

Opamp Inverting Amplifier

PART NUMBER	04A-005
GROUP NAME	Opamp Amplifiers (04A)
CIRCUIT NAME	Inverting Amplifier
VARIANT DESCRIPTION	Single supply, DC Bias Trimmer
BOARD DESIGN	PCB50-A-05
PRODUCT DESCRIPTION	Panel of #04A-005 miniPCBs, v-scored (1 Panel = 4 Pieces)

Basic Circuit Diagram

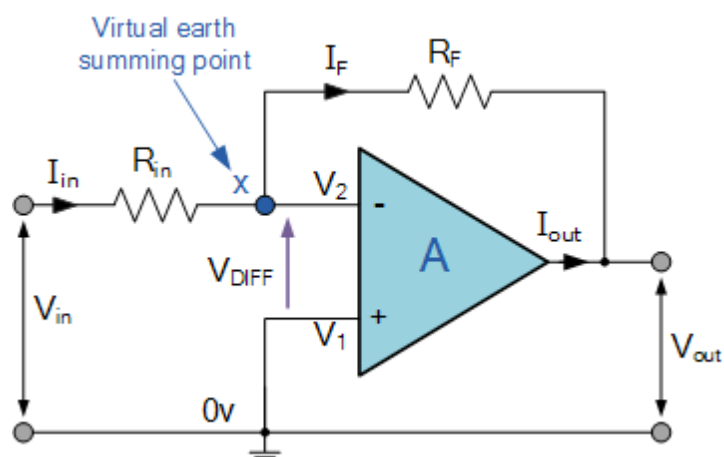


Figure 1 – Source: https://www.electronics-tutorials.ws/opamp/opamp_2.html

Theory of Operation

This circuit amplifies a small voltage signal. Since there is not DC blocking capacitor on the signal input pin P1-4 the difference between the DC component of the input signal, and the reference voltage set by the potentiometer R2 will be amplified.

The feedback capacitor C6 allows larger feedback resistor values to be used without decreasing the amplifier's bandwidth.

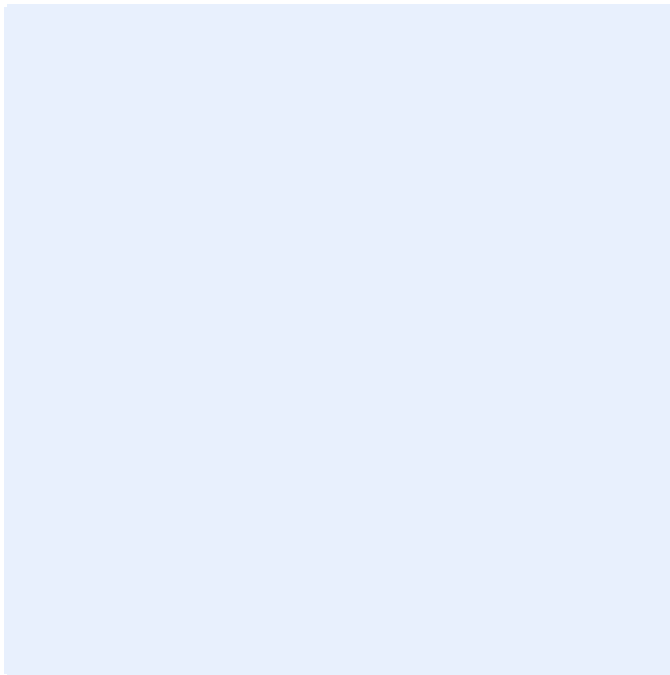
A low-pass Butterworth filter is formed by resistor R6 and capacitor C3 to minimize noise on the non-inverting opamp input.

The input impedance is largely determined by resistor R4. The output impedance is largely determined by the opamp U1.

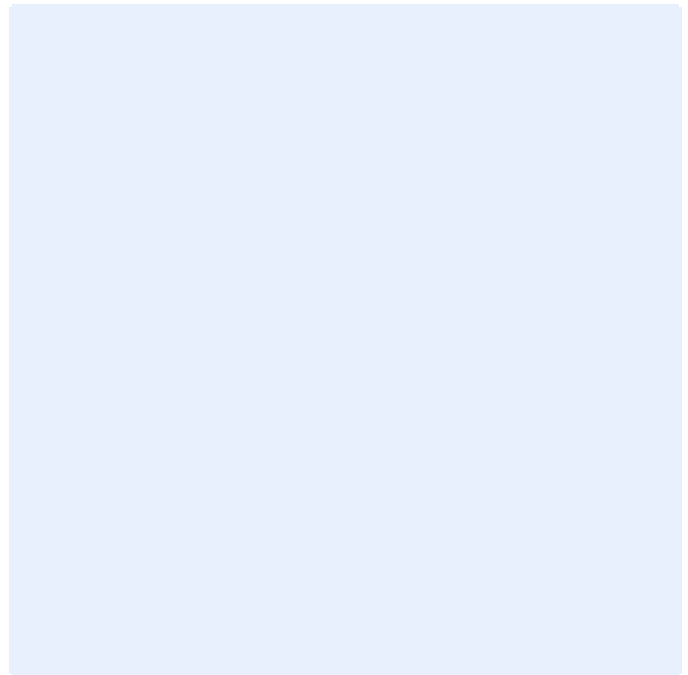
The minimum and maximum supply voltage is largely determined by the opamp U1.

Capacitors C2 and C5 filter the power supplied to the circuit. Using power filter capacitors C2 and C5 with different values, generally between 10X and 1000X different, will provide better performance than two capacitors with similar values. The smaller capacitor should be C2 since C2 is closer to the opamp pin than C5.

Panel Board

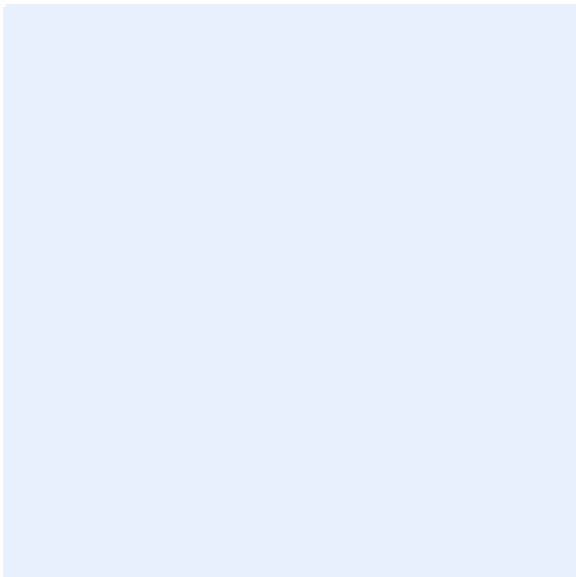


TOP VIEW

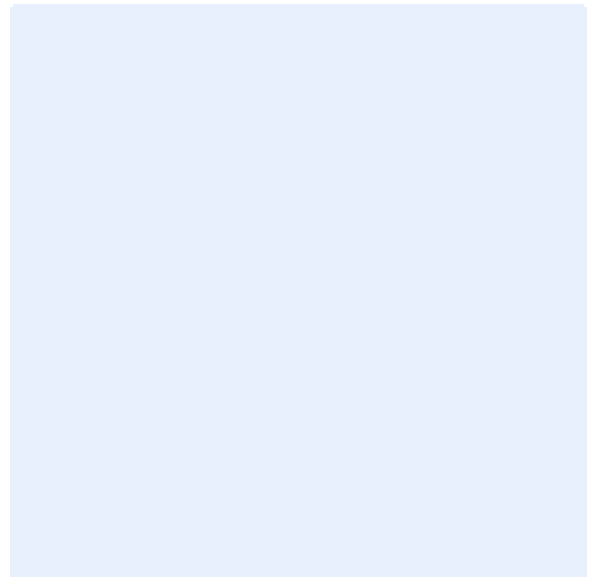


BOTTOM VIEW

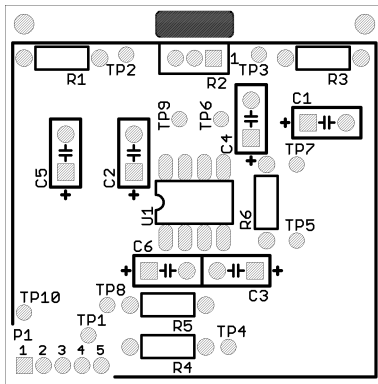
Single Board



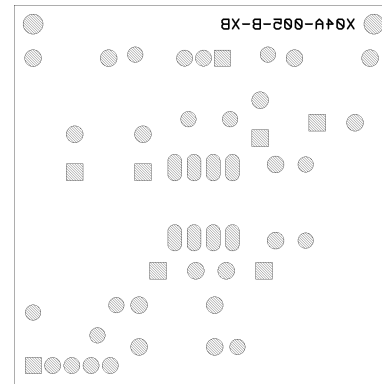
TOP VIEW



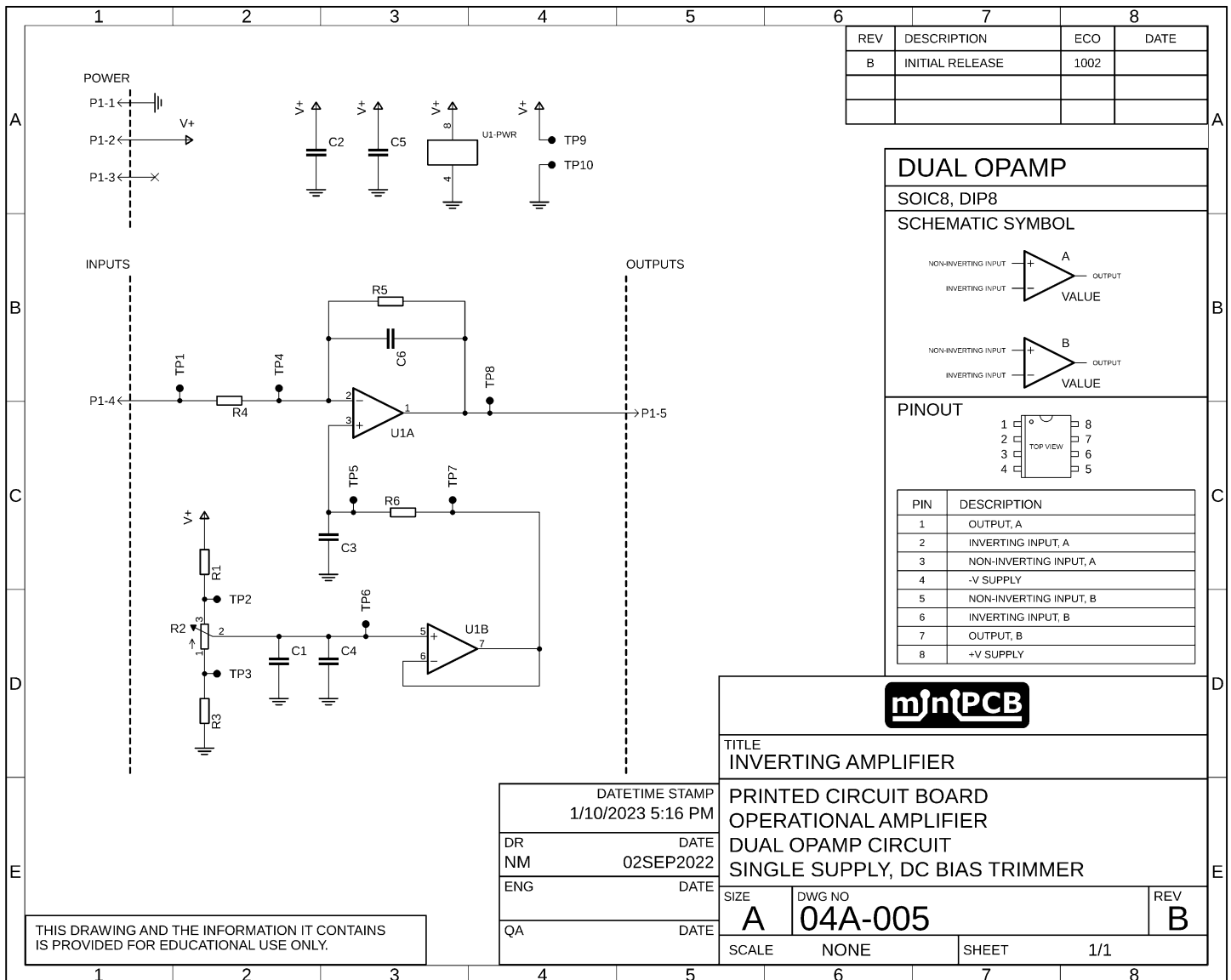
BOTTOM VIEW



TOP VIEW



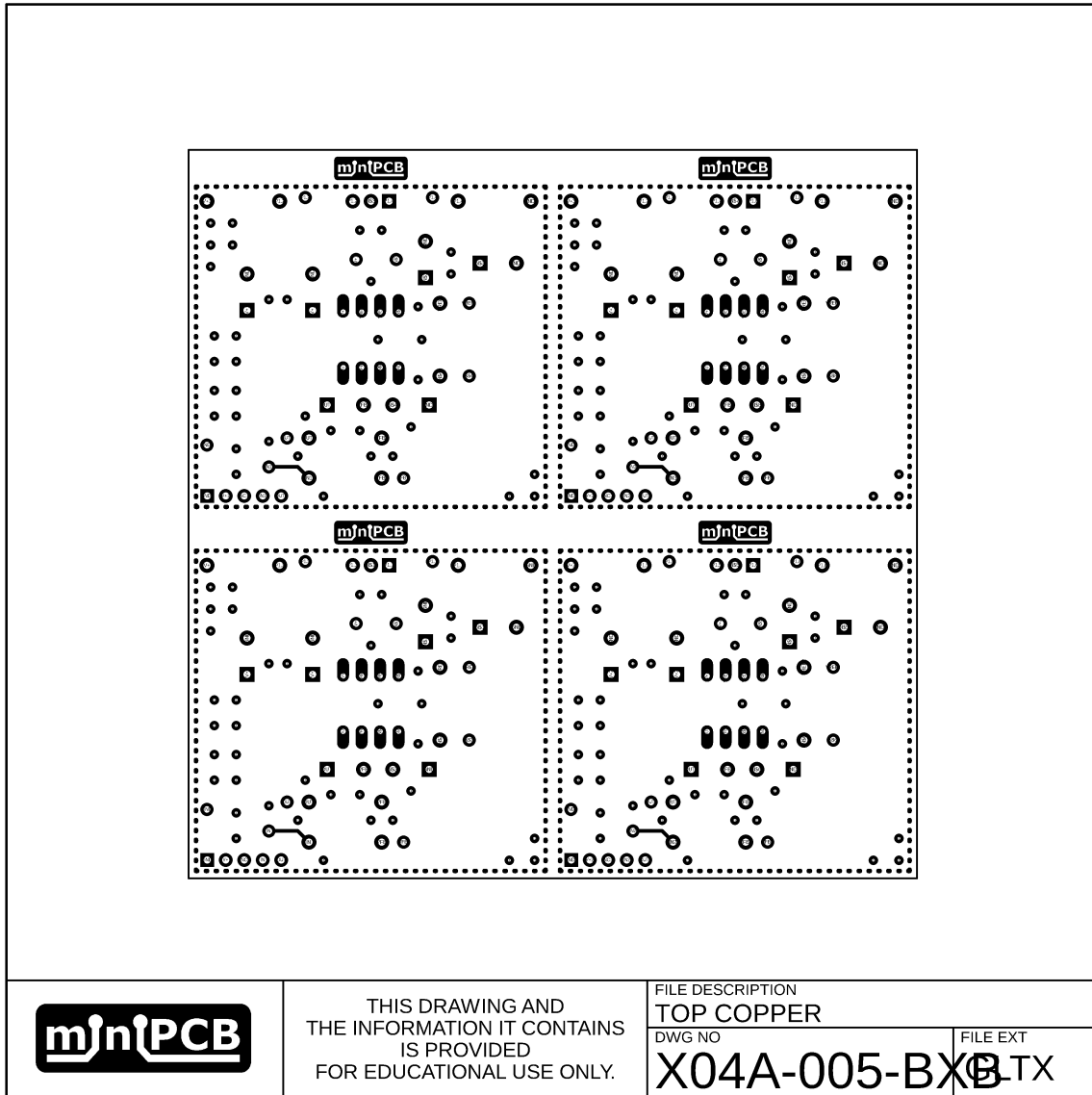
BOTTOM VIEW




Gerber Files

This section contains images of the layers included in each Gerber file.

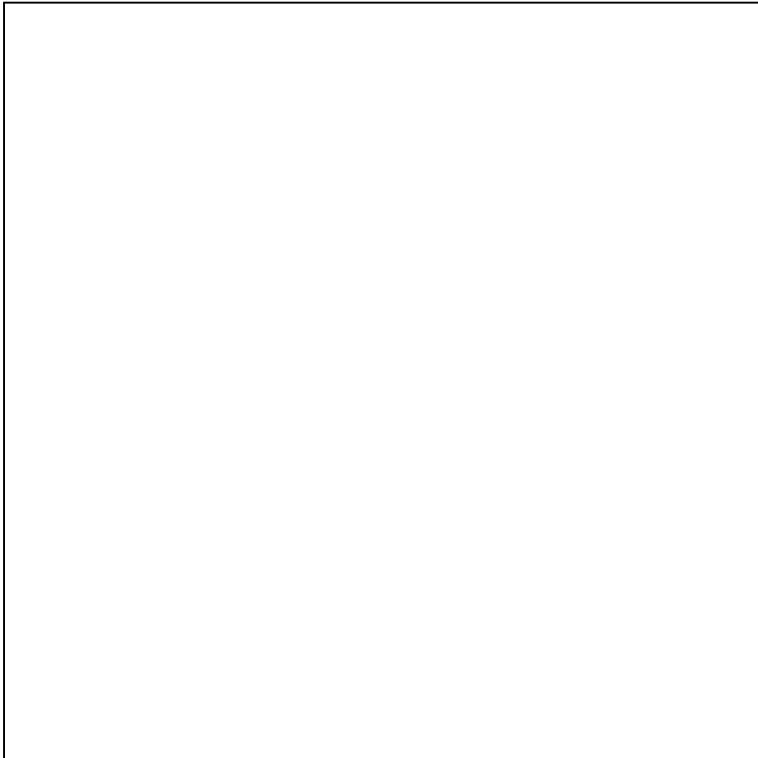

TOP COPPER (GLTX)



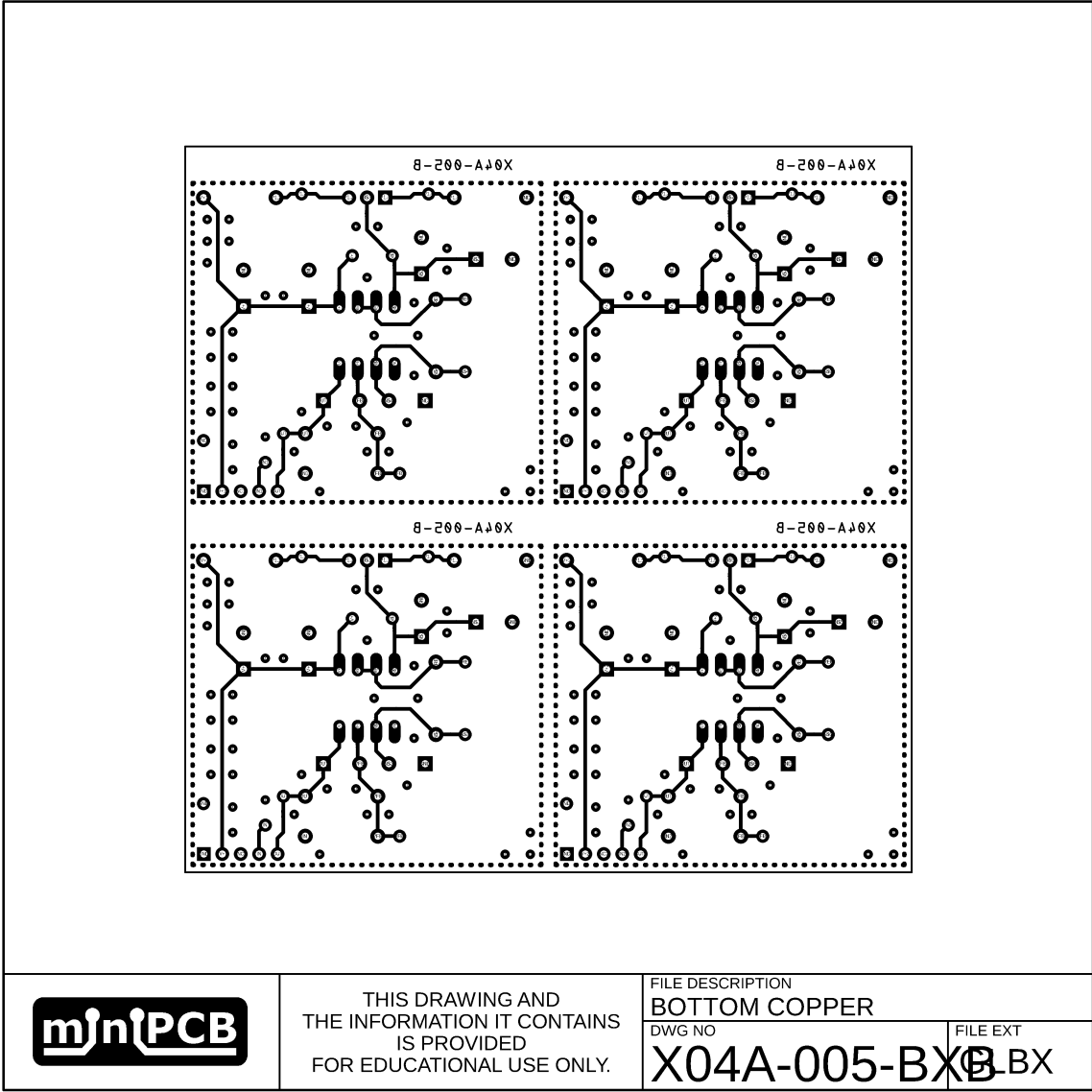
TOP CREAM (GCTX)

	THIS DRAWING AND THE INFORMATION IT CONTAINS IS PROVIDED FOR EDUCATIONAL USE ONLY.	FILE DESCRIPTION TOP CREAM	
		DWG NO X04A-005-BXB	FILE EXT GCTX

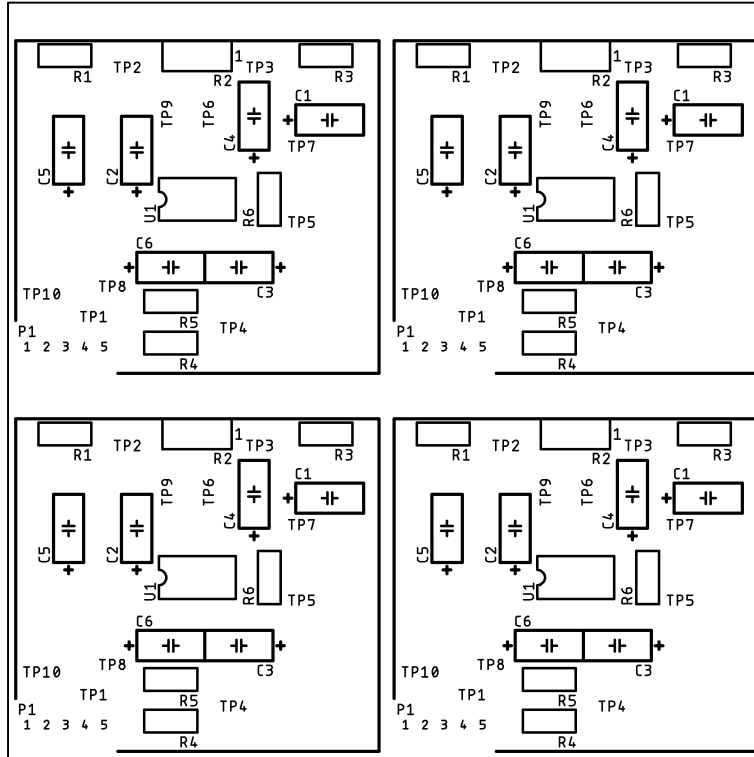
BOTTOM CREAM (GCBX)

			
	THIS DRAWING AND THE INFORMATION IT CONTAINS IS PROVIDED FOR EDUCATIONAL USE ONLY.	FILE DESCRIPTION BOTTOM CREAM	
		DWG NO X04A-005-BXB	FILE EXT GCBX

BOTTOM COPPER (GLBX)



TOP SILKSCREEN (GOTX)



THIS DRAWING AND
THE INFORMATION IT CONTAINS
IS PROVIDED
FOR EDUCATIONAL USE ONLY.

FILE DESCRIPTION

TOP SILKSCREEN

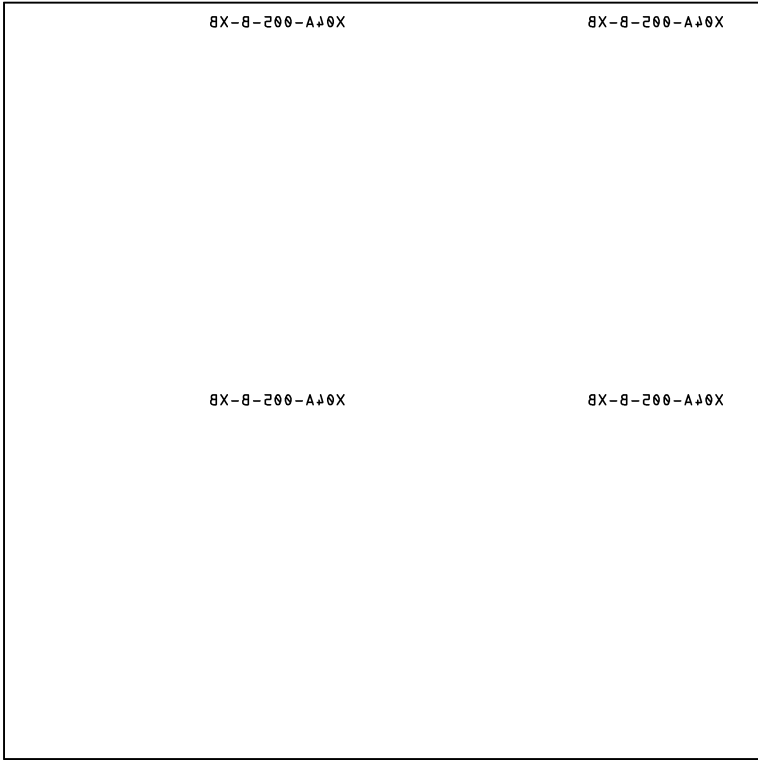

DWG NO

X04A-005-BX

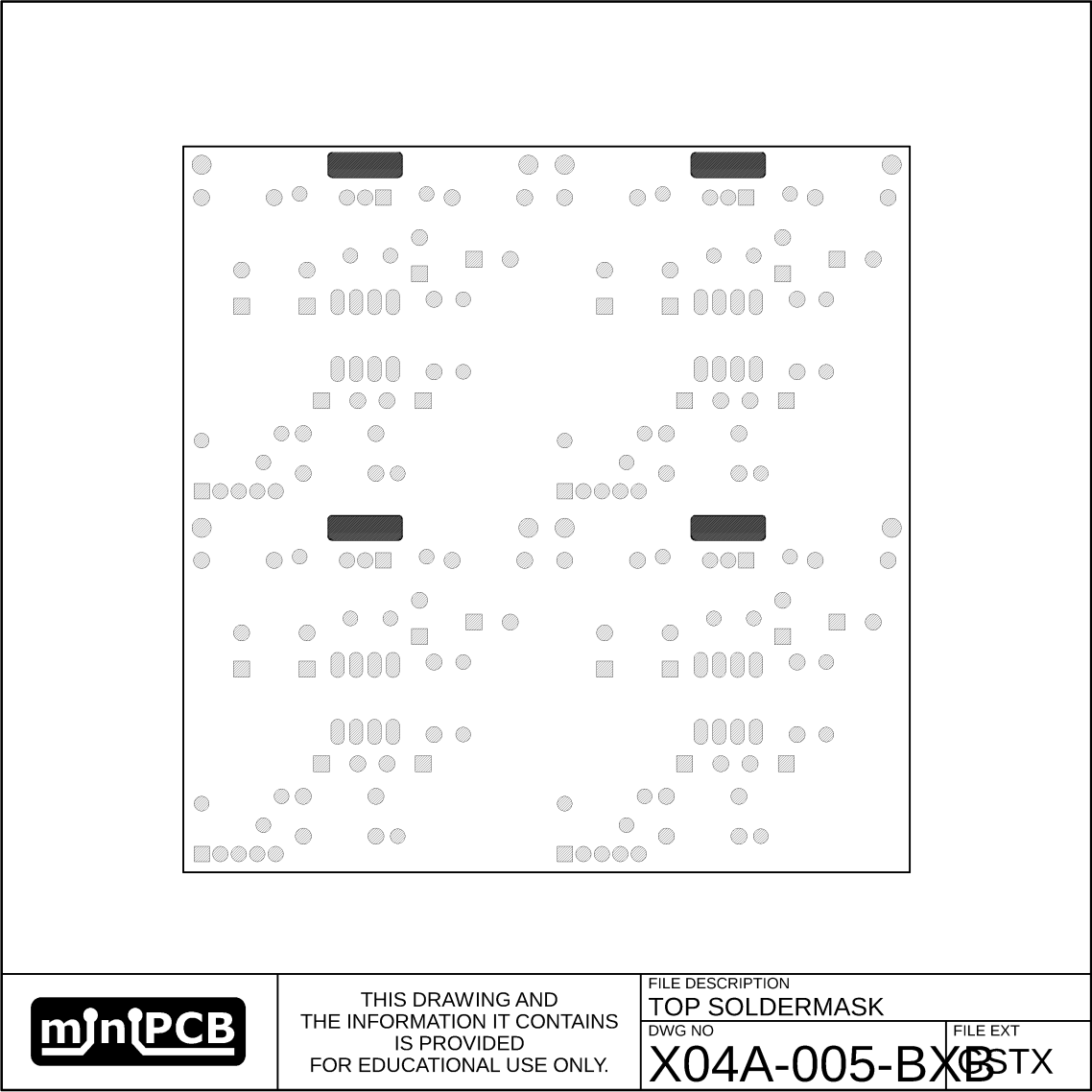
FILE EXT

GOTX

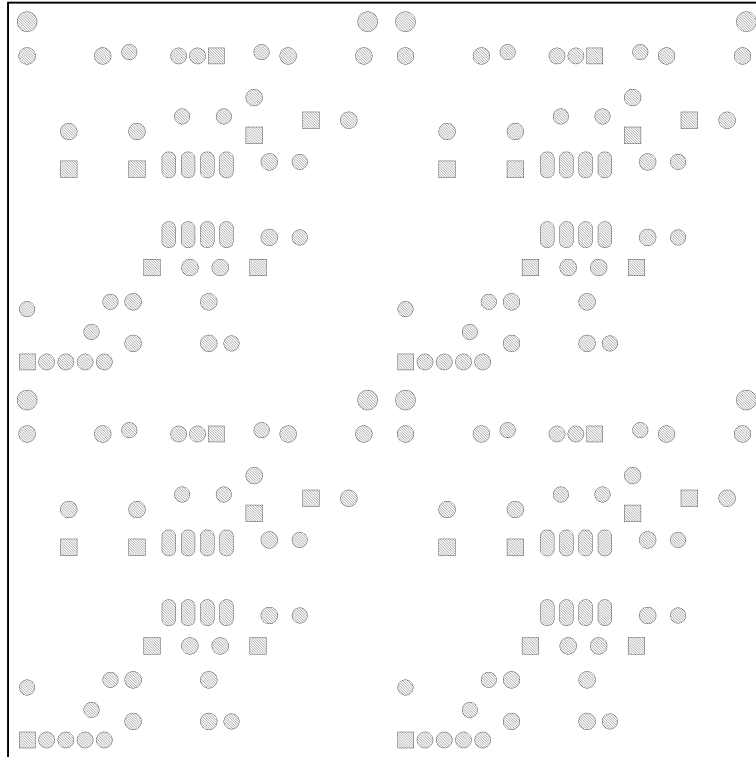
BOTTOM SILKSCREEN (GOBX)

		FILE DESCRIPTION	
		BOTTOM SILKSCREEN	
	THIS DRAWING AND THE INFORMATION IT CONTAINS IS PROVIDED FOR EDUCATIONAL USE ONLY.	DWG NO	FILE EXT
		X04A-005-BX	GOBX

TOP SOLDERMASK (GSTX)



BOTTOM SOLDER MASK (GSBX)



THIS DRAWING AND
THE INFORMATION IT CONTAINS
IS PROVIDED
FOR EDUCATIONAL USE ONLY.

FILE DESCRIPTION

BOTTOM SOLDERMASK

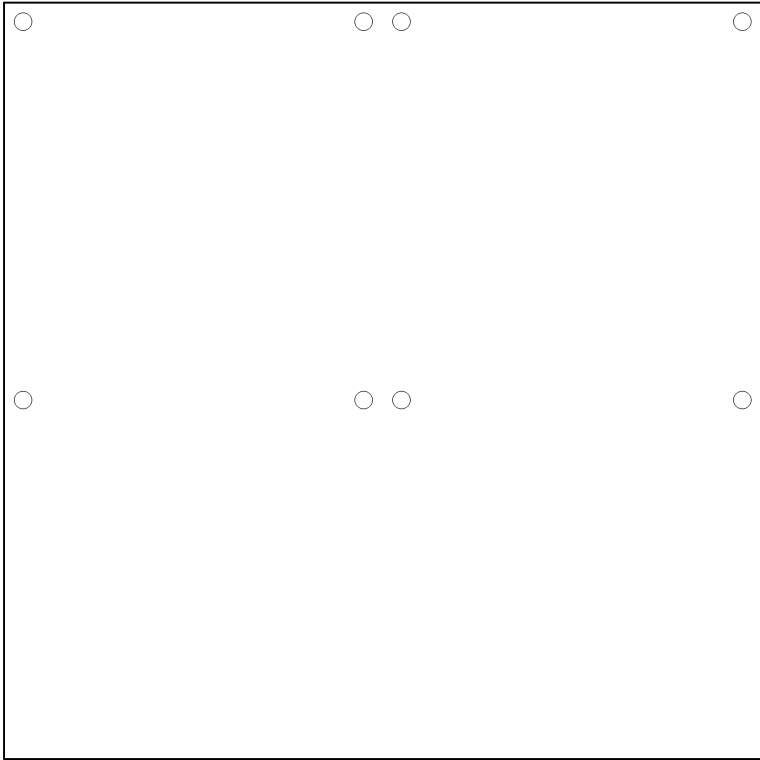
DWG NO


X04A-005-BX

FILE EXT

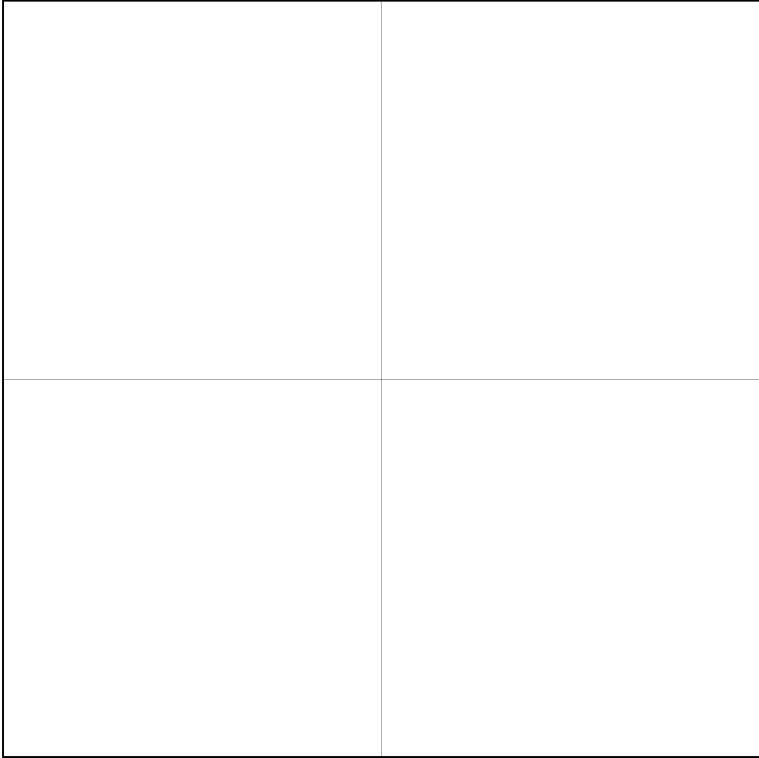

GSBX

EDGE (GM1)




	THIS DRAWING AND THE INFORMATION IT CONTAINS IS PROVIDED FOR EDUCATIONAL USE ONLY.	FILE DESCRIPTION	
		EDGE	
		DWG NO	FILE EXT
		X04A-005-BX	GM1

VSCORE (GM2)

		FILE DESCRIPTION	
		V-SCORE	
	THIS DRAWING AND THE INFORMATION IT CONTAINS IS PROVIDED FOR EDUCATIONAL USE ONLY.	DWG NO	FILE EXT
		X04A-005-BXB	GM2

MILLING (GM3)

	THIS DRAWING AND THE INFORMATION IT CONTAINS IS PROVIDED FOR EDUCATIONAL USE ONLY.	FILE DESCRIPTION MILLING	
		DWG NO X04A-005-BXB	FILE EXT GM3

Design Example

Design Specifications

POWER REQUIREMENTS

PARAMETER NAME	SYMBOL	UNITS	LOWER LIMIT	TARGET VALUE	UPPER LIMIT
Positive DC Supply	+V	V	3.1	3.3	3.5
Negative DC Supply	-V	V	N/A	N/A	N/A

STIMULI REQUIREMENTS

PARAMETER NAME	SYMBOL	UNITS	LOWER LIMIT	TARGET VALUE	UPPER LIMIT
Maximum Voltage Gain	A_v	$\frac{V}{V}$			
Bandwidth	f_{-3dB}	Hz			
Common-Mode Offset	V_{cm}	$\frac{V}{V}$			
Common-Mode Gain	A_{cm}	$\frac{V}{V}$			
Maximum Input Bias Current	I_{bias}	A			
Maximum Phase Shift	ϕ_{max}	°			
Source Impedance	R_s	Ω			

PERFORMANCE CHARACTERISTICS

PARAMETER NAME	SYMBOL	UNITS	LOWER LIMIT	TARGET VALUE	UPPER LIMIT
Quiescent Current	I_q	A			
Voltage Gain	A_v	$\frac{V}{V}$			
Input Impedance	R_i	Ω			
Output Impedance	R_o	Ω			

Parts List

QTY REQ	REFERENCE DESIGNATORS	PART NUMBER	PART DESCRIPTION	FIND
1	-	04A-005	PRINTED CIRCUIT BOARD, miniPCB™	1
1	C1	47 uF	CAPACITOR, ELECTROLYTIC	2
1	C2	330 nF	CAPACITOR, ELECTROLYTIC	3
1	C3	6.8 uF	CAPACITOR, ELECTROLYTIC	4
1	C4	4.7 nF	CAPACITOR, CERAMIC	5
1	C5	3.3 uF	CAPACITOR, ELECTROLYTIC	6
1	C6	100 pF	CAPACITOR, CERAMIC	7
1	P1	-	HEADER PINS, 5P	8
1	R1	10 KΩ	RESISTOR	9
1	R2	100 KΩ	POTENTIOMETER, MULTITURN	10
1	R3	10 KΩ	RESISTOR	11
1	R4	10 KΩ	RESISTOR	12
1	R5	100 KΩ	RESISTOR	13
1	R6	10 Ω	RESISTOR	14
1	U1	MCP6022-I/P	OPAMP, 2 CHANNEL, DIP8	15
10	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10	5000	TEST POINTS, KEYSTONE ELECTRONICS	16

Test List

TEST #	TEST NAME	TEST DESCRIPTION
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

Test Results

Test Conclusions

FORM: Test Results

FORM: Design Specifications

POWER REQUIREMENTS

PARAMETER NAME	SYMBOL	UNITS	LOWER LIMIT	TARGET VALUE	UPPER LIMIT
Postive DC Supply	+V	V	3.1	3.3	3.5
Negative DC Supply	-V	V	N/A	N/A	N/A

STIMULI REQUIREMENTS

PARAMETER NAME	SYMBOL	UNITS	LOWER LIMIT	TARGET VALUE	UPPER LIMIT
Maximum Voltage Gain	A_v	$\frac{V}{V}$			
Bandwidth	f_{-3dB}	Hz			
Common-Mode Offset	V_{cm}	$\frac{V}{V}$			
Common-Mode Gain	A_{cm}	$\frac{V}{V}$			
Maximum Input Bias Current	I_{bias}	A			
Maximum Phase Shift	ϕ_{max}	°			
Source Impedance	R_s	Ω			

PERFORMANCE CHARACTERISTICS

PARAMETER NAME	SYMBOL	UNITS	LOWER LIMIT	TARGET VALUE	UPPER LIMIT
Quiescent Current	I_q	A			
Voltage Gain	A_v	$\frac{V}{V}$			
Input Impedance	R_i	Ω			
Output Impedance	R_i	Ω			

FORM: Parts List

QTY REQ	REFERENCE DESIGNATORS	PART NUMBER	PART DESCRIPTION	FIND
1	-	04A-005	PRINTED CIRCUIT BOARD, miniPCB™	1
1	C1		CAPACITOR	2
1	C2		CAPACITOR	3
1	C3		CAPACITOR	4
1	C4		CAPACITOR	5
1	C5		CAPACITOR	6
1	C6		CAPACITOR	7
1	P1		HEADER PINS, 5P	8
1	R1		RESISTOR	9
1	R2		POTENTIOMETER, MULTITURN	10
1	R3		RESISTOR	11
1	R4		RESISTOR	12
1	R5		RESISTOR	13
1	R6		RESISTOR	14
1	U1		OPAMP, 2 CHANNEL, DIP8	15
10	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10	5000	TEST POINTS, KEYSTONE ELECTRONICS	16

Change and Liability Notice

This document is subject to change without notice. While effort has been made to ensure the accuracy of the material contained within this document, Nolan Manteufel shall under no circumstances be liable for incidental or consequential damages or related expenses resulting from the use of this document.

Trademark Notice

miniPCB is a trademark of Nolan Manteufel.

This datasheet does not constitute permission to use the miniPCB trademark.

WORDMARK	FIGUREMARK	FIGUREMARK
miniPCB™		

Revision History

REV	DESCRIPTION	ECO	DATE
A	Initial Release	1002	