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

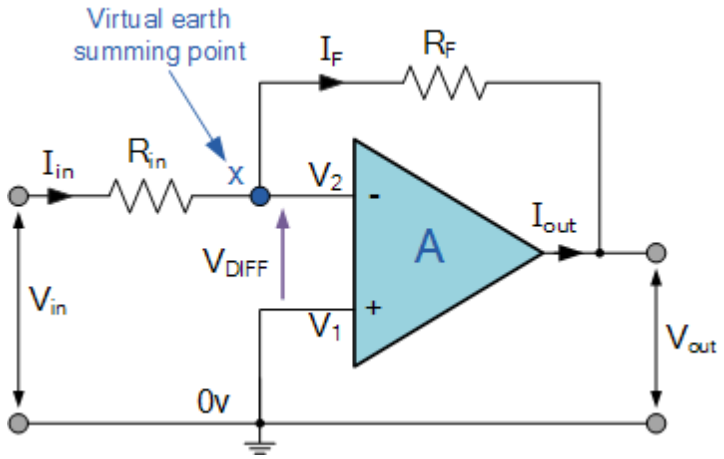
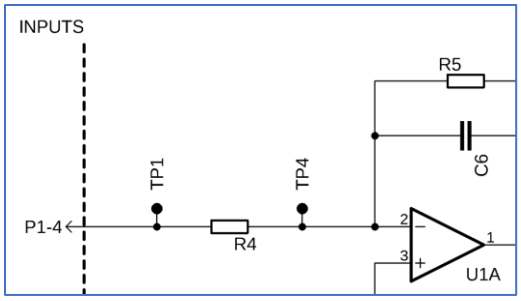


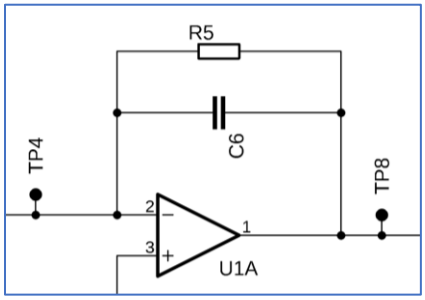
Figure 1 – Source: https://www.electronics-tutorials.ws/opamp/opamp_2.html

Theory of Operation

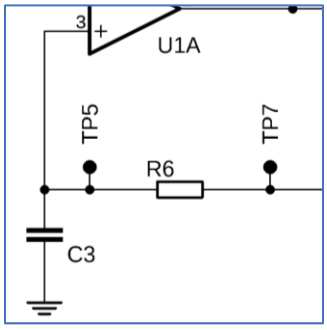
This circuit amplifies a small voltage signal. Since there is no DC blocking capacitor on the signal input pin P1-4, the difference between the DC component of the input signal and the reference voltage set by the potentiometer R2 will be amplified.



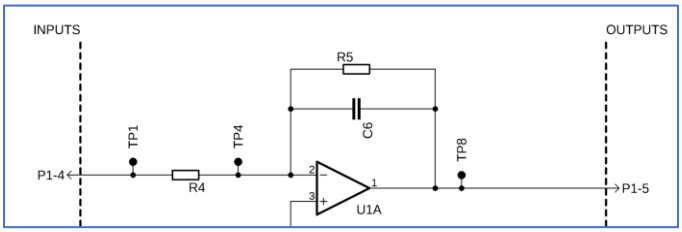
The feedback capacitor C6 allows larger feedback resistor values to be used without decreasing the amplifier's gain bandwidth.



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

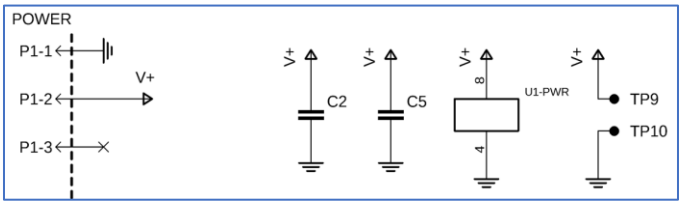


The input impedance is largely determined by resistor R4. The output impedance is largely determined by the opamp U1.



The minimum and maximum supply voltage is largely determined by the opamp U1. Only the V+ power source is needed to operate this circuit.

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



Panel Board

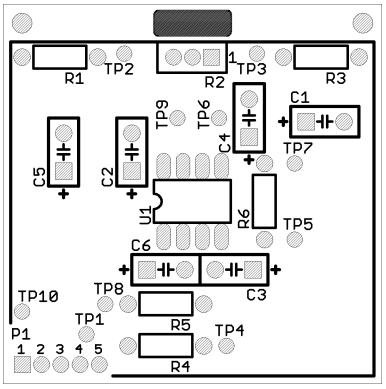
TOP VIEW

BOTTOM VIEW

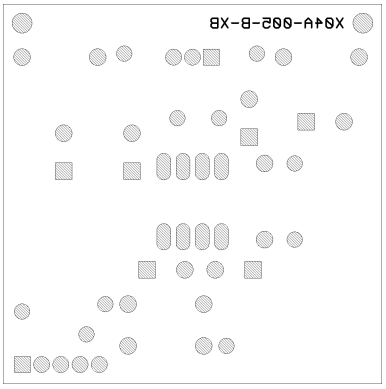
Single Board

TOP VIEW

BOTTOM VIEW

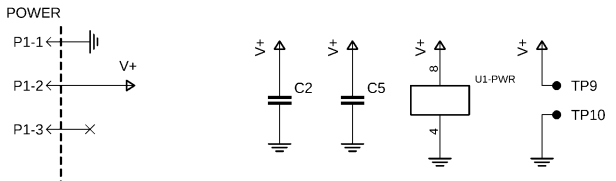


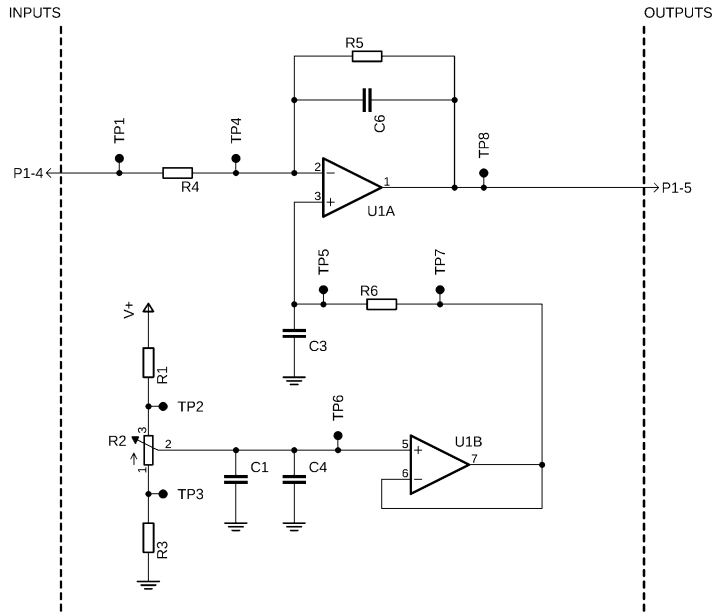
TOP VIEW



BOTTOM VIEW

REV	DESCRIPTION	ECO	DATE
B	INITIAL RELEASE	1002	

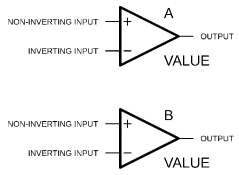




DUAL OPAMP

SOIC8, DIP8

SCHEMATIC SYMBOL



PINOUT

PIN	DESCRIPTION
1	OUTPUT, A
2	INVERTING INPUT, A
3	NON-INVERTING INPUT, A
4	-V SUPPLY
5	NON-INVERTING INPUT, B
6	INVERTING INPUT, B
7	OUTPUT, B
8	+V SUPPLY

TITLE
INVERTING AMPLIFIER

PRINTED CIRCUIT BOARD
OPERATIONAL AMPLIFIER
DUAL OPAMP CIRCUIT
SINGLE SUPPLY, DC BIAS TRIMMER

DATETIME STAMP
1/10/2023 5:16 PM

DR	DATE
NM	02SEP2022
ENG	DATE
QA	DATE

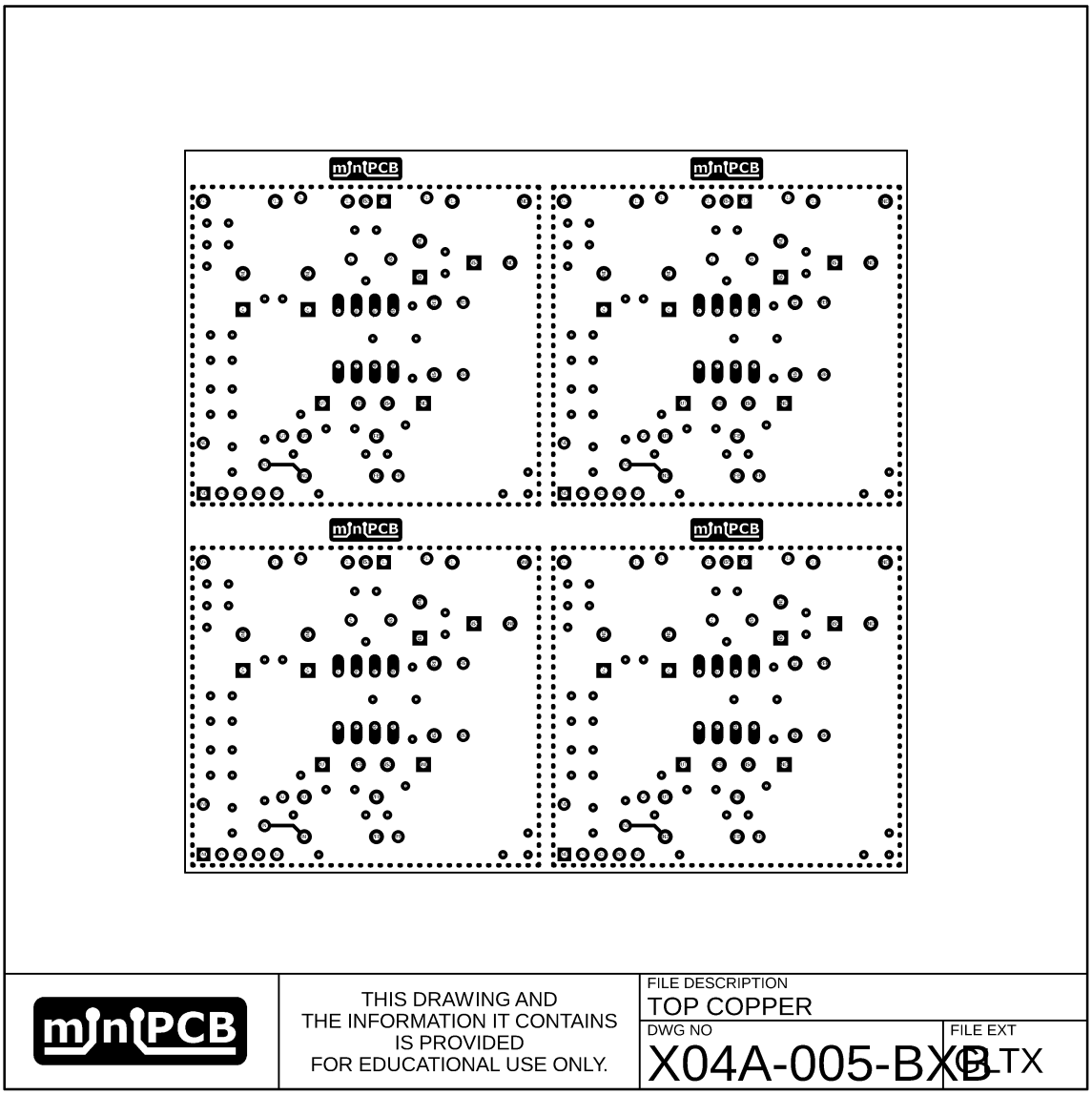
SIZE	DWG NO	REV
A	04A-005	B

SCALE NONE SHEET 1/1

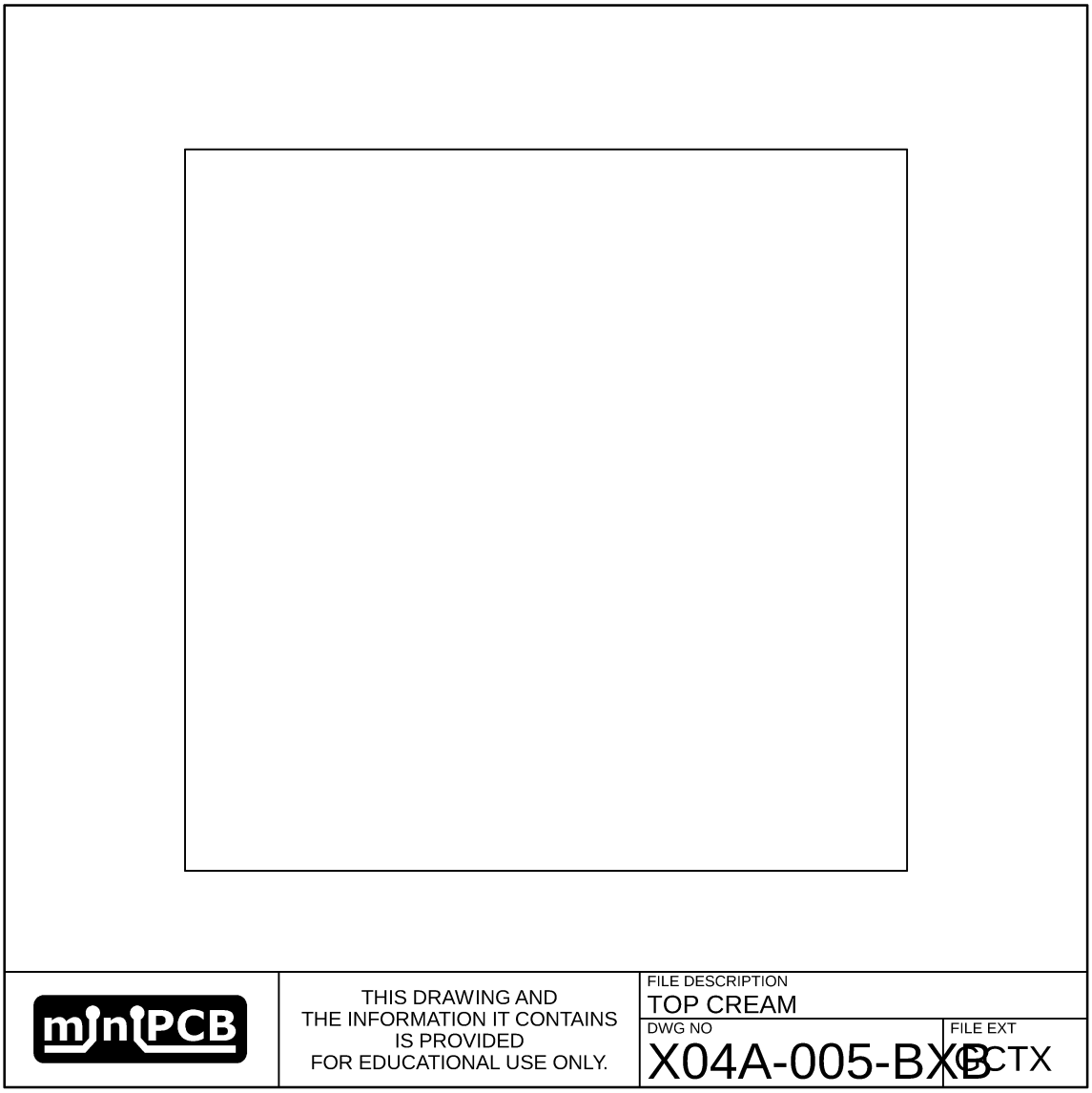
Gerber Files

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

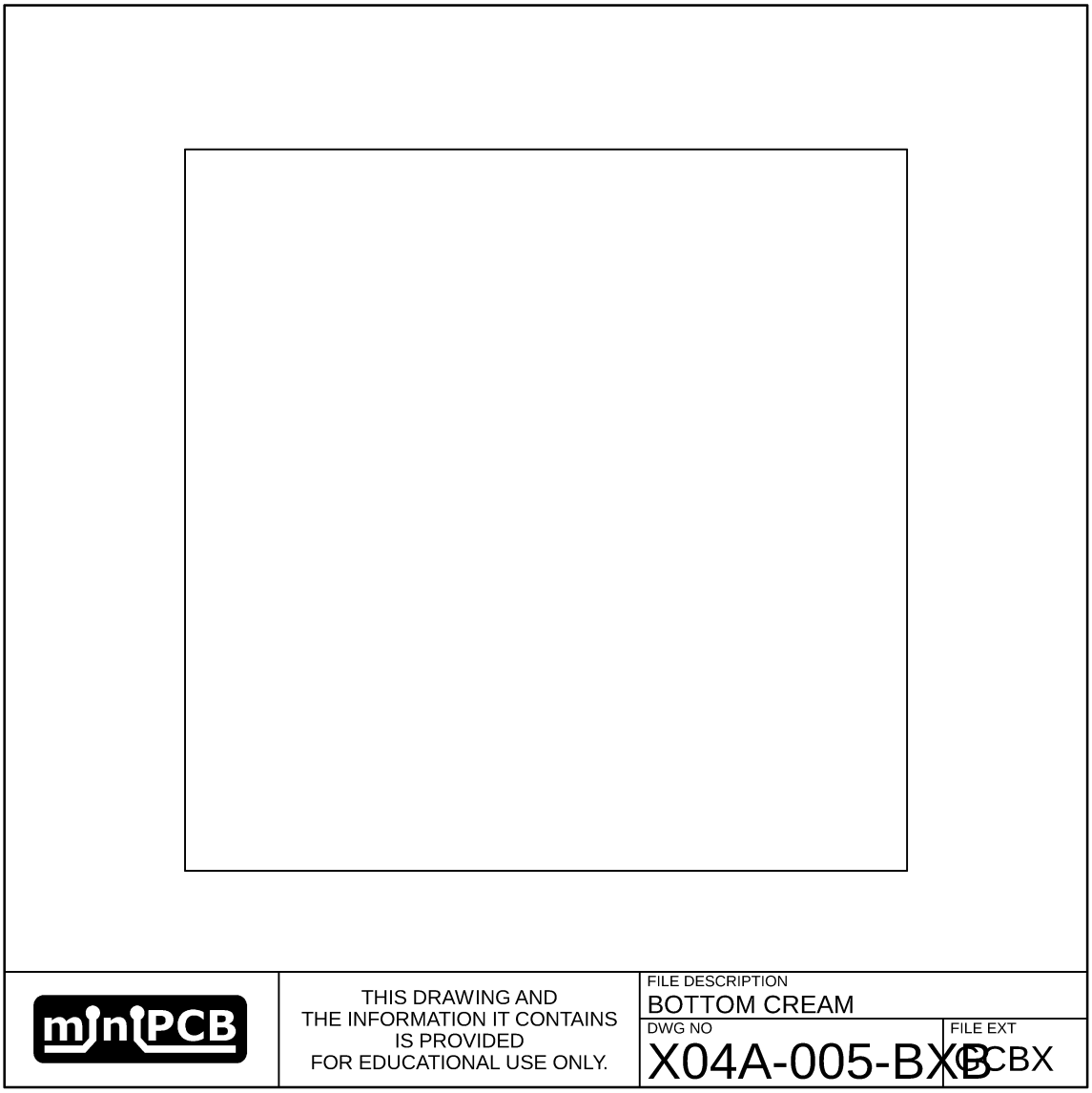
TOP COPPER (GLTX)



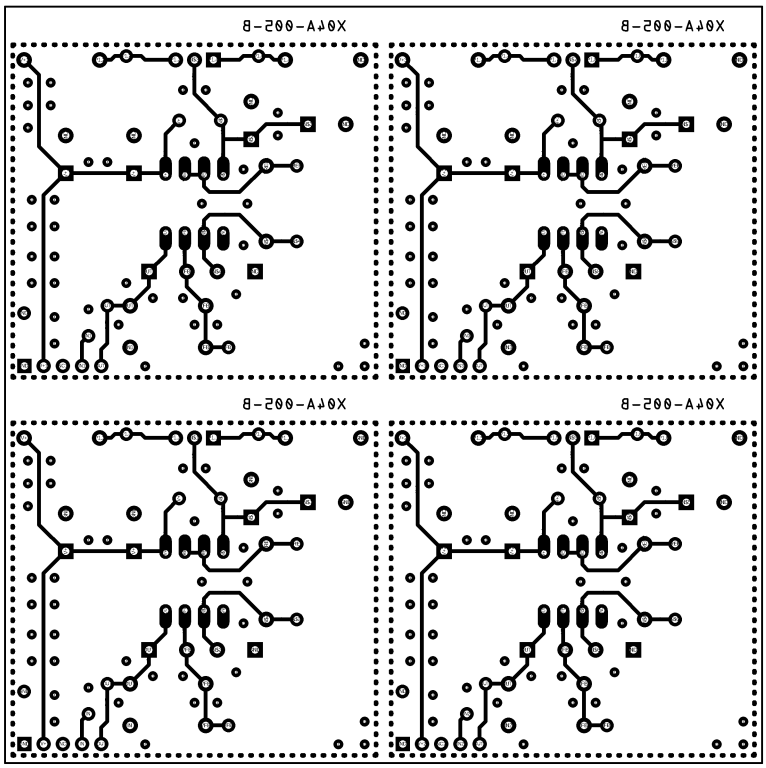
TOP CREAM (GCTX)



BOTTOM CREAM (GCBX)

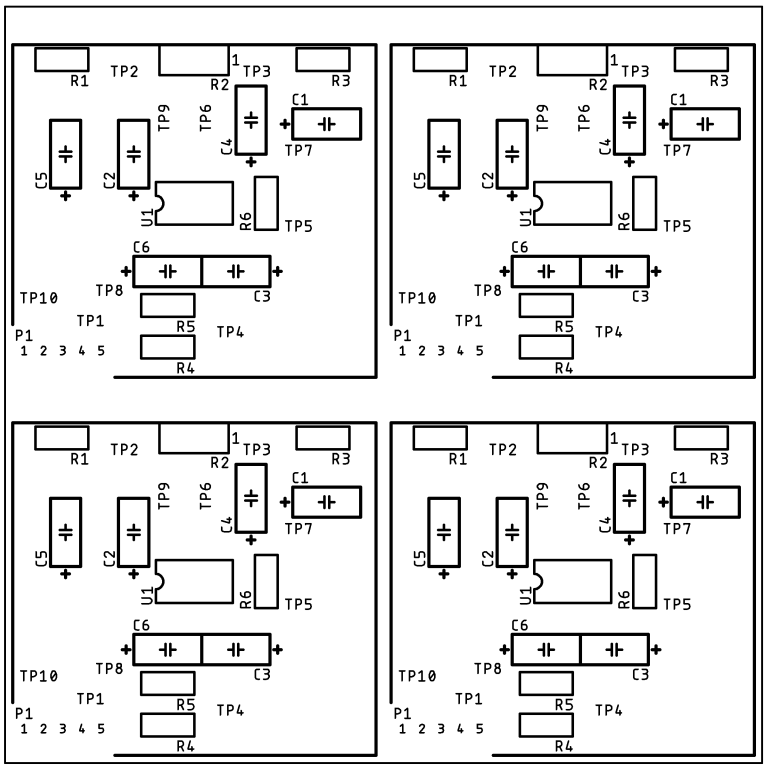


BOTTOM COPPER (GLBX)



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

TOP SILKSCREEN (GOTX)



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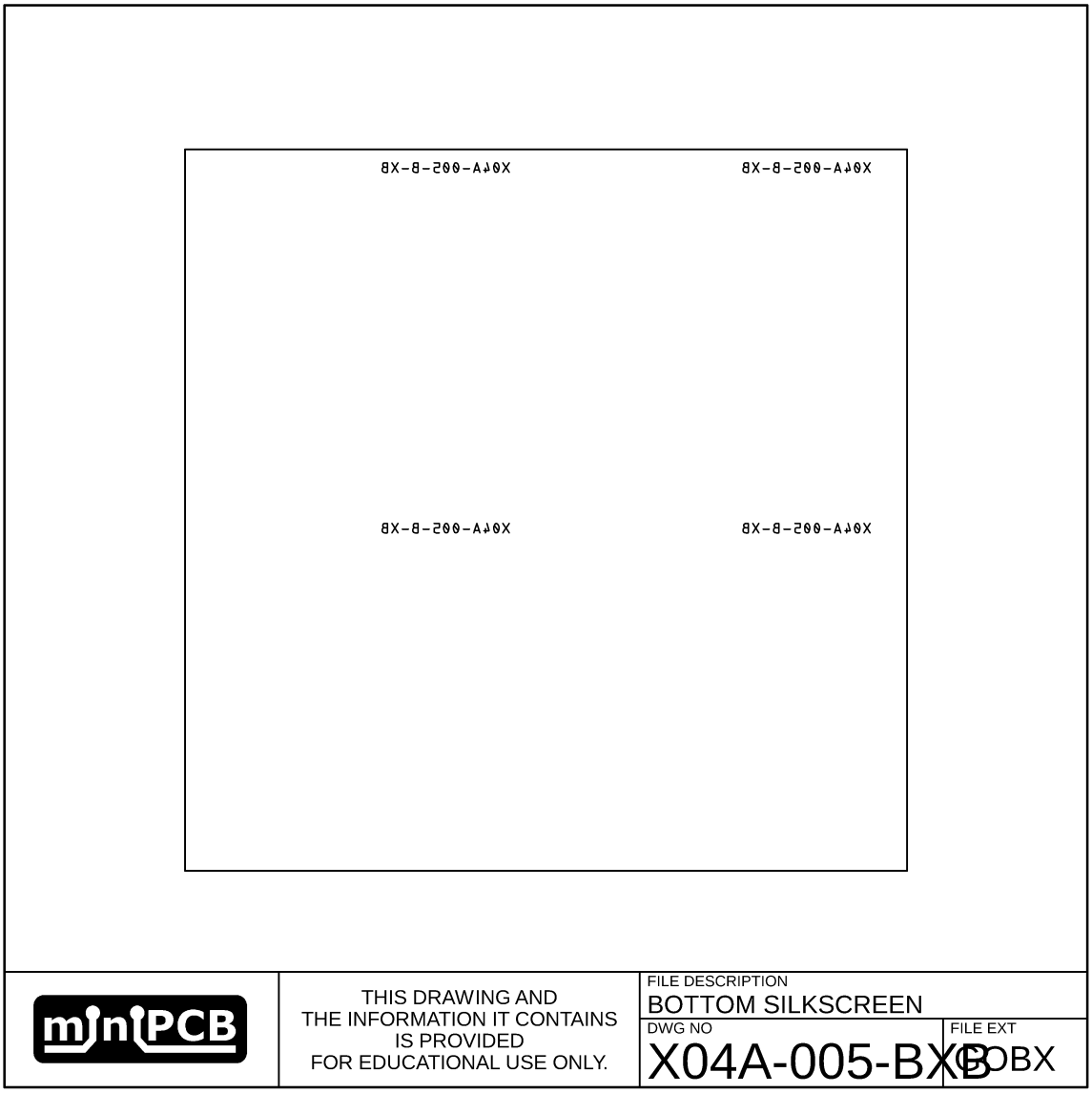
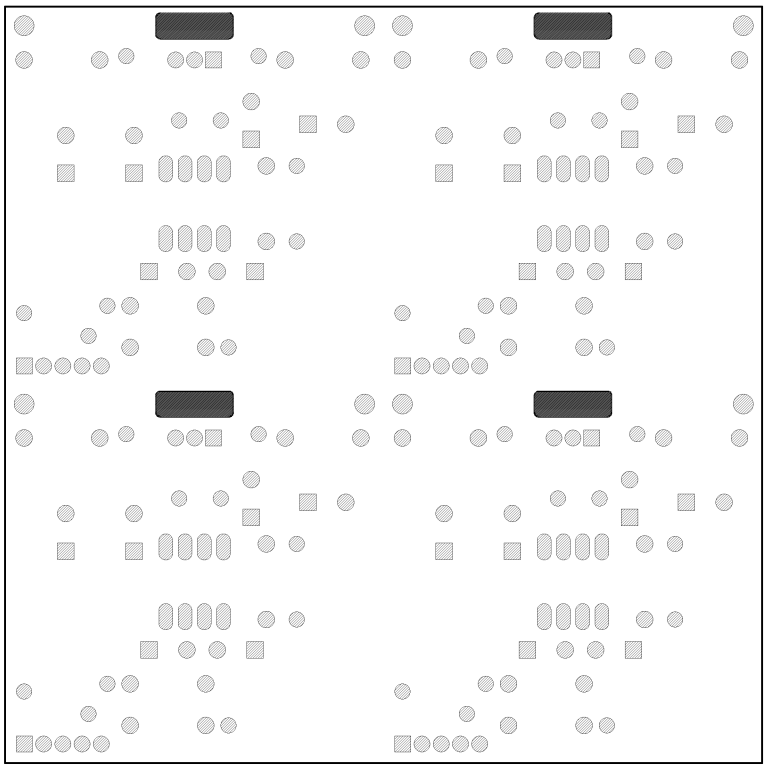
DWG NO: X04A-005-BXCB
FILE EXT: GOTX

BOTTOM SILKSCREEN (GOBX)



TOP SOLDERMASK (GSTX)



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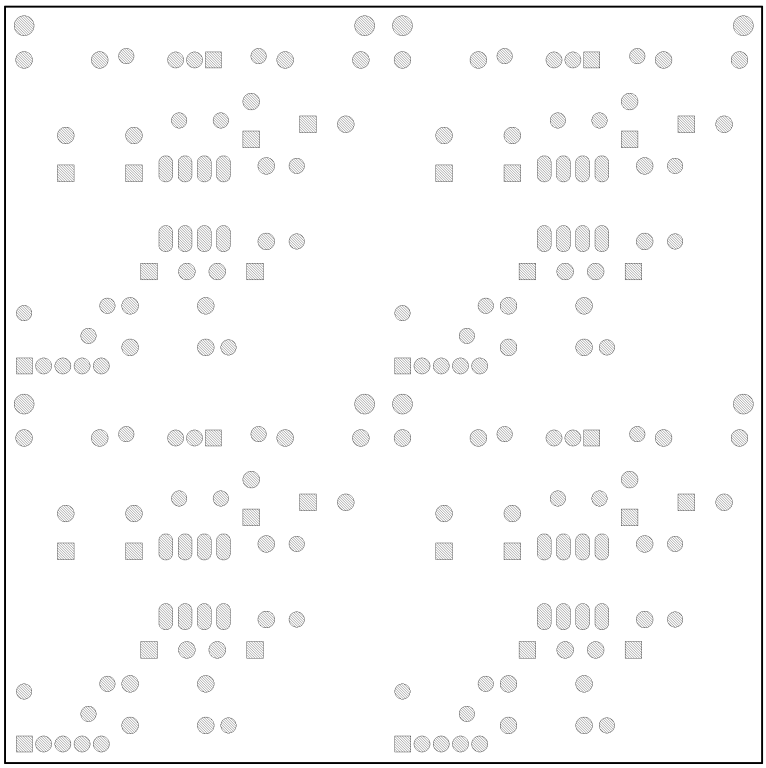
BOTTOM SOLDER MASK (GSBX)



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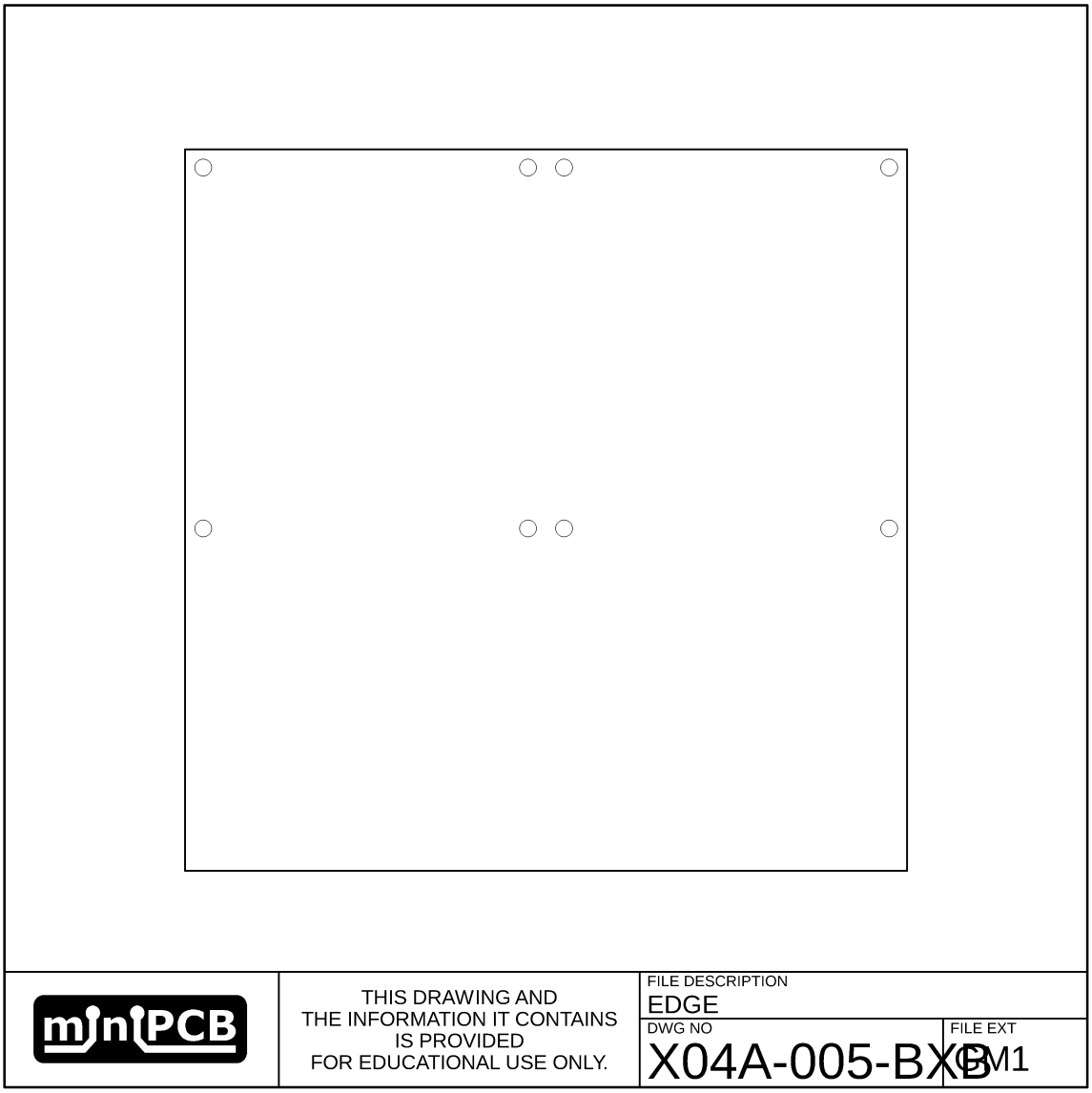
EDGE (GM1)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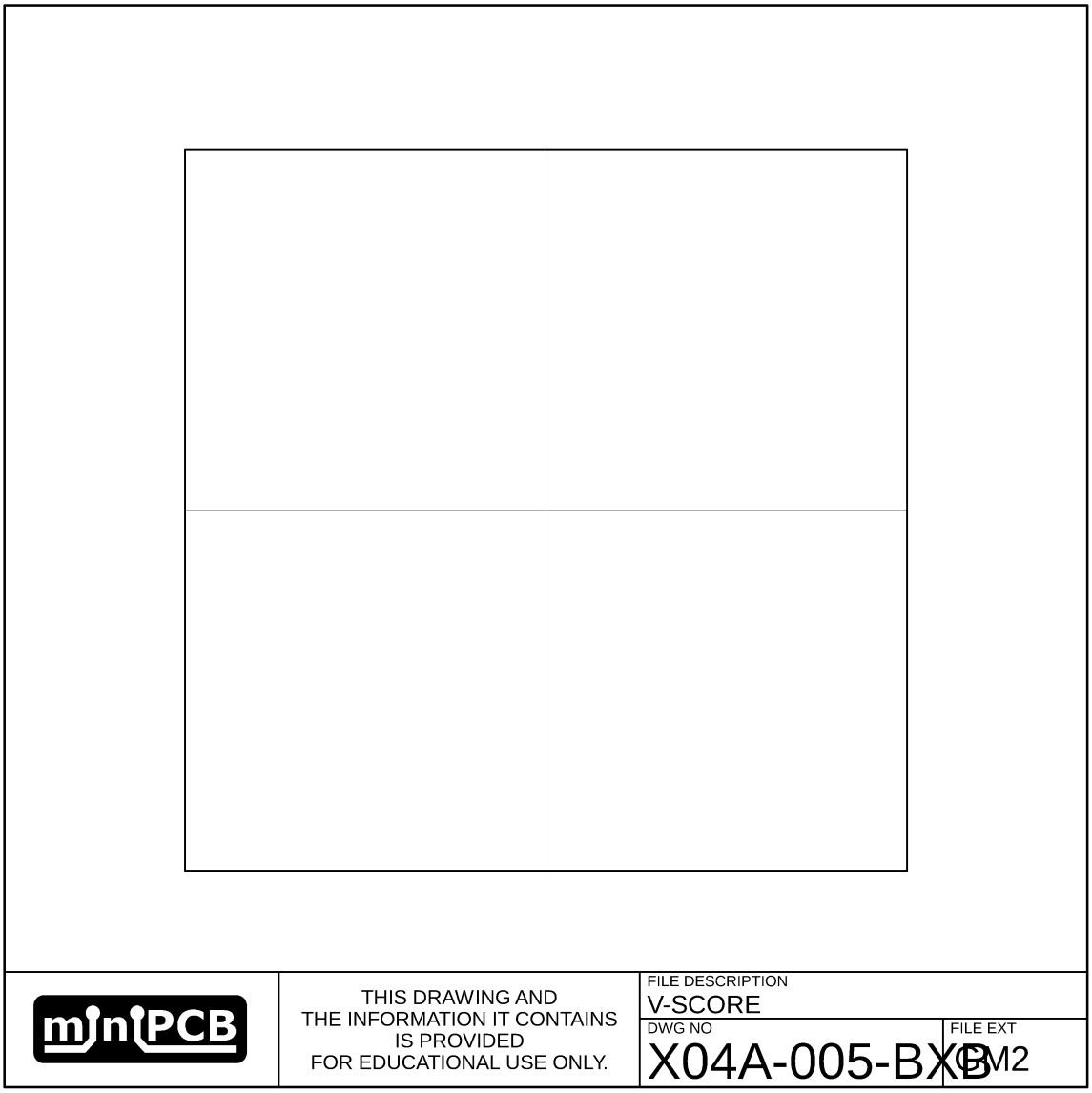
EDGE
DWG NO
X04A-005-BXB
FILE EXT
GM1

VSCORE (GM2)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DWG NO
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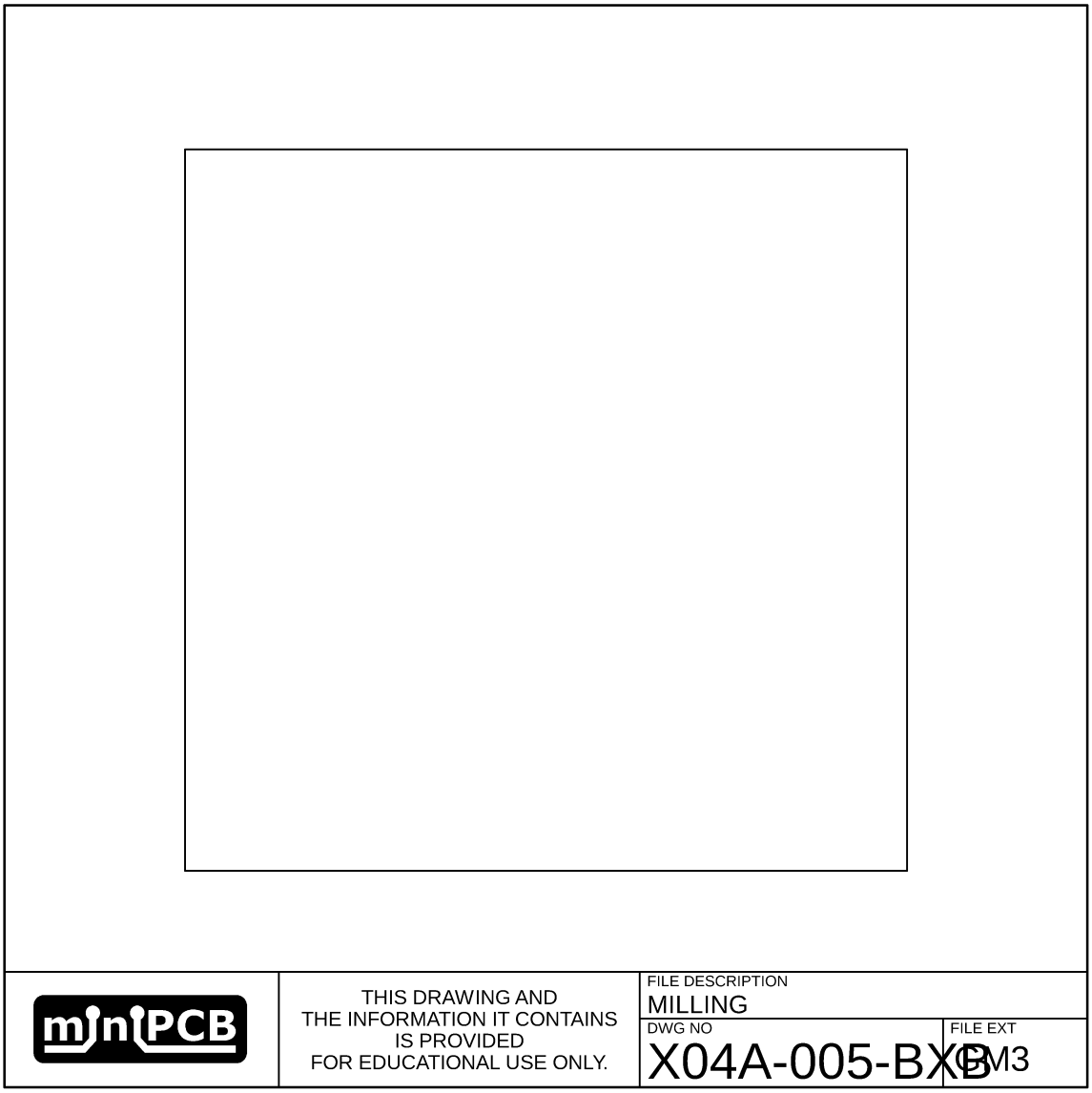
FILE EXT
GM2

MILLING (GM3)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IS PROVIDED
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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
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
Quiescient Current	I_q	A			
Voltage Gain	A_v	$\frac{V}{V}$			
Input Impedance	R_i	Ω			
Output Impedance	R_i	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
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Maximum Phase Shift	ϕ_{max}	°			
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PERFORMANCE CHARACTERISTICS

PARAMETER NAME	SYMBOL	UNITS	LOWER LIMIT	TARGET VALUE	UPPER LIMIT
Quiescient 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

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WORDMARK	FIGUREMARK	FIGUREMARK
miniPCB™		

Revision History

REV	DESCRIPTION	ECO	DATE
A	Initial Release	1002	