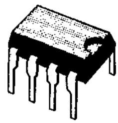
DUAL HIGH PERFORMANCE OPERATIONAL AMPLIFIER

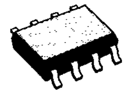
- SINGLE OR SPLIT SUPPLY OPERATION
- LOW POWER CONSUMPTION
- HIGH UNITY GAIN BANDWIDTH
- NO CROSSOVER DISTORSION
- NO POP NOISE
- SHORT-CIRCUIT PROTECTION
- HIGH CHANNEL SEPARATION

DESCRIPTION

The LS4558N is a high performance dual operational amplifier with frequency and phase compensation built into the chip. The internal phase compensation allows stable operation as voltage follower in spite of its high gain-bandwidth products. The circuit presents very stable electrical characteristics over the entire supply voltage range and the specially designed input stage allow the LS4558N to be used in low noise audio signal processing application. The optimized class AB output stage completely eliminates crossover, distorsion, under any load conditions, has large source and sink capacity and is short-circuit protected.



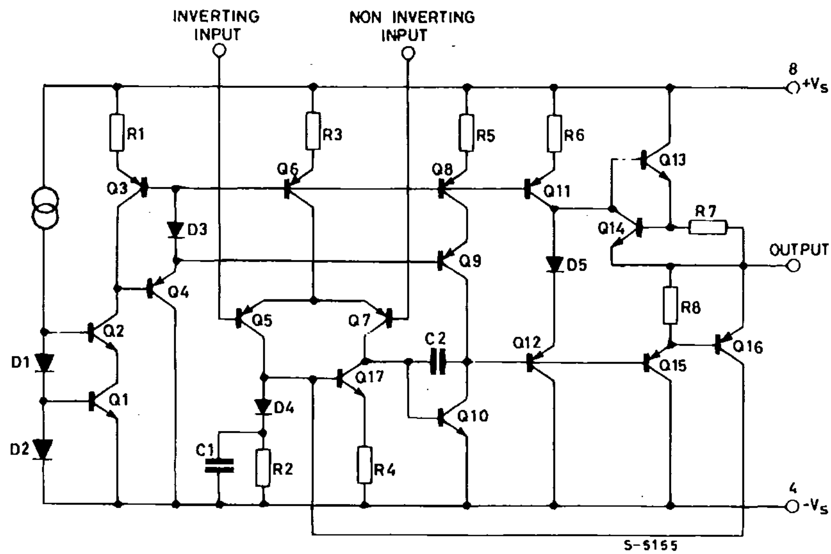
Minidip



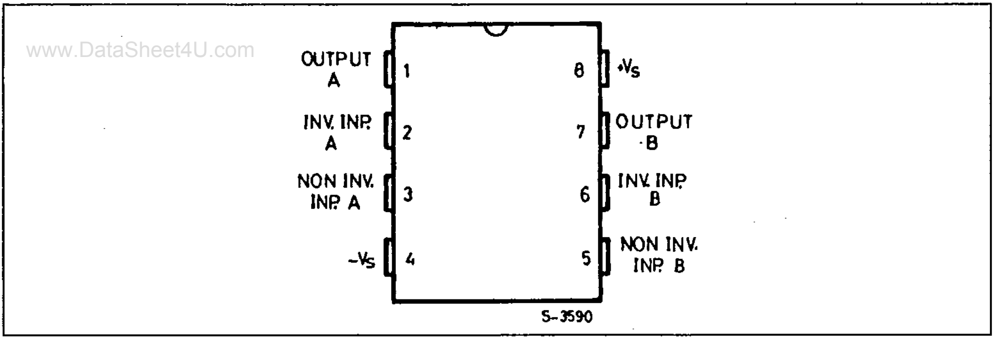
SO-8J

ORDER CODES : LS4558NB (Minidip)
LS4558NM (SO-8J)

SCHEMATIC DIAGRAM (one section)



CONNECTION DIAGRAM (top view)



ABSOLUTE MAXIMUM RATINGS

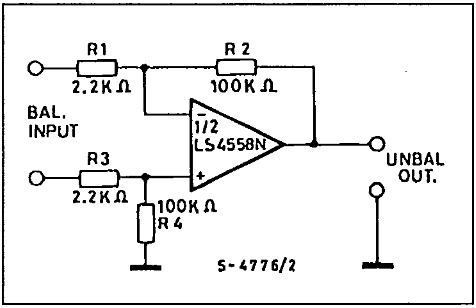
Symbol	Parameter		Value	Unit
V_s	Supply Voltage		± 18	V
V_I	Input Voltage		± V_s	
V_i	Differential Input Voltage		± (V_s – 1)	V
P_{tot}	Power Dissipation at T_{amb} = 70 °C	Minidip Micropackage	665 400	mW mW
T_{op}	Operating Temperature		0 to 70	°C
T_j	Junction Temperature		150	°C
T_{stg}	Storage Temperature		– 55 to 150	°C

THERMAL DATA

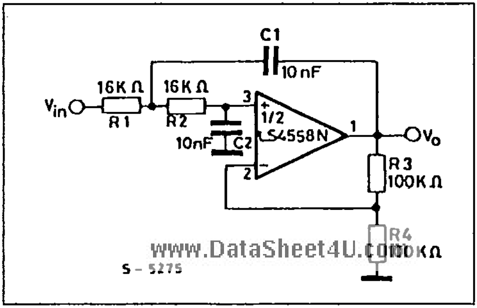
		Minidip	SO-8
$R_{th\ j\text{-}amb}$	Thermal Resistance Junction-ambient	120 °C/W	200 °C/W

TYPICAL APPLICATIONS

Balanced Input Audio Preamplifier.



DC Coupled Low-pass Active Filter
(f = 1 KHz, Gv = 6 dB).



ELECTRICAL CHARACTERISTICS ($V_s = \pm 15$ V, $T_{amb} = 25$ °C, unless otherwise specified)

Symbol	Parameter		Test Conditions	Min.	Typ.	Max.	Unit
I_s	Supply Current (*)				1	2	mA
I_b	Input Bias Current				50	500	nA
			$T_{min} < T_{op} < T_{max}$			800	nA
R_i	Input Resistance		f = 1 KHz	0.3	1		MΩ
V_{os}	Input Offset Voltage		$R_g \leq 10$ KΩ		0.5	5	mV
			$R_g \leq 10$ KΩ $T_{min} < T_{op} < T_{max}$			7.5	mV
I_{os}	Input Offset Current				20	200	nA
			$T_{min} < T_{op} < T_{max}$			500	nA
I_{sc}	Output Short Circuit Current				23		mA
G_v	Large Signal Open Loop Voltage Gain		$R_L = 2$ KΩ	86	100		dB
B	Gain-bandwidth Product		f = 20 KHz	2	3		MHz
e_N	Total Input Noise Voltage		f = 1 KHz $R_g = 50$ Ω $R_g = 1$ KΩ $R_g = 10$ KΩ		8 10 18	15	$\frac{nV}{\sqrt{Hz}}$
e_N	Popcorn Noise		B = 1 Hz to 1 KHz $R_g = 10$ KΩ t = 10 sec			10	µV Peak
d	Distortion		$G_v = 20$ dB $R_L = 2$ KΩ $V_o = 2$ Vpp f = 1 KHz		0.03		%
V_o	Output Voltage Swing		$R_L = 2$ KΩ		± 13		V
V_o	Large Signal Voltage Swing		$R_L = 10$ KΩ f = 10 KHz		28		Vpp
	Transient Response	Rise Time	$V_i = 20$ mV $R_L = 2$ KΩ $C_L = 100$ pF		0.13		µS
		Overshoot			5		%
SR	Slew Rate		Unity Gain $R_L = 2$ KΩ	0.8	1.5		V/µs
CMR	Common Mode Rejection		$V_i = 10$ V $T_{min} < T_{op} < T_{max}$	70	90		dB
SVR	Supply Voltage Rejection		$V_i = 1$ V f = 100 Hz $T_{min} < T_{op} < T_{max}$	80	100		dB
CS	Channel Separation		f = 10 KHz $R_g = 1$ KΩ		105		dB

(*) Both amplifiers.

Figure 1 : Open Loop Frequency and Phase Response.

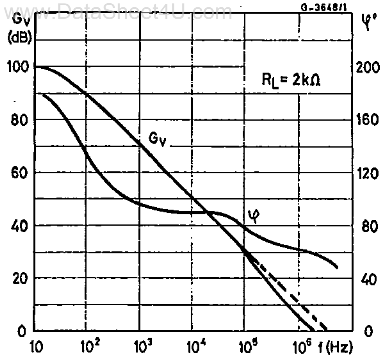


Figure 2 : Open Loop Gain vs. Ambient Temperature.

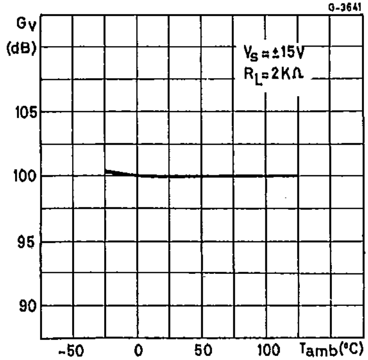


Figure 3 : Supply Voltage Rejection vs. Frequency

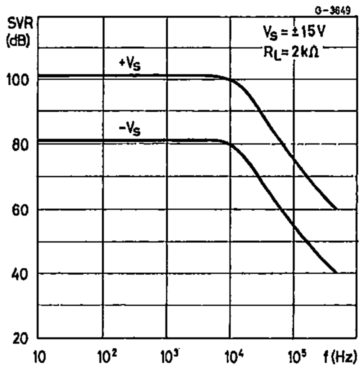


Figure 4 : Large Signal Frequency Response

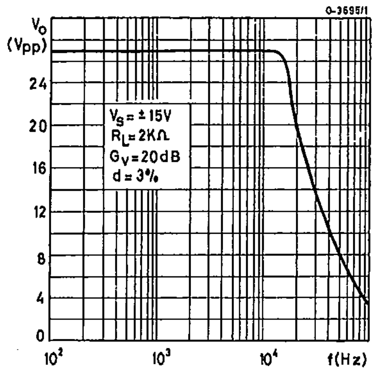


Figure 5 : Output Voltage Swing vs. Load Resistance.

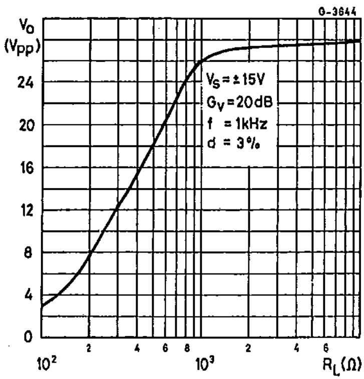


Figure 6 : Total Input Noise vs. Frequency.

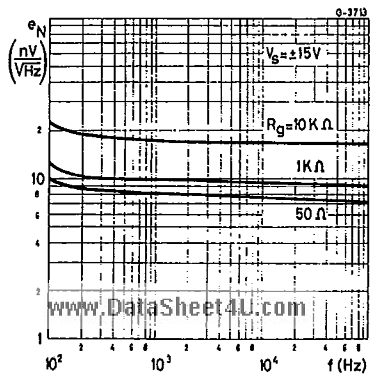


Figure 7 : Channel Separation.

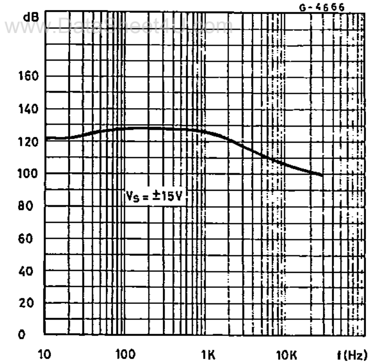


Figure 8 : Transient Response.

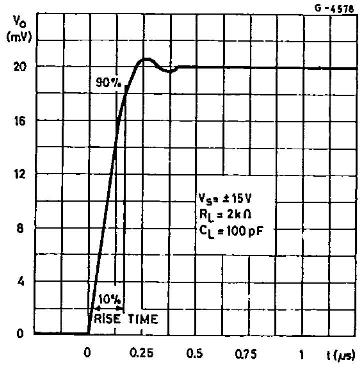
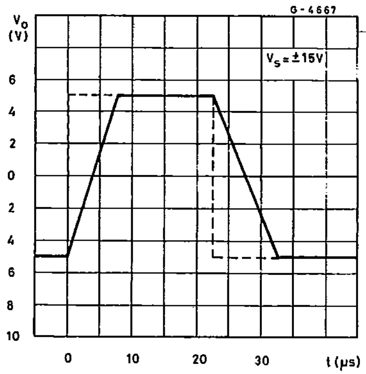
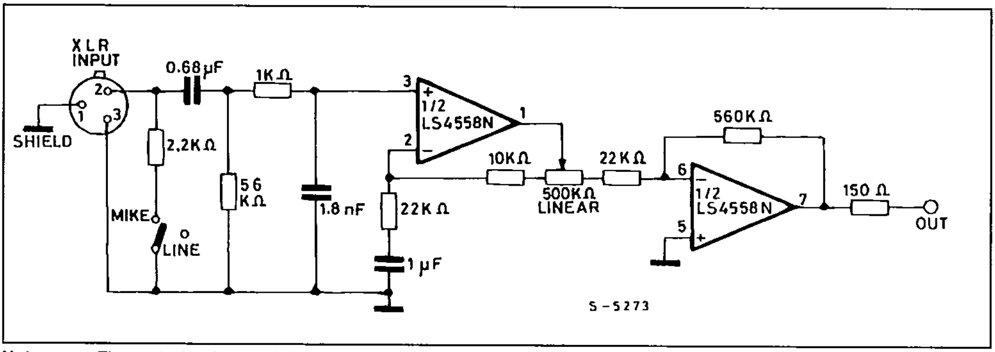


Figure 9 : Voltage Follower Large-signal Pulse Response.



APPLICATION INFORMATION

Figure 10 : Mike/Line Preamplifier for Audio Mixers (0 dB to 60 dB continuously variable gain).



Note : The particular characteristics of the circuit of Figure 10 is that using a linear potentiometer, the gain is continuously variable in a logarithmic mode from 0 dB to 60 dB in the audio band.

Figure 11 : Microphones Nomograph.

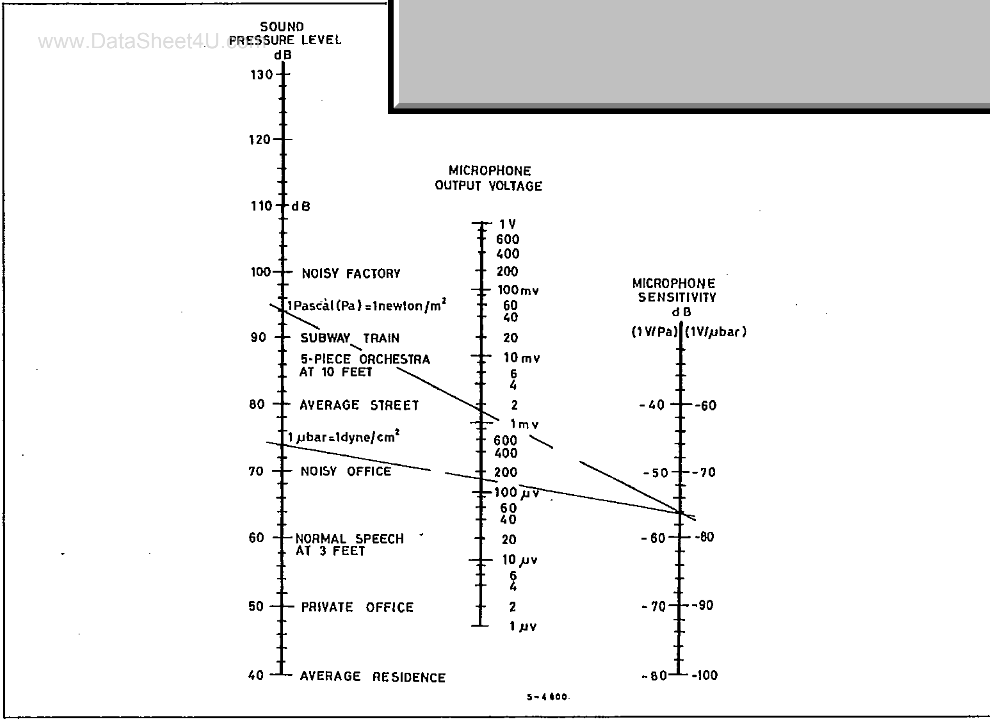


Figure 12 : Very Low-noise Mike Preamplifier (Gv = 40 dB).

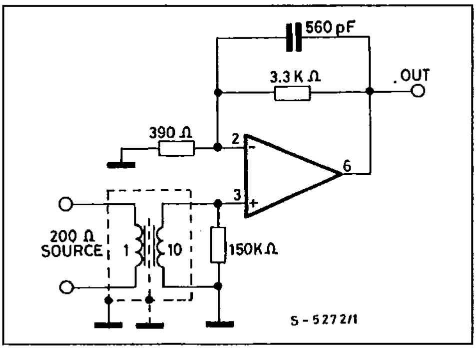


Figure 13 : Balanced Input Audio Preamplifier.

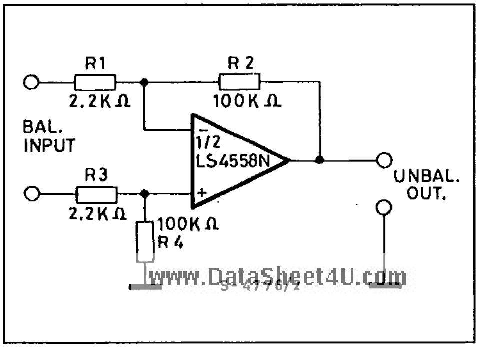


Figure 14 : 20 Hz to 200 Hz Variable High-pass Filter (Gv = 3 dB).

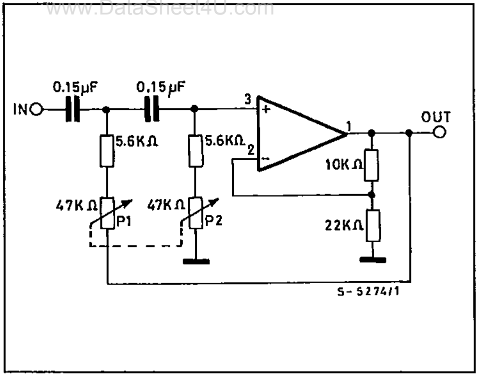


Figure 15 : Frequency Response of the High-pass Filter of Figure 14.

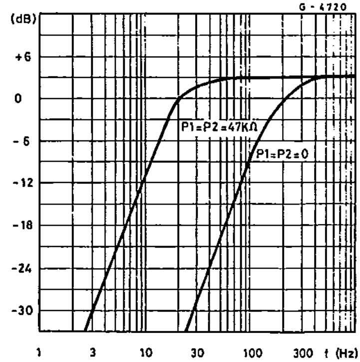


Figure 16 : DC Coupled Low-pass Active Filter (f = 1 KHz, Gv = 6 dB).

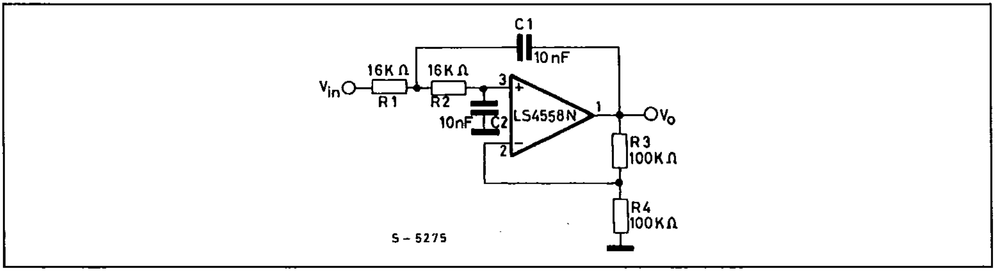


Figure 17 : Switchable HP-LP Audio Filter.

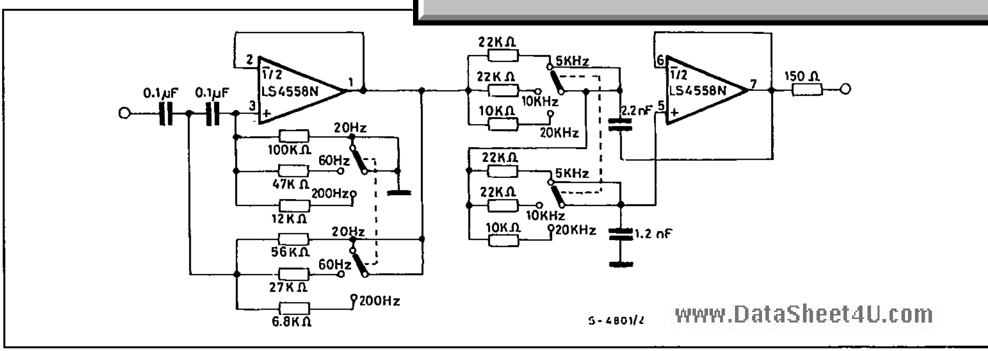
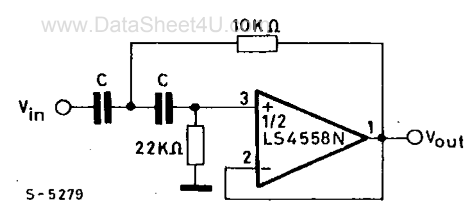
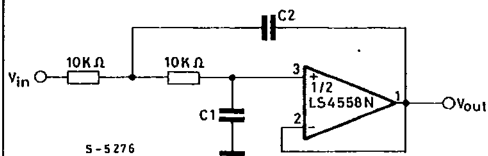


Figure 18 : Subsonic or Rumble Filter (GV = 0 dB).



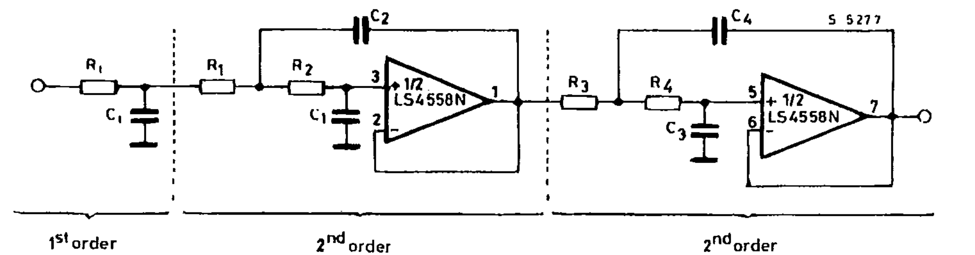
fc (Hz)	C (μF)
15	0.68
22	0.47
30	0.33
55	0.22
100	0.1

Figure 19 : High-cut Filter (Gv = 0 dB).



fc (KHz)	C1 (nF)	C2 (nF)
3	3.9	6.8
5	2.2	4.7
10	1.2	2.2
15	0.68	1.5

Figure 20 : Fifth Order 3.4 KHz Low-pass Butterworth Filter.



For f_c = 3.4 KHz and RI = R1 = R2 = R3 = R4 = 10 KΩ, we obtain :

$$C1 = 1.354 \cdot \frac{1}{R} \cdot \frac{1}{2 \pi f_c} = 6.33 \text{ nF}$$

$$C1 = 0.421 \cdot \frac{1}{R} \cdot \frac{1}{2 \pi f_c} = 1.97 \text{ nF}$$

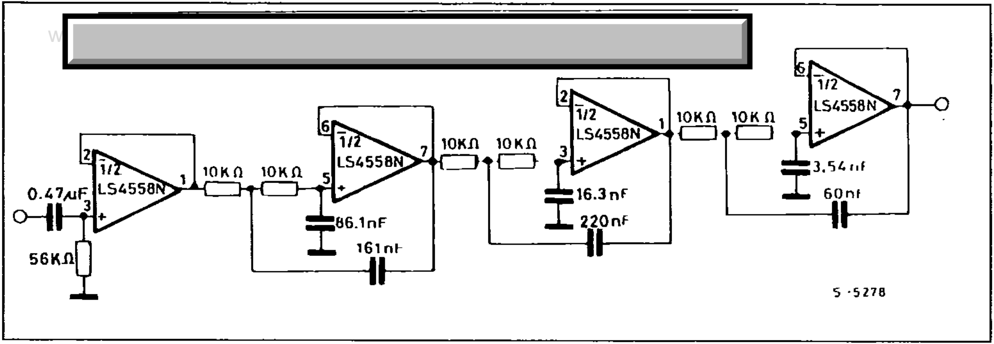
$$C1 = 1.753 \cdot \frac{1}{R} \cdot \frac{1}{2 \pi f_c} = 8.20 \text{ nF}$$

$$C1 = 0.309 \cdot \frac{1}{R} \cdot \frac{1}{2 \pi f_c} = 1.45 \text{ nF}$$

$$C1 = 3.325 \cdot \frac{1}{R} \cdot \frac{1}{2 \pi f_c} = 15.14 \text{ nF}$$

The attenuation is 30 dB at 3.8 KHz and better than 60 dB at 15 KHz.

Figure 21 : Six-pole 355 Hz Low-pass Filter (Chebychev type).



This is a 6-pole Chebychev type with ± 0.25 dB ripple in the passband. A decoupling stage is used to avoid the influence of the input impedance on the filter's characteristics. The attenuation is about 55 dB at 710 Hz and reaches 80 dB at 1065 Hz. The in band attenuation is limited in practice to the ± 0.25 dB ripple and does not exceed 0.5 dB at 0.9 fc.