



ML918 DISCRETE OP-AMP KIT MANUAL

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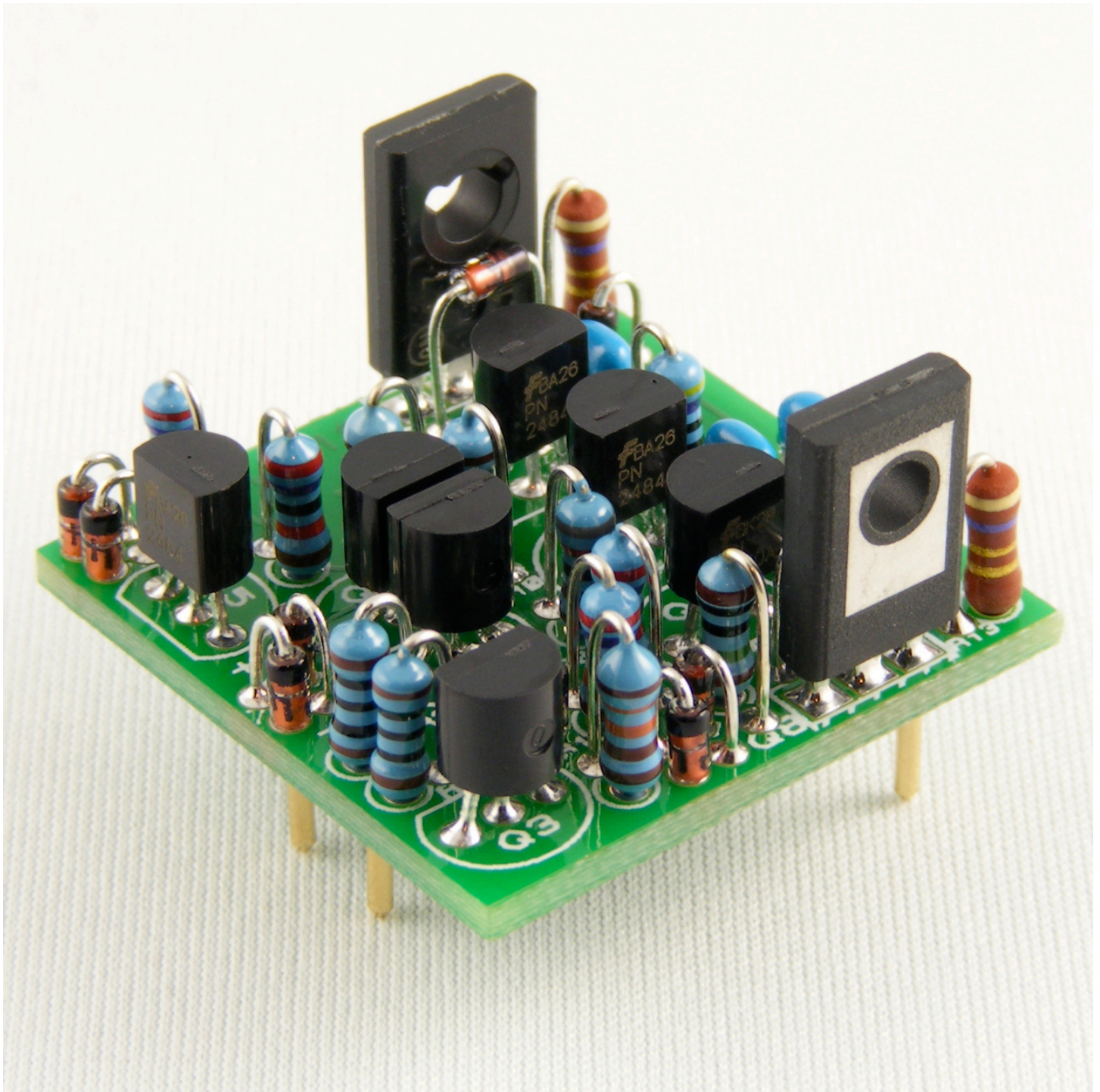


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INTRODUCTION

FOREWORD

Thank you for purchasing the ML918 Kit. The ML981 came to be from the personal request of a fellow forum member at The Lab who had been looking for a Jensen JE-918 op-amp to use in a unique preamp project. In an attempt at keeping things as authentic as possible, the closest modern substitute transistors are used in the ML918 along with the highest quality ceramic capacitors and resistors. But...what about the sound? Being the 'old brother' of the very well regarded Jensen 990 op-amp, it is clean, smooth and has a well-balanced tone compared to the more forward sounding ML2520.

The ML918 will bring a great tonal option to your recordings. 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	39p	5%	C0G	100V	2.5mm	Murata	RPE5C2A390J2P1Z03B	1
C2	1n	5%	C0G	50V	2.5mm	Murata	RPE5C1H102J2P1A03B	1
C3	100n	10%	X7R	50V	2.5mm	Murata	RPER71H104K2P1A03B	2
C4	100n	10%	X7R	50V	2.5mm	Murata	RPER71H104K2P1A03B	

RESISTORS								
Ref.	Value	Tol.	Type	Rating	Manufacturer	Manufacturer Part #	Qty.	
R1	1.3K	1%	Metal Film	0.25W	Xicon	271-1.3K-RC	1	
R2	100R	1%	Metal Film	0.25W	Xicon	271-100-RC	2	
R3	100R	1%	Metal Film	0.25W	Xicon	271-100-RC		
R4	8.2K	1%	Metal Film	0.25W	Xicon	271-8.2K-RC	1	
R5	2.7K	1%	Metal Film	0.25W	Xicon	271-2.7K-RC	1	
R6	27K	1%	Metal Film	0.25W	Xicon	271-27K-RC	3	
R7	27K	1%	Metal Film	0.25W	Xicon	271-27K-RC		
R8	27K	1%	Metal Film	0.25W	Xicon	271-27K-RC		
R9	470R	1%	Metal Film	0.25W	Xicon	271-470-RC	1	
R10	10K	1%	Metal Film	0.25W	Xicon	271-10K-RC	1	
R11	150R	1%	Metal Film	0.25W	Xicon	271-150-RC	2	
R12	150R	1%	Metal Film	0.25W	Xicon	271-150-RC		
R13	4.7R	5%	Metal Film	1W	Vishay/BC	PR01000104708JR500	2	
R14	4.7R	5%	Metal Film	1W	Vishay/BC	PR01000104708JR500		

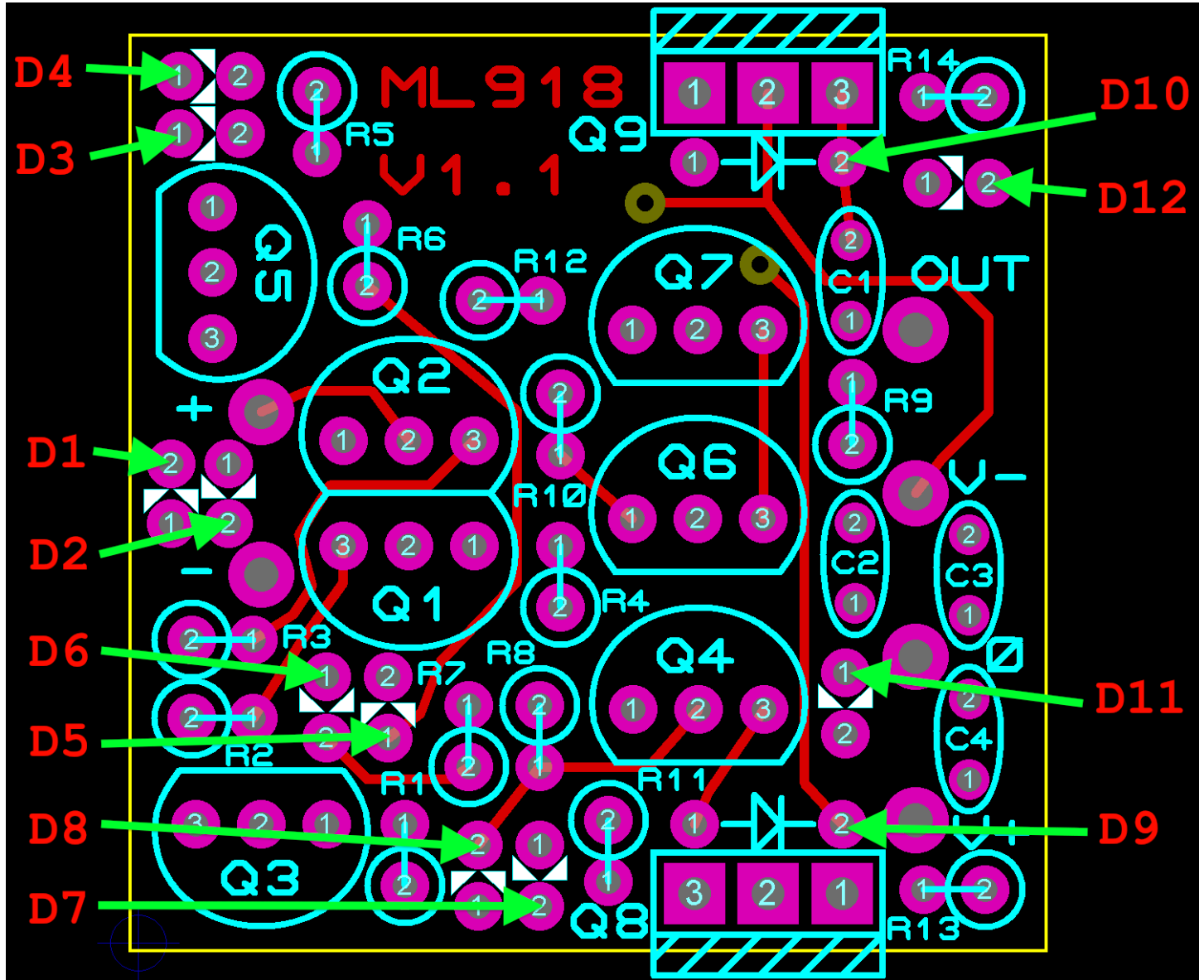
DIODES								
Ref.	Type	Application	$V_{R(max)}$	$I_{F(max)}$	Manufacturer	Manufacturer Part #	Qty.	
D1	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B	12	
D2	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		
D3	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		
D4	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		
D5	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		
D6	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		
D7	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		
D8	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		
D9	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		
D10	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		
D11	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		
D12	1N914B	Small Signal	100V	0.3A	Fairchild	1N914B		

TRANSISTORS						
Ref.	Type	Application	Comments	Mfr.	Mfr. Part #	Qty.
Q1	BC560C - PNP	Low Noise Amp	H _{fe} > 400 Matched Pair	Fairchild	BC560C	2
Q2	BC560C - PNP	Low Noise Amp		Fairchild	BC560C	
Q3	PN4250A - PNP	General Purpose	2N4250A Replacement	Fairchild	PN4250A	2
Q4	PN4250A - PNP	General Purpose	2N4250A Replacement	Fairchild	PN4250A	
Q5	PN2484 - NPN	Low Noise Amp	2N2484 Replacement	Fairchild	PN2484	3
Q6	PN2484 - NPN	Low Noise Amp	2N2484 Replacement	Fairchild	PN2484	
Q7	PN2484 - NPN	Low Noise Amp	2N2484 Replacement	Fairchild	PN2484	
Q8	MJE181 - NPN	Low Power Audio	Output Transistor	ON Semi.	MJE181G	1
Q9	MJE171 - PNP	Low Power Audio	Output Transistor	ON Semi.	MJE171G	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	ML918 v1.1 PC Board	Whistle Rock Audio	ML918-PCB	1

COMPONENT LAYOUT

Below is the component layout of the ML918 PCB. Notice that most diodes are not labeled on the PCB silk screen 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.



RECOMMENDED STUFFING ORDER

The following is only a recommendation based on my personal experience building a fair amount of ML918 OP-AMPS. Feel free to improvise if you are comfortable with a soldering iron.

1	DOA PINS	21	R1 – 1.3K Ω res. (BRN-ORG-BLK-BRN-BRN)
2	R13 – Maroon 4.7 Ω res. (YEL-PUR-GLD-GLD)	22	D5 – 1N914B
3	R14 – Maroon 4.7 Ω res. (YEL-PUR-GLD-GLD)	23	D6 – 1N914B
4	D12 – 1N914B	24	Q3 – PN4250A
5	C3 – 100nF (labeled '104')	25	R2 – 100 Ω res. (BRN-BLK-BLK-BLK-BRN)
6	C4 – 100nF (labeled '104')	26	R3 – 100 Ω res. (BRN-BLK-BLK-BLK-BRN)
7	D11 – 1N914B	27	Q1* – BC560C (H_{fe} matched to Q2)
8	C2 – 1nF (labeled '102')	28	Q2* – BC560C (H_{fe} matched to Q1)
9	R9 – 470 Ω res. (YEL-PUR-BLK-BLK-BRN)	29	D1 – 1N914B
10	C1 – 39pF (labeled '39')	30	D2 – 1N914B
11	Q4 – PN4250A	31	R12 – 150 Ω res. (BRN-GRN-BLK-BLK-BRN)
12	Q6 – PN2484	32	R6 – 27K Ω res. (RED-PUR-BLK-RED-BRN)
13	Q7 – PN2484	33	Q5 – PN2484
14	R11 – 150 Ω res. (BRN-GRN-BLK-BLK-BRN)	34	R5 – 2.7K Ω res. (RED-PUR-BLK-BRN-BRN)
15	R8 – 27K Ω res. (RED-PUR-BLK-RED-BRN)	35	D3 – 1N914B
16	R4 – 8.2K Ω res. (GRY-RED-BLK-BRN-BRN)	36	D4 – 1N914B
17	R10 – 10K Ω res. (BRN-BLK-BLK-RED-BRN)	37	Q8 – MJE181
18	D7 – 1N914B	38	Q9 – MJE171
19	D8 – 1N914B	39	D9** – 1N914B
20	R7 – 27K Ω res. (RED-PUR-BLK-RED-BRN)	40	D10** – 1N914B

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 Q8 and Q9 is possible if desired. I have not found it necessary to prevent thermal runaway.

REMARKS

1. The ML918 has not been tested for unity gain stability.
2. Even with matched input transistor pair Q1 and Q2, the ML918 will have a typical <math><5\text{mV}</math> DC offset at its output. This is not a problem if driving a transformer directly.
3. Higher DC offset voltage can appear at the output if the impedances presented at the differential inputs are not equal.
4. The ML918 has been optimized for $\pm 16\text{V}$ operation. Do not exceed a supply voltage of $\pm 20\text{V}$ or you risk damaging the op-amp.
5. For $\pm 24\text{V}$ operation, substitute R6, R7 and R8 with $47\text{k}\Omega$ resistors.
6. From experience, the thermal coupling of biasing diodes D9 & D10 to Q8 & Q9 respectively is not required.
7. From experience, the thermal coupling of Q1 to Q2 is not required.

Last modified on May 22nd, 2011.

All the information within this document and the PCB layout of the ML918 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, April 2011.