q84 Q85 Q86 Q87 Q88 Q89 Q90 Q91 Q92 Q93 Q94 Q95 Q96 Q97 Q98 Q99 Q100

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U69 U70 U71 U72 U73 U74 U75 U76 U77 U78 U79 U80 U81 U82 U83 U84 U85 U86 U87 U88 U89 U90 U91 U92 U93 U94 U95 U96 U97 U98 U99 U100

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U69 U70 U71 U72 U73 U74 U75 U76 U77 U78 U79 U80 U81 U82 U83 U84 U85 U86 U87 U88 U89 U90 U91 U92 U93 U94 U95 U96 U97 U98 U99 U100

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U69 U70 U71 U72 U73 U74 U75 U76 U77 U78 U79 U80 U81 U82 U83 U84 U85 U86 U87 U88 U89 U90 U91 U92 U93 U94 U95 U96 U97 U98 U99 U100

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U69 U70 U71 U72 U73 U74 U75 U76 U77 U78 U79 U80 U81 U82 U83 U84 U85 U86 U87 U88 U89 U90 U91 U92 U93 U94 U95 U96 U97 U98 U99 U100

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U69 U70 U71 U72 U73 U74 U75 U76 U77 U78 U79 U80 U81 U82 U83 U84 U85 U86 U87 U88 U89 U90 U91 U92 U93 U94 U95 U96 U97 U98 U99 U100

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U69 U70 U71 U72 U73 U74 U75 U76 U77 U78 U79 U80 U81 U82 U83 U84 U85 U86 U87 U88 U89 U90 U91 U92 U93 U94 U95 U96 U97 U98 U99 U100

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U69 U70 U71 U72 U73 U74 U75 U76 U77 U78 U79 U80 U81 U82 U83 U84 U85 U86 U87 U88 U89 U90 U91 U92 U93 U94 U95 U96 U97 U98 U99 U100

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U69 U70 U71 U72 U73 U74 U75 U76 U77 U78 U79 U80 U81 U82 U83 U84 U85 U86 U87 U88 U89 U90 U91 U92 U93 U94 U95 U96 U97 U98 U99 U100

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U69 U70 U71 U72 U73 U74 U75 U76 U77 U78 U79 U80 U81 U82 U83 U84 U85 U86 U87 U88 U89 U90 U91 U92 U93 U94 U95 U96 U97 U98 U99 U100

U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14 U15 U16 U17 U18 U19 U20 U21 U22 U23 U24 U25 U26 U27 U28 U29 U30 U31 U32 U33 U34 U35 U36 U37 U38 U39 U40 U41 U42 U43 U44 U45 U46 U47 U48 U49 U50 U51 U52 U53 U54 U55 U56 U57 U58 U59 U60 U61 U62 U63 U64 U65 U66 U67 U68 U

TOP CIRCUIT LAYER

Title SWOPA DISC OPAMP THD(1) PWB		
Size 8.5x14	Number SWOPA2885PWB1	Rev B
Date Thu May 09, 2013	Drawn by D. Chisholm	
Filename SWOPA_Post2885PWB_B.pcb	Sheet	of

PWB Drawing Sheet Index

The printed wiring board (PWB) human-readable drawing (filename: SWOPA2885PWB_B_ALL.pdf) includes sheets described below. Print at 1:1 scale ("Actual Size", not "Fit to Page") on 8.5" x 14.0" paper (US "Legal" size) in "Landscape" orientation.

Sheet 1: SWOPA2885PWB1_BRD Overall dimensions and overview of the PWB as used in the intended assembly. Magnified component placement view. Fabrication notes used by the PWB etching house. Mounting hole detail.

Sheet 2: EBC_PLACEMENT Magnified view of component placement on completed PCB assembly. Transistor outlines for TO-92 packages are shown for devices with "EBC" pinout, such as the 2N4401/2N4403. Component values are also shown, but not guaranteed to be accurate - consult parts list for the particular varainat and revision level being constructed. This sheet is most likely used as a guide during assembly and inspection check-print.

Sheet 3: CBE_PLACEMENT Magnified view of component placement on completed PCB assembly. Transistor outlines for TO-92 packages are shown for devices with "CBE" pinout, such as the BC550/BC560. Component values are also shown, but not guaranteed to be accurate - consult parts list for the particular varainat and revision level being constructed. This sheet is most likely used as a guide during assembly and inspection check-print.

Sheet 4: DRILL_LOCATIONS View showing all holes. 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 5: TOP_COPPER Pads and traces on the top (component) side of the PWB.

Sheet 6: TOP_COPPER_ONLY Same as sheet 5, 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 2.4:1). 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 7: 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 8: BTM_COPPER_ONLY Same as sheet 7, but the drawing title block and border has been removed and the bottom circuit layer has been magnified to fit the page.

Sheet 9: BTM_COPPER_MIRROR A "mirror image" of sheet 8. (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 10: 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.) A few of the reference designators are placed in ambiguous locations - refer to the component placement diagram on sheet 2 or sheet 3.

Sheet 11: TOP_SILK_ONLY Same as sheet 10, but the drawing title block and border has been removed and the silkscreen layer has been magnified to fit the

page .

Sheet 12: TOP_SILK_COPPER Combined view of top-side traces and silk-screen may be useful for critiquing the PWB layout.