Example 2 - Full Range

Speaker Specifications

DC resistance	R_e	7.2 Ohms
BL product	$B\ell$	5.63 Newtons/Ampere
Suspension compliance	C_{ms}	1.35 mm/Newton
Moving mass	M_{ms}	2.8 grams
Electrical Damping	Q_{es}	0.33
Mechanical Damping	Q_{ms}	4.8
Piston Area	SD	0.0065 m^2
Voice Coil Impedance	L_e	35 μH

Lumped Parameter Model

See Appendix A for conversions.

R_e	7.2 Ohms
R_m	105 Ohms
C_m	88 μFd
L_m	42.8 mH

Infinite Baffle

Transfer function (not including air loading)

$$T_1(S) = \frac{1578S}{S^2 + 1687S + 2.66 \times 10^5}$$

Poles are at $S = -176$ and $S = -1510$ (overdamped).

Input impedance

$$Z_1(S) = 7.2\frac{S^2 + 1687S + 2.66 \times 10^5}{S^2 + 108S + 2.66 \times 10^5}$$

Poles are at $S = -54 \pm 513j$.

Simple Enclosure

The Butterworth solution with no acoustic damping materials added occurs when

f_0	190 Hz	
L_a	9.82 mH	or 1.31×10^{-8} m^5/Newton
V	1.86 Liters	using $\rho c^2 = 1.42 \times 10^5$ Newtons/m^2

Transfer function (not including air loading)

$$T_1(S) = \frac{1578S}{S^2 + 16875S + 1.42 \times 10^6}$$

Input impedance

$$Z_1(S) = 7.2\frac{S^2 + 1687S + 1.42 \times 10^6}{S^2 + 108S + 1.42 \times 10^6}$$

Frequency Responses

In the following graph, the normalized response for infinite baffle is shown in red and the simple enclosure is shown in black.