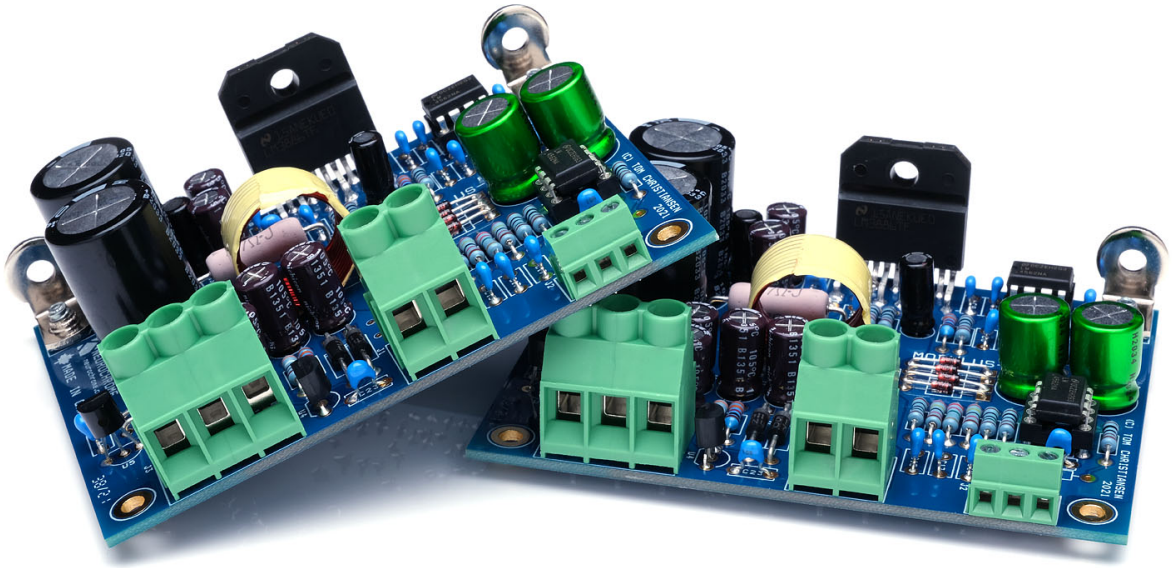
Modulus-86 R3.0 Stereo Kit Assembly Guide



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Revision History

Modulus-86 R3.0 Stereo Kit Assembly Guide

Revision	Date	Notes
1.0	13 JAN 2023	Document created.
1.1	23 DEC 2024	General cleanup & consolidation.

Disclaimer

The Modulus-86 is a circuit intended for Do-It-Yourself (DIY) assembly and use. While the circuit has been thoroughly tested and found to work exceptionally well, mistakes in assembly do happen. By using the circuit board, the builder assumes all responsibility for the performance of the assembled board and assumes all risk associated with the assembly and use of the board.

Design Documentation & Warnings

Please read the design documentation for the Modulus-86 before you start building. In particular, heed the warnings in that document and familiarize yourself with the power supply needs and heat sink requirements of the Modulus-86.

Make sure the heat sink is smooth and free of burrs in the area where you will mount the LM3886. Such burrs will often puncture the included thermal pads, thereby, connecting the metal back of the LM3886 to the (grounded) heat sink. This will destroy the LM3886 on the first power-up of the completed amp. Verify with an ohmmeter or continuity tester that there is no electrical connection between the metal tab of the LM3886 and the heat sink before powering up the amp for the first time.

BOM Differences

Eagle eyed builders will notice that the bill-of-materials (BOM) for the Kit differs from that in the Modulus-86 Design Documentation. Rest assured that the differences will not impact the performance of the Modulus-86. The changes were made to ensure multiple sources for the components to the extent possible and also to deal with parts obsolescence. The most noteworthy change is that the LM3886**TF**/NOPB specified for the Modulus-86 was changed to the metal back version (LM3886**T**/NOPB) in the Kit. This was done in response to supply shortages. As result, the Kit also contains the thermal pads and shoulder washers needed when mounting the metal back LM3886T to a heat sink.

Assembly Sequence

Start with the components that are low to the board (1/4 W resistors) and work towards those that stand tall (electrolytic capacitors). Do this while accounting for the components' susceptibility to damage by electrostatic discharge (ESD) – ideally by mounting the most ESD tolerant parts first. In addition, mount the most heat tolerant parts first. Generally, this results in the following assembly sequence:
1/4 W resistors, IC sockets, ceramic capacitors, diodes, mounting brackets, connectors, inductors, power resistors, electrolytic capacitors, and finally the ICs. For more detail please see the Assembly section of the Modulus-86 Design Documentation.
The LM3886 needs to be aligned correctly between the circuit board and the heat sink. The easiest way to do this is to mount the LM3886 and the circuit board to the heat sink before soldering the pins of the LM3886. Note that the mounting screw for the LM3886 needs to be fitted with the shoulder washer included with the Kit to prevent the screw from forming an electrical connection between the metal tab of the LM3886 and the heat sink. The shoulder washer is intended for use with a US #4 or metric M3 machine screw. Also note that the included thermal pad must be placed between the LM3886 and the heat sink. Verify with an ohmmeter or continuity tester that there is no electrical connection between the metal tab of the LM3886 and the heat sink before powering up the amp for the first time.

Parts Identification

The 1/4 W resistors can be a bit difficult to tell apart. The same goes for the ceramic capacitors. Most of these parts are delivered on paper tape so at least those are grouped by value. But not all values were available on tape, so some are mixed together in bulk.

Unpack the Kit by part type. I.e., first open the bag of resistors, sort them, and verify that you have received the correct number of each value. Then populate the circuit boards value by value. Repeat for the ceramic capacitors, etc.

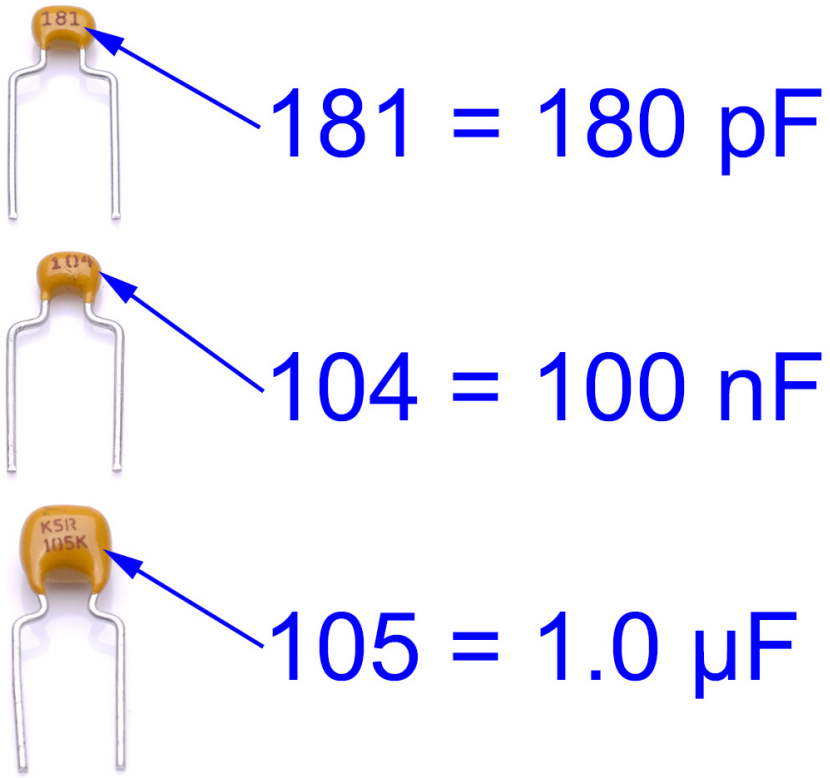
The resistor values are indicated on the resistors by coloured bands following the Electronics Colour Code. Three examples are shown below. Colour codes for the values used in the Modulus-86 are listed on the BOM. If in doubt, measure the resistor with an ohmmeter.

Orange - Orange - Red - Black - Brown = 332 Ω

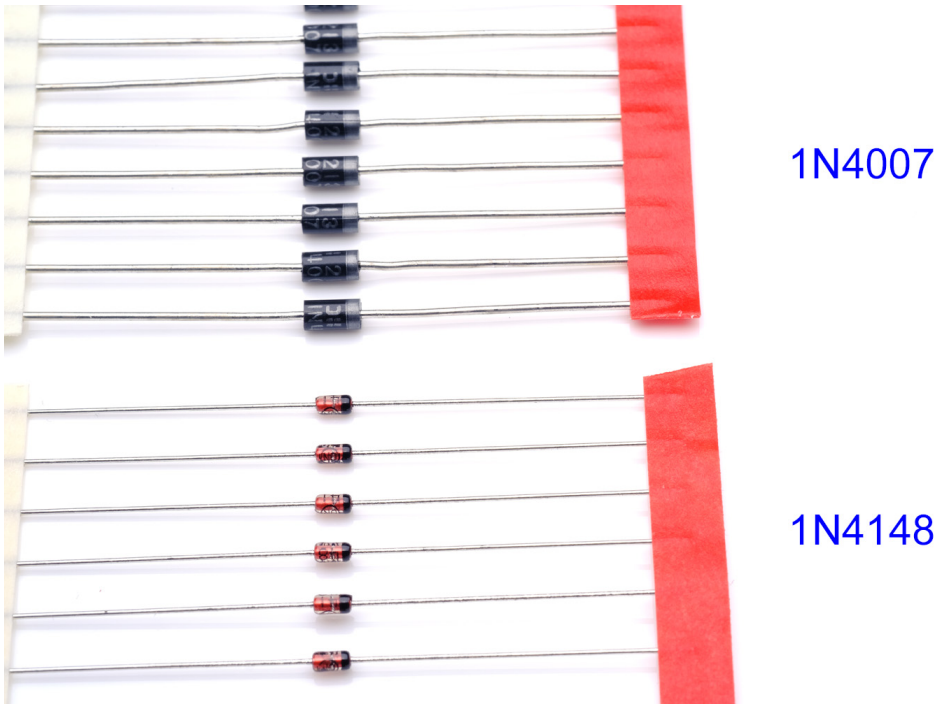
Orange - Orange - Red - Red - Brown = 33200 Ω = 33.2 kΩ

Brown - Black - Black - Brown - Brown = 1000 Ω = 1.00 kΩ

The ceramic capacitors are marked following a similar system, except with digits rather than coloured bands. The first two digits of the code form the two most significant digits of the capacitance. The third digit of the code is the multiplier (or number of zeros). The capacitance is indicated in pF. Three examples are shown below and the capacitance codes for all the ceramic capacitors are listed on the BOM. Note that in some cases the capacitance code may be followed by the letter J or K indicating ±5% and ±10% tolerance, respectively.



The diodes are marked with the part number directly on the package, but it is far easier to tell them apart by their different package types as shown below.



The remainder of the parts should be fairly straight-forward to identify as the part value is printed directly on the part.

Modulus-86 Stereo Kit: Bill of Materials

The bill of materials (BOM) for the Modulus-86 Stereo Kit is provided on the following pages. Have fun with your build!

MODULUS-86 Rev. 3.0 Stereo Kit :: Bill of Materials

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Item	Quantity	Reference	Part	Manufacturer	Manufacturer P/N	Mouser P/N	Marking
ELECTROLYTIC CAPACITORS							
1	4	C1,C13	100uF	Panasonic	EEU-EB1A101S	667-EEU-EB1A101S	100 µF, 10 V
2	12	C2,C18,C24,C25,C28,C29	22uF	KEMET	ESY226M063AE3AA	80-ESY226M063AE3AA	22 µF, 63 V
3	4	C20,C7	100uF	Nichicon	UES1C101MPM1TD	647-UES1C101MPM1TD	100 µF, 16 V, MUSE BP
4	4	C22,C26	1000uF/50V	Nichicon	UPW1H102MHD	647-UPW1H102MHD	1000 µF, 50 V
CERAMIC CAPACITORS							
5	4	C14,C3	1u0 X5R	KEMET	C333C105K5R5TA	80-C333C105K5R	105
6	14	C4,C5,C10,C11,C12,C23,C27	100n	KEMET	C322C104K5R5TA	80-C322C104K5R	104
7	2	C6	220pF NP0	Vishay	K221J10C0GH5UH5	594-K221J10C0GH5UH5	221
8	4	C16,C8	180pF NP0	KEMET	C317C181J1G5TA	80-C317C181J1G	181
9	4	C21,C9	33pF NP0	Vishay	K330J15C0GF5TH5	594-K330J15C0GF5TH5	33
10	4	C15,C19	470pF NP0	Vishay	K471J15C0GF5TH5	594-K471J15C0GF5TH5	471
11	2	C17	100pF NP0	Vishay	K101J10C0GF5UH5	594-K101J10C0GF5UH5	101
RESISTORS							
12	8	R1,R6,R8,R16	1k0	Yageo	MFR-25FBF52-1K	603-MFR-25FBF52-1K	Brown-Black-Black-Brown-Brown
13	2	R2	10k	Yageo	MFR-25FTF52-10K	603-MFR-25FTF52-10K	Brown-Black-Black-Red-Brown
14	4	R19,R3	100R	Yageo	MF0207FRE52-100R	603-MF0207FRE52-100R	Brown-Black-Black-Black-Brown
15	4	R4,R17	2k0	TE	YR1B2K0CC	279-YR1B2K0CC	Red-Black-Black-Brown-Violet
16	2	R5	1R5/2W	KOA Speer	MOSX3CT631R1R5J	660-MOSX3CT631R1R5J	1.5 Ω
17	4	R7,R18	20k	Yageo	MFP-25BRD52-20K	603-MFP-25BRD52-20K	Red-Black-Black-Red-Violet
18	4	R15,R9	24k	Yageo	MFR-25FTE52-24K	603-MFR-25FTE52-24K	Red-Yellow-Black-Red-Brown
19	6	R10,R20,R22	332R	Yageo	MFR-25FBF52-332R	603-MFR-25FBF52-332R	Orange-Orange-Red-Black-Brown
20	2	R11	33k2	Yageo	MFR-25FBF52-33K2	603-MFR-25FBF52-33K2	Orange-Orange-Red-Red-Brown
21	2	R12	2R7/2W	KOA Speer	MOSX3CT631R2R7J	660-MOSX3CT631R2R7J	2.7 Ω
22	2	R13	2M21	Stackpole	RNF14FTD2M21	Digikey: RNF14FTD2M21CT-ND	Red-Red-Brown-Yellow-Brown
23	2	R14	DNP				
24	4	R23,R21	3k90	Yageo	MFR-25FTE52-3K9	603-MFR-25FTE52-3K9	Orange-White-Black-Brown-Brown
SEMICONDUCTORS							
25	8	D1,D2,D3,D4	1N4148	ON Semiconductor	1N4148TA	512-1N4148TA	1N4148
26	8	D5,D6,D7,D8	1N4007	Diodes Incorporated	1N4007-T	621-1N4007	1N4007
27	2	U1	LM3886	Texas Instruments	LM3886T/NOPB	926-LM3886T/NOPB	LM3886T
28	4	U3,U2	LM4562	Texas Instruments	LME4562NA/NOPB	926-LM4562NA/NOPB	LM4562NA
29	2	U4	LM317L/TO	Texas Instruments	LM317LZ/NOPB	926-LM317LZ/NOPB	L317LC
30	2	U5	LM337L/TO	Texas Instruments	LM337LZ/NOPB	926-LM337LZ/NOPB	LM337LZ

MISCELLANEOUS							
31	2	J1	OUT	Phoenix Contact	1714955	651-1714955	
32	2	J2	IN	Amphenol	20020327-D031B01LF	649-220327-D031B01LF	
33	2	J3	PWR	Phoenix Contact	1714968	651-1714968	
34	2	L1	1u1	Neurochrome	MOD_IND	N/A	
35	4	BR1,BR2	4332	Keystone	4332	534-4332	
36	4	BR1,BR2	#6-32 x 1/4	Keystone	9307	534-9307	
37	4	U3,U2	Socket	Mill-Max	110-47-308-41-001000	575-110473084100 1000	
38	2	U1	Thermal pad	Kerafol	86/82	N/A	
39	2	U1	Shoulder washer	Aavid	7721-7PPSG	532-7721-7PPS	
PRINTED CIRCUIT BOARDS							
40	2		MOD86 Rev. 3.0	Neurochrome	MOD86		

Notes:
DNP = Do Not Populate