



ML2520 DISCRETE OP-AMP KIT MANUAL

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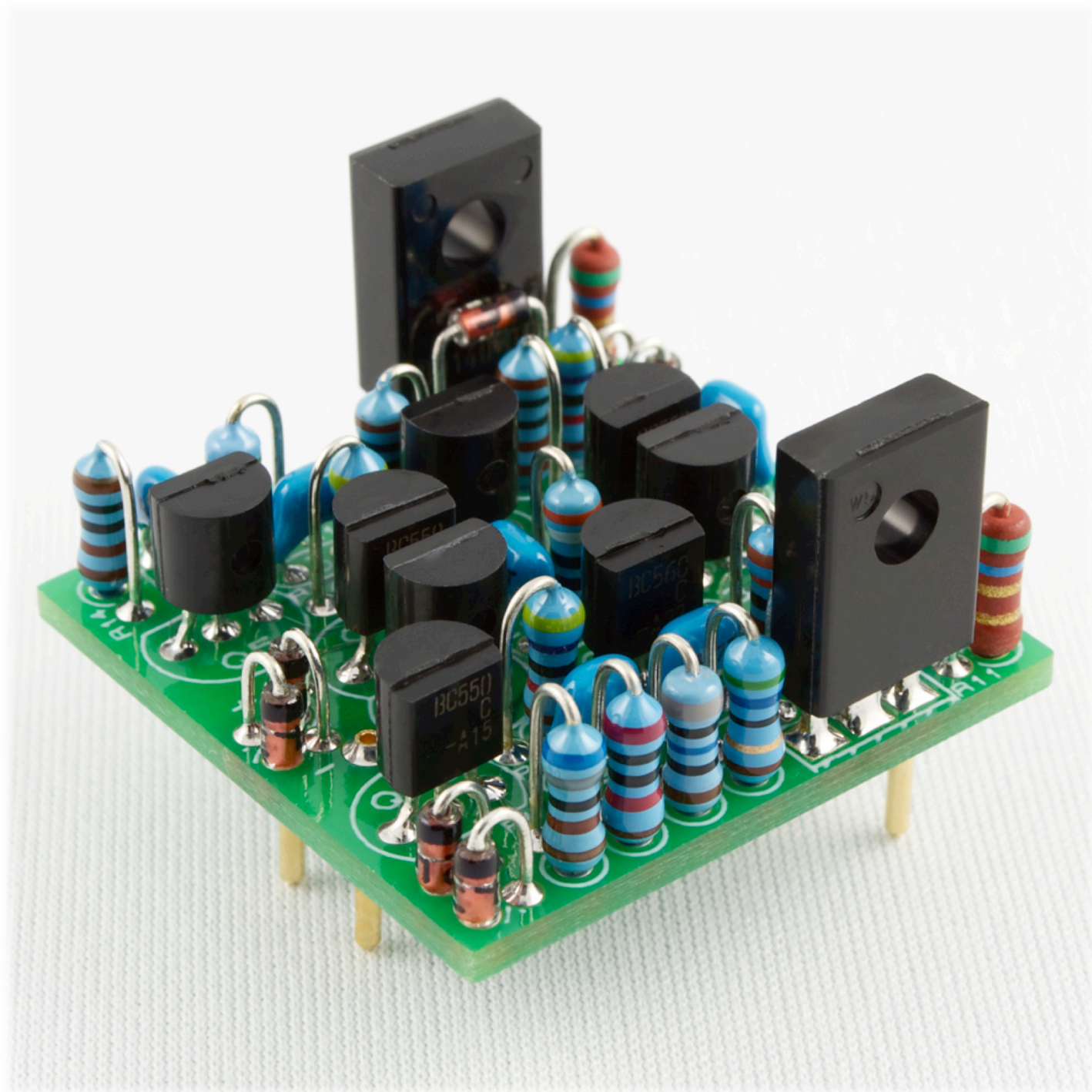


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INTRODUCTION

FOREWORD

Thank you for purchasing the ML2520 Kit.

The ML2520 is the result of many hours of critical listening tests and has been relentlessly refined throughout this process. It is my take on the famous AP2520 discrete op-amp, popular amongst DIY enthusiasts and tweak-head audio engineers. It is a vital part of what makes the classic American console sound, sought after by many.

This manual will give you the essential information required to assemble the kit. This build requires good soldering skills and a steady hand. So lay off the caffeine before diving in.

I hope you enjoy the sound of the ML2520 as much as I do and I wish you a happy DIY!

Sincerely,

Mike Lebon

Contact: mike@whistlerockaudio.com

DISCLAIMER

I am not liable for any damage, harm or loss of any kind resulting from the assembly and/or use of this kit. This kit contains small parts that may be easily swallowed by a child. Keep all components of the kit AWAY from children and animals. Finally, always take necessary precautions when handling potentially dangerous tools such as cutters, scissors and soldering iron.

BILL OF MATERIALS

The following should be present in a complete kit. Make sure that you can identify every component before you start assembly. If in doubt, check the values with a multimeter before soldering.

CAPACITORS								
Ref.	Value	Tol.	Type	Rating	Lead Spcng.	Manufacturer	Manufacturer Part #	Qty.
C1	1n	5%	C0G	50V	2.5mm	Murata	RPE5C1H102J2P1A03B	1
C2	10p	5%	C0G	100V	2.5mm	Murata	RPE5CA100J2P1Z03B	2
C5	10p	5%	C0G	100V	2.5mm	Murata	RPE5CA100J2P1Z03B	
C3	47p	5%	C0G	100V	2.5mm	Murata	RPE5CA470J2P1Z03B	2
C6	47p	5%	C0G	100V	2.5mm	Murata	RPE5CA470J2P1Z03B	
C4	33p	5%	C0G	100V	2.5mm	Murata	RPE5CA330J2P1Z03B	1
C7	100n	10%	X7R	50V	2.5mm	Murata	RPER71H104K2P1A03B	2
C8	100n	10%	X7R	50V	2.5mm	Murata	RPER71H104K2P1A03B	

RESISTORS								
Ref.	Value	Tol.	Type	Rating	Manufacturer	Manufacturer Part #	Qty.	
R1	47K	1%	Metal Film	0.25W	Xicon	271-47K-RC	3	
R3	47K	1%	Metal Film	0.25W	Xicon	271-47K-RC		
R16	47K	1%	Metal Film	0.25W	Xicon	271-47K-RC		
R2	390Ω	1%	Metal Film	0.25W	Xicon	271-390-RC	1	
R4	6.8K	1%	Metal Film	0.25W	Xicon	271-6.8K-RC	1	
R5	20K	1%	Metal Film	0.25W	Xicon	271-20K-RC	1	
R6	3.3K	1%	Metal Film	0.25W	Xicon	271-3.3K-RC	2	
R7	3.3K	1%	Metal Film	0.25W	Xicon	271-3.3K-RC		
R8	1K	1%	Metal Film	0.25W	Xicon	271-1K-RC	3	
R14	1K	1%	Metal Film	0.25W	Xicon	271-1K-RC		
R15	1K	1%	Metal Film	0.25W	Xicon	271-1K-RC		
R9	56Ω	1%	Metal Film	0.25W	Xicon	271-56-RC	2	
R13	56Ω	1%	Metal Film	0.25W	Xicon	271-56-RC		
R10	806Ω	1%	Metal Film	0.25W	Xicon	271-806-RC	1	
R11	5.6Ω	5%	Metal Film	1W	Vishay/BC	PR01000105608JR500	2	
R12	5.6Ω	5%	Metal Film	1W	Vishay/BC	PR01000105608JR500		

DIODES							
Ref.	Type	Application	V _{R(max)}	I _{F(max)}	Manufacturer	Manufacturer. Part #	Qty.
D1	1N4148	Small Signal	100V	0.3A	Fairchild	1N4148	8
D2	1N4148	Small Signal	100V	0.3A	Fairchild	1N4148	
D3	1N4148	Small Signal	100V	0.3A	Fairchild	1N4148	
D4	1N4148	Small Signal	100V	0.3A	Fairchild	1N4148	
D5	1N4148	Small Signal	100V	0.3A	Fairchild	1N4148	
D6	1N4148	Small Signal	100V	0.3A	Fairchild	1N4148	
D7	1N4148	Small Signal	100V	0.3A	Fairchild	1N4148	
D8	1N4148	Small Signal	100V	0.3A	Fairchild	1N4148	

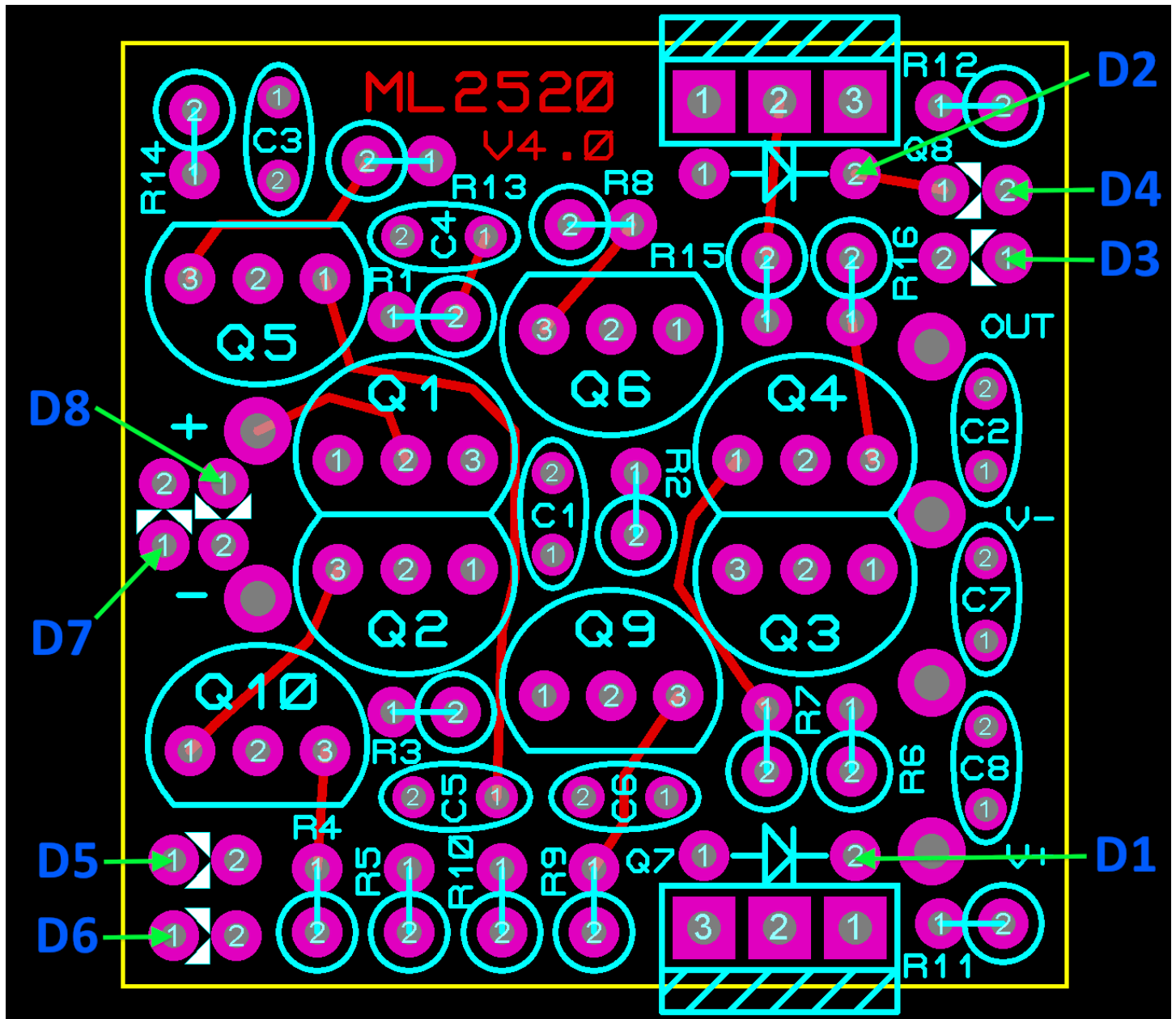
TRANSISTORS						
Ref.	Type	Application	Comments	Mfr.	Mfr. Part #	Qty.
Q1	BC550C - NPN	Low Noise Amp	H _{fe} > 400 Matched Pair	Fairchild	BC550C	6
Q2	BC550C - NPN	Low Noise Amp		Fairchild	BC550C	
Q3	BC550C - NPN	Low Noise Amp	-	Fairchild	BC550C	
Q4	BC550C - NPN	Low Noise Amp	-	Fairchild	BC550C	
Q5	BC550C - NPN	Low Noise Amp	-	Fairchild	BC550C	
Q10	BC550C - NPN	Low Noise Amp	-	Fairchild	BC550C	
Q6	BC560C - PNP	Low Noise Amp	-	Fairchild	BC560C	2
Q9	BC560C - PNP	Low Noise Amp	-	Fairchild	BC560C	
Q7	BD139 - NPN	Low Power Audio	Output Transistor	Fairchild	BD139	1
Q8	BD140 - PNP	Low Power Audio	Output Transistor	Fairchild	BD140	1

MISCELLANEOUS				
Ref.	Description	Manufacturer	Manufacturer Part #	Qty.
DOA PINS	1mm Gold Finished PC Pins	Mill-Max	3103-2-00-21-00-00-08-0	6
PCB	ML2520 v4 PC Board	Whistle Rock Audio	ML2520-PCB	1

COMPONENT LAYOUT

Below is the component layout of the ML2520 PCB. Notice that none of the diodes are labeled on the PCB silk screen in an effort to keep the layout uncluttered and easier to read. Refer to the title page picture of this document if you are unsure about the diodes orientation.

All missing labels are clearly shown below.



RECOMMENDED STUFFING ORDER

The following is only a recommendation. Feel free to improvise whichever way you feel most comfortable with.

1	DOA PINS	23	R5 – 20K Ω res. (RED-BLK-BLK-RED-BRN)
2	C2 – 10pF (labeled '10')	24	R4 – 6.8K Ω res. (BLU-GRY-BLK-BRN-BRN)
3	C7 – 100nF (labeled '104')	25	C5 – 10pF (labeled '10')
4	C8 – 100nF (labeled '104')	26	R3 – 47K Ω res. (YEL-PUR-BLK-RED-BRN)
5	R11 – Maroon 5.6 Ω res. (GRN-BLU-GLD-GLD)	27	Q2* – BC550C (H_{fe} matched to Q1)
6	R12 – Maroon 5.6 Ω res. (GRN-BLU-GLD-GLD)	28	Q1* – BC550C (H_{fe} matched to Q2)
7	D3 – 1N4148	29	R1 – 47K Ω res. (YEL-PUR-BLK-RED-BRN)
8	D4 – 1N4148	30	C4 – 33pF (labeled '33')
9	R6 – 3.3K Ω res. (ORG-ORG-BLK-BRN-BRN)	31	R13 – 56 Ω res. (GRN-BLU-BLK-GLD-BRN)
10	R7 – 3.3K Ω res. (ORG-ORG-BLK-BRN-BRN)	32	D6 – 1N4148
11	R16 – 47K Ω res. (YEL-PUR-BLK-RED-BRN)	33	D5 – 1N4148
12	R15 – 1K Ω res. (BRN-BLK-BLK-BRN-BRN)	34	Q10 – BC550C
13	Q3 – BC550C	35	D8 – 1N4148
14	Q4 – BC550C	36	D7 – 1N4148
15	R9 – 56 Ω res. (GRN-BLU-BLK-GLD-BRN)	37	Q5 – BC550C
16	C6 – 47pF (labeled '47')	38	C3 – 47pF (labeled '47')
17	Q9 – BC560C	39	R14 – 1K Ω res. (BRN-BLK-BLK-BRN-BRN)
18	R2 – 390 Ω res. (ORG-WHT-BLK-BLK-BRN)	40	Q7 – BD139
19	C1 – 1000pF (labeled '102')	41	Q8 – BD140
20	Q6 – BC560C	42	D1* – 1N4148
21	R8 – 1K Ω res. (BRN-BLK-BLK-BRN-BRN)	43	D2* – 1N4148
22	R10 – 806 Ω res. (GRY-BLK-BLU-BLK-BRN)		

Notes:

- 1- * You can thermally couple Q1 and Q2 before stuffing and soldering them. I have not found it necessary for proper DC performance.
- 2- ** These diodes are located on the PCB such that thermal coupling with Q7 and Q8 is possible if desired. I have not found it necessary to prevent thermal runaway.

REMARKS

1. The ML2520 is optimized for +/-16V operation. Do not exceed a supply voltage of +/-20V or you risk damaging the op-amp
2. This new layout of the ML2520 allows the user to easily mount heatsinks to output transistors Q7 and Q8. This may come in useful when running the DOA at +/-20V, as the transistors generate more heat.
3. Diodes D7 and D8 are new in this revision of the ML2520. They are input protection diodes that will come in handy if the op-amp is installed in a faulty circuit.

Last modified on November 7th, 2011.

All the information within this document and the PCB layout of the ML2520 discussed herein are my intellectual property. No copying or distribution of this manual in part or in full is allowed without my prior consent. You may not use this product in any commercial application without contacting me first.

Michael Lebon, September 2011.