

Adire Audio's Bang! Loudspeaker

Superior Sound for a C Note!



Bang! Loudspeaker Photo

This page describes the Bang! Loudspeaker. This design is targeted as a sub-\$200 loudspeaker design, created as an entry to a \$100 loudspeaker design contest. The name Bang! actually arises from the high-value, "bang-for-the-buck" this design represents. The \$100 cost limit for the contest included:

Raw Drivers

Crossover Components

Electrical Terminals

Wire

The cost of damping material, grille material, speaker cabinets were not included, since they can usually be scrounged for cheap. The cost applied to a PAIR of speakers; that is, we had a budget of \$50 per speaker. Any style, drivers, etc. of loudspeaker could be used, as long as the \$100 total system cost was observed.

The rules of the contest were:

1. The price of all electrical components in the speakers MUST be less than \$100 US
2. The prices must represent prices available to everyone - no back-door/dealer deals
3. All components must be available to everyone - again, no special deals or sale prices allowed
4. Design must be completely documented and reproducible

Our additional, self-imposed design goals were:

1. Efficiency must be above 93 dB SPL (1w/1m) for use with low power SE tube amps
2. Bass extension (-3 dB point) must be below 40 Hz

3. Frequency response must be better than +/- 3dB from 200 Hz to 20 kHz
4. Imaging must be very good
5. Power handling must be greater than 60 W long term
6. Cabinet construction should be simple and low-cost
7. Total system cost should be limited to \$200

This design should represent a great starting project for a new speaker builder. The low cost is affordable to most people, and with the design goals the system should offer good performance.

By now, you probably want to know more about this speaker... well, let's dispense the legal stuff first...

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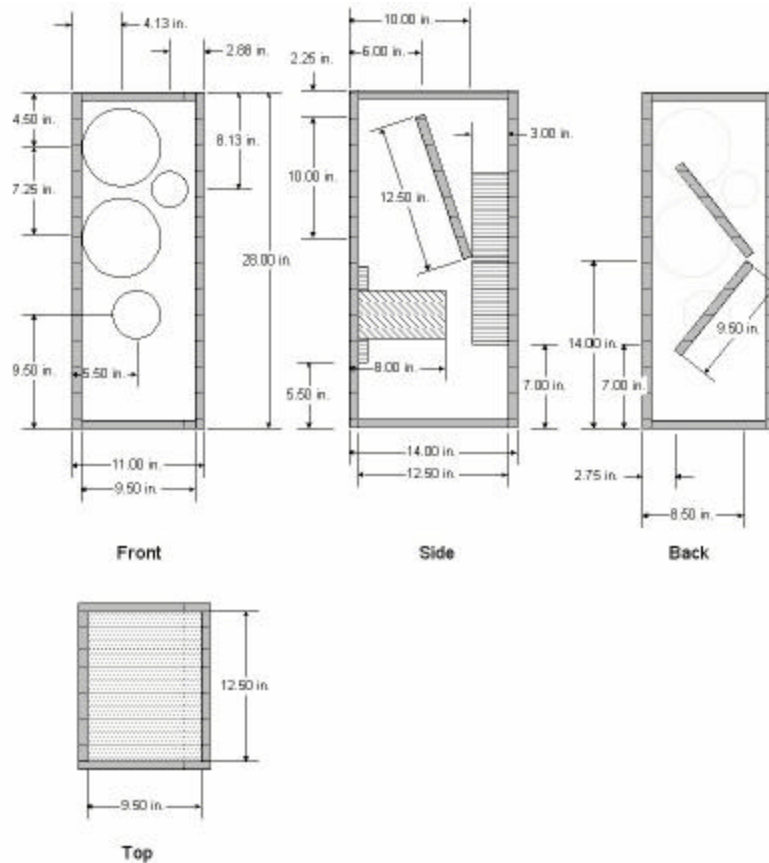
Oh yeah... Few last things. If you could be so kind as to drop us a note describing what you think of the system, we'd greatly appreciate it! Also, if you've published a page about your Bang!, we'll be happy to add a link from our site to yours, too.

With that out of the way, here's everything you would want to know!

1. To meet design goals 1 and 2, we used a pair of 6.5" woofers in a vented enclosure.
2. To meet design goal 3, good drivers, and a custom-tuned crossover are used.
3. To meet design goals 4 and 5, we used a 4th order LR crossover.
4. Lastly, to meet design goal 6, we used ordinary 3/4" particleboard, a plain, rectangular box, and low-cost veneer (*Formica brand laminate*).

The woofers we used are the MCM 55-1170, and the tweeter is the MCM 53-525. Net internal volume of the box is 46.5 liters (*note that the [Madisound](#) WS123REV is almost a PERFECTLY sized box to use, if you do not want to make your own*), tuned to 42 Hz with a 4" port that's 8" long.

Bang! Loudspeaker Cabinet Design-



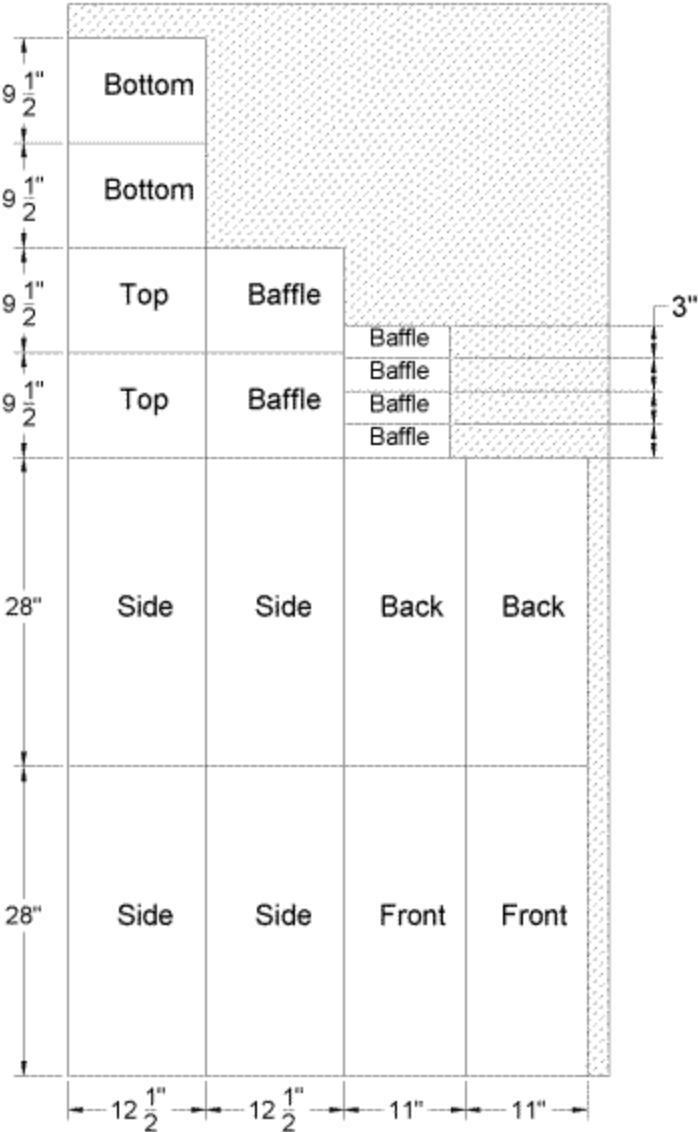
Cabinet drawing courtesy of Bang!-builder Robert Pfister; thanks, Robert!

The cabinets are constructed out of 3/4" particleboard. We didn't use MDF mainly because we already had the particleboard, and with the amount of bracing and dimensions of the cabinet, they're quite dead anyway. Also, since particleboard is roughly half the cost of MDF and takes nails (*rather than screws, as would be needed for MDF*), particleboard keeps the cabinet cost down.

However, we do understand that most DIYers have sheets of MDF laying around, and probably could guide you to the MDF stack in the local lumber store while blindfolded and hopping on one leg! As such, we've got a sheet-cut guide that assumes MDF. Remember, a sheet of MDF is 97" long by 49" wide - it's 1" bigger in each dimension, as compared to particleboard or plywood.

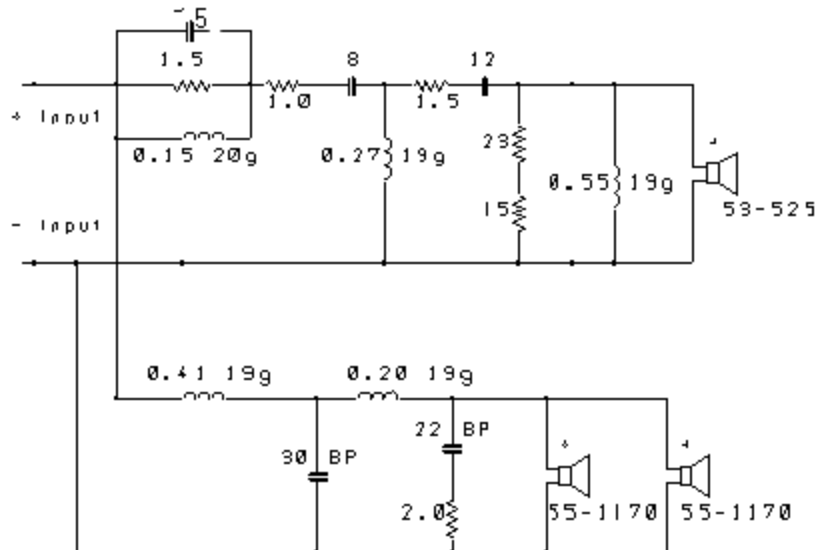
If you do use particleboard or plywood, you can still use this cut sheet. However, there will be VERY little scrap left down by the big panels (after you account for the kerfs, you're looking at around 1/2" overall), so take some time to get the cuts just right!

Here's the sheet-cut guide for all the cabinet pieces:



Updated drawing courtesy of Jesse B - Thank you, Jesse!

The system uses a modified 4th order LR crossover, with a crossover frequency of ~2.4 kHz for the woofers, and ~2.2 kHz for the tweeter (*the overlap takes care of a small suck-out in the tweeter at that frequency*). Also, a single notch filter is used to remove a small broad rise in the tweeter response (*from roughly 4 kHz to 9 kHz*). The crossover design is tuned for the the MCM drivers only; using other drivers will most likely result in worse performance.



All cap values uF. resistors in ohms. inductors in mH
 All caps are Carlo metallized mylar unless otherwise noted
 All resistors are 5% 15W wirewound sandwich
 All inductors are air core of indicated gauge

Bang! Loudspeaker Crossover Design

We used an [IMP/M](#) to measure this design. Try these numbers on for size: +/- 2.6 dB from 200 Hz to 20 kHz. Sensitivity of 93.8 dB SPL (*peak SPL that we've attempted and measured is 117 dB SPL @ 1 kHz with both channels driven by a mono signal, for a minimum of 65 WPC power handling*). Impedance above the resonance varies from a low of 3.55 ohms @ 2.25 kHz to a high of 8 ohms at 20 kHz, with no more than 30 degrees of phase shift (*fairly flat and linear for tube and low-feedback amps*). Oh, yeah... the low frequency extension? Try 39 Hz for a -3dB point!

The cabinets were finished in Formica brand Laminate: Acajou Mahogany on the sides and top, with Nile Dorian Marble on the front. They do look different, but we like them.

Here's a FULL parts list for the speaker:

BANG! ELECTRICAL COMPONENTS					
Qty	Item	Source	Part No.	Part Cost	Line Total
2	1" Silk Dome Tweeter	MCM	53-525	\$9.99	\$19.98
4	6.5" Poly Woofer with Foam Surround	MCM	55-1170	\$7.99	\$31.96
2	0.55 mH Air Core Inductor, 19g	Madisound	.55MB	\$2.20	\$4.40
2	0.45 mH Air Core Inductor, 19g	Madisound	.45MB	\$2.20	\$4.40
2	0.30 mH Air Core Inductor, 19g	Madisound	.30MB	\$1.90	\$3.80
2	0.20 mH Air Core Inductor, 19g	Madisound	.20MB	\$1.75	\$3.50
2	0.15 mH Air Core Inductor, 20g	Madisound	.15SB	\$1.65	\$3.30
2	31 uF Bennis Bipolar Capacitor	Madisound	31BP	\$1.35	\$2.70

2	22 uF Bennis Bipolar Capacitor	Madisound	22BP	\$1.05	\$2.10
2	12 uF Carli Metallized Polyester Capacitor	Madisound	12C	\$3.20	\$6.40
2	8 uF Carli Metallized Polyester Capacitor	Madisound	8C	\$2.30	\$4.60
2	5 uF Elpac Mylar Capacitor	Madisound	5EC	\$0.65	\$1.30
2	23 ohm 5% 15W Wire Wound Resistor	Madisound	23WW	\$0.40	\$0.80
2	14 ohm 5% 15W Wire Wound Resistor	Madisound	14WW	\$0.40	\$0.80
2	2 ohm 5% 15W Wire Wound Resistor	Madisound	2WW	\$0.40	\$0.80
4	1.5 ohm 5% 15W Wire Wound Resistor	Madisound	1.5WW	\$0.40	\$1.60
2	1 ohm 5% 15W Wire Wound Resistor	Madisound	1WW	\$0.40	\$0.80
2	Chromed Input Cup	Madisound	CB CUP	\$2.00	\$4.00
10	16 g Lamp Cord, 1 foot	Home Depot	278-092	\$0.17	\$1.70

Total Electrical Cost: \$99.74

BANG! CABINET COMPONENTS

1	4' x 8' x 3/4" Particle Board	Home Depot	165-557	\$9.88	\$9.88
1	4' x 6' Formica brand Laminate	Home Depot	7008-43	\$36.77	\$36.77
1	3d Nails, 1 lb. box	Home Depot	446-475	\$1.09	\$1.09
1	Wood Glue, 10 oz. Bottle	Home Depot	620-041	\$3.27	\$3.27
1	10 oz. tube Red Devil Caulk	Home Depot	128-333	\$0.74	\$0.74
1	Frost King Rope Caulk, 90'	Home Depot	518-670	\$4.15	\$4.15
12	6x32 T-Nuts, pair	Home Depot	584-318	\$0.33	\$3.96
12	6x32 x 1" Cap Screws, pair	Home Depot	682-424	\$0.65	\$7.80
2	4" ID x 10" Long ABS tubing	Home Depot	N/A	\$1.29	\$2.58
1	1 qt. Weldwood Contact Cement	Home Depot	465-364	\$5.83	\$5.83

Total Cabinet Cost: \$76.07

TOTAL SYSTEM COST: \$175.81

You can see that the design price goals of \$100 and \$200 for the electrical and system costs, respectively, were met (*not including tax*).

MCM Electronics can be contacted at <http://www.mcmelectronics.com>. Madisound can be contacted at <http://www.madisound.com>