

ALEM RC1 Electrical Design Rev.H

Reference Closed-Back 4x12 Vintage 30
Candidate Prototype Schematic and BOM

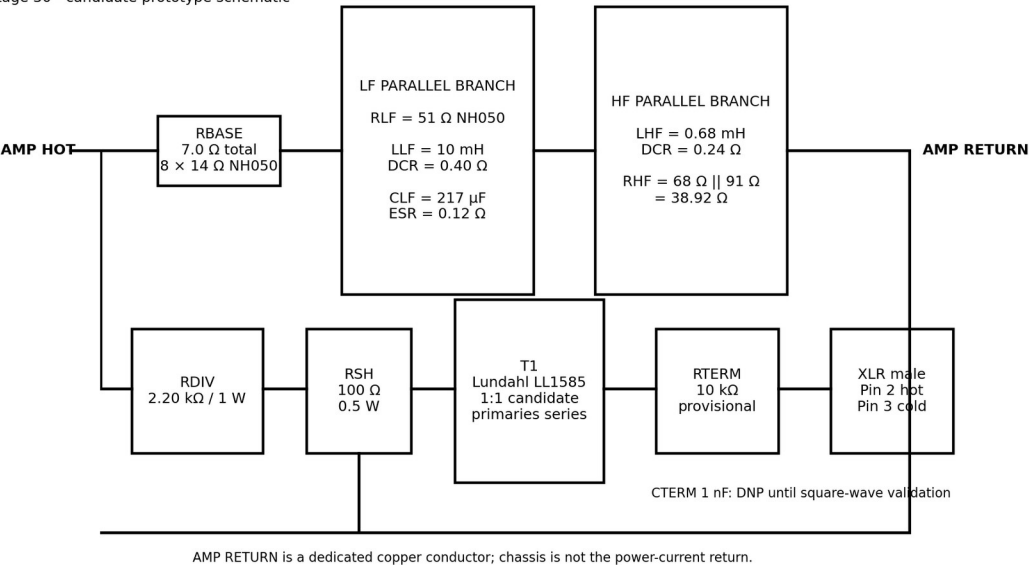
Status: CANDIDATE PROTOTYPE — NOT YET RELEASED FOR CONSTRUCTION
ECN: ECN-005
Architecture: RC1 Frozen

1. Revision purpose

Rev.H converts the ideal parametric reference into a candidate physical implementation. It adds provisional winding resistance, capacitor-bank ESR, branch dissipation, a proposed Vishay/Dale NH resistor implementation, and a passive LL1585 line-output interface for the balanced line input of a MOTU M4.

2. Candidate schematic

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Reference Closed-Back 4x12 Vintage 30 - candidate prototype schematic



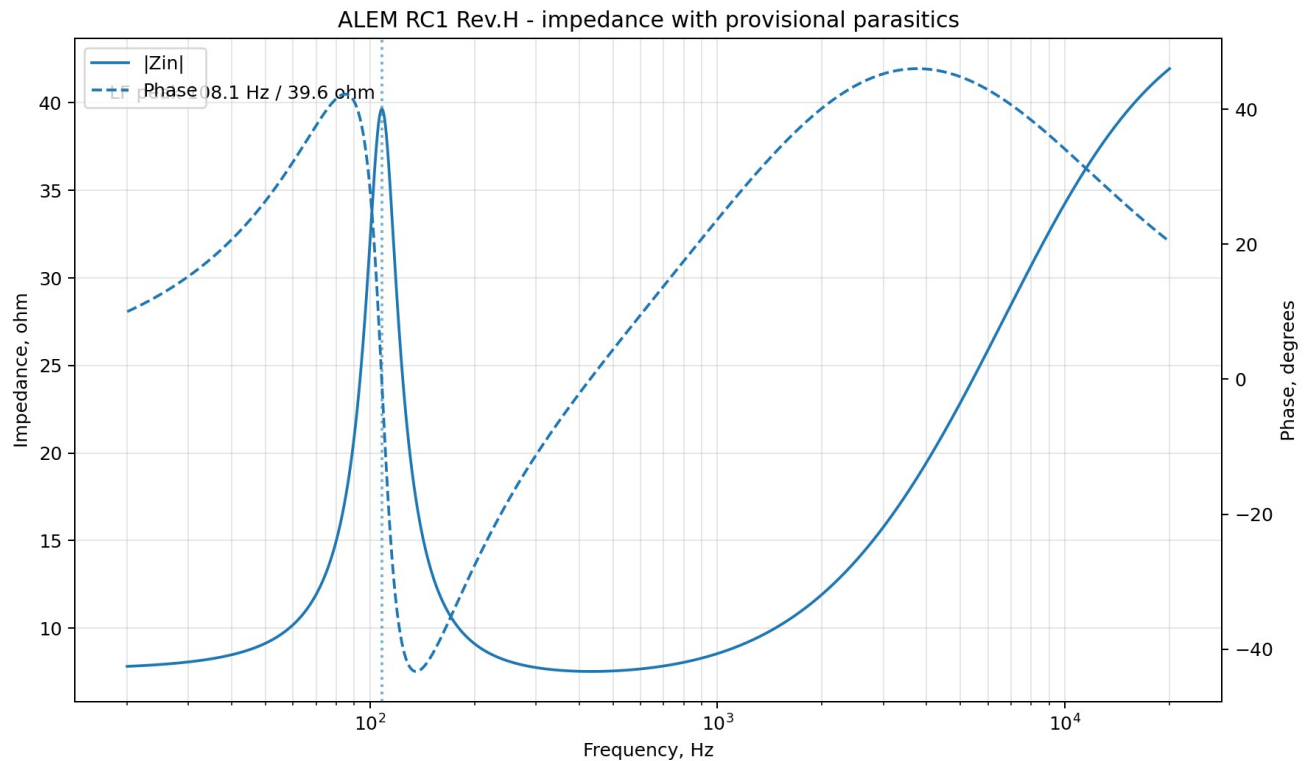
The measurement output is connected across AMP HOT and AMP RETURN through a high-value divider. It is not inserted in the power-current path. XLR pin 1 and the transformer screen are bonded to the chassis locally at the XLR connector; AMP RETURN remains a separate copper conductor.

3. Electrical network values

Element	Value	Physical candidate	Function	Status
RBASE	7.0 Ω	8 $\times$ 14 Ω NH050: four 28 Ω series pairs in parallel	Midband floor / power dissipation	Candidate

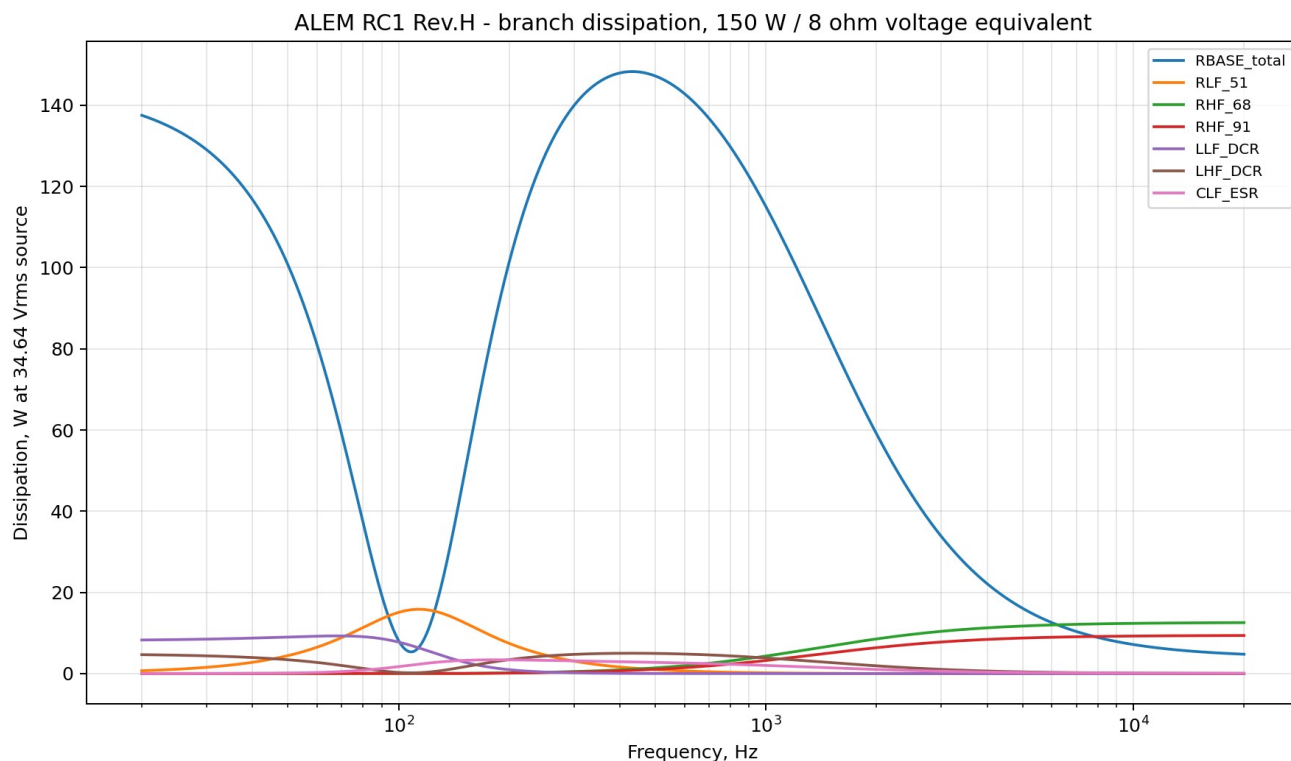
RLF	51 Ω	1 $\times$ NH050	Restores LF peak after parasitic losses	Candidate
LLF	10 mH + 0.40 Ω	Jantzen 000-5387	LF resonance	Candidate / test required
CLF	217 μ F + 0.12 Ω ESR	6 $\times$ 33 μ F + 18 μ F + 1 μ F	LF resonance	Candidate / ripple test required
LHF	0.68 mH + 0.24 Ω	Jantzen 000-1854	HF inductive rise	Preferred candidate
RHF	38.92 Ω	68 Ω NH050 91 Ω NH050	HF limit / damping	Candidate

4. Calculated impedance with provisional parasitics



Calculated LF maximum: 108.1 Hz at 39.64 Ω . Minimum impedance: 7.53 Ω at 433 Hz. The model remains above the 6.8 Ω safety target, but this result must be repeated with measured component values and an independent circuit simulator.

5. Branch power analysis



Element	Maximum dissipation	Frequency	Engineering decision
RBASE_total	148.31 W	433 Hz	Distributed across eight NH050 units
RBASE_each_8x14	18.54 W	433 Hz	Acceptable candidate; chassis thermal test mandatory
RLF_51	15.84 W	114 Hz	NH050 gives substantial electrical margin
LLF_DCR	9.29 W	68 Hz	Validate winding temperature and L(I)
CLF_ESR	3.40 W	185 Hz	Validate bank ripple current and temperature
RHF_68	12.55 W	20000 Hz	NH050 gives substantial margin
RHF_91	9.38 W	20000 Hz	NH050 gives substantial margin
LHF_DCR	5.01 W	430 Hz	Validate coil temperature

6. LL1585 line-output candidate

The proposed passive divider is 2.20 k Ω series and 100 Ω shunt. Its unloaded division ratio is 0.04348 and its Thevenin source resistance is approximately 95.7 Ω . This is deliberately much lower than the earlier 47 k Ω / 2.2 k Ω concept and is a more credible passive drive for LL1585.

Amplifier condition	Divider output	Level	Series-resistor loss
1 W / 8 Ω	0.123 Vrms	-15.99 dBu	0.003 W
10 W / 8 Ω	0.389 Vrms	-5.99 dBu	0.033 W

100 W / 8 Ω	1.230 Vrms	4.01 dBu	0.333 W
120 W / 8 Ω	1.347 Vrms	4.80 dBu	0.399 W
150 W / 8 Ω	1.506 Vrms	5.77 dBu	0.499 W

The calculation does not yet include transformer insertion loss or frequency-dependent loading. RTERM = 10 k Ω is provisional. CTERM = 1 nF is marked DNP and must not be populated unless the square-wave test demonstrates that correction is required.

7. Prototype BOM release position

The accompanying spreadsheet is the first Candidate Prototype BOM. It is not a purchase release. The selected resistor topology is sufficiently defined for quotation and mechanical placement, but LLF, CLF and LL1585 interface components remain subject to bench qualification.

8. Mandatory gates before construction release

- Run the supplied netlist in LTspice or ngspice and independently reproduce the impedance curve.
- Measure LLF inductance versus current to at least 5 A RMS / 8 A peak and record winding temperature.
- Measure the assembled CLF bank capacitance, ESR and ripple-current heating.
- Verify that the Modushop side panels keep every NH050 case temperature within the chosen derating limit.
- Measure LL1585 frequency response, phase, THD and square-wave behavior with the 2.20 k Ω / 100 Ω divider and MOTU-equivalent load.
- Confirm no audible or measurable magnetic pickup in the line-output transformer after final component placement.

9. Source notes

- Lundahl LL1585 datasheet: <https://www.lundahltransformers.com/wp-content/uploads/datasheets/1585.pdf>
- Vishay/Dale RH/NH datasheet: <https://www.vishay.com/docs/30201/rhnh.pdf>
- MOTU M4 specifications: <https://motu.com/en-us/products/m-series/m4/specs/>
- Jantzen 000-5387 candidate data: <https://www.soundimports.eu/en/jantzen-audio-000-5387.html>
- Jantzen 000-1854 candidate data: <https://www.soundimports.eu/en/jantzen-audio-000-1854.html>

10. Release decision

Rev.H is accepted as the Candidate Prototype Electrical Design. Architecture remains frozen. Numerical changes required by independent simulation or bench validation are allowed under ECN without reopening voicing, attenuation, Cab Out or multi-profile functionality.