

**PRELIMINARY**

Notice: This is not a final specification.  
Some parametric limits are subject to change.

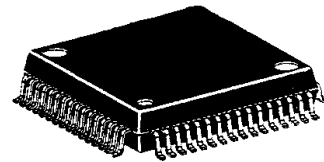
**7-ELEMENT GRAPHIC EQUALIZER WITH MICROCOMPUTER INTERFACE**

**DESCRIPTION**

The M62431FP is 2-channel 7-band graphic equalizer IC developed for home audio, car audio sets, etc. This IC can be control by serial data from microcomputer.

**FEATURES**

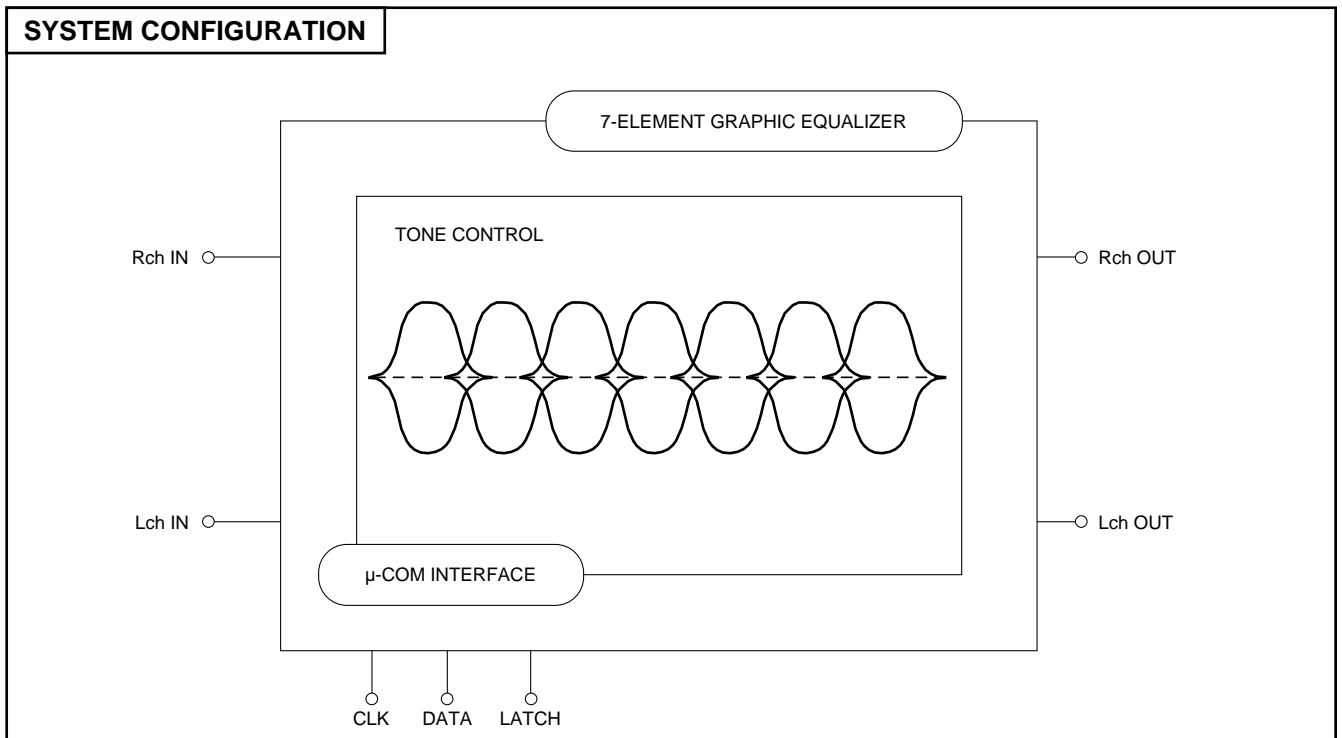
- Be able to operate with serial data from microcomputer
- Can be gaining control of 7-band ( $\pm 10\text{dB}$  and  $2\text{dB}$  steps)
- Power supply is single power supply or  $\pm$  power supplies
- Low noise  $V_{no}$  (flat) =  $5\mu\text{Vrms}$  (typ) <JIS-A>
- Low distortion THD =  $0.005\%$  (typ) <HPF400Hz, LPF30kHz>



**RECOMMENDED OPERATING CONDITION**

Supply voltage range.....  $AV_{DD}$ ,  $AV_{SS} = \pm 4.5$  to  $\pm 7.0\text{V}$   
(2 power supplies)  
Or,  $AV_{DD} = 9$  to  $14\text{V}$   
(Single power supply  $AV_{SS} = 0\text{V}$ )  
 $DV_{DD} = 4.5$  to  $5.5\text{V}$   
(However,  $DV_{DD} < AV_{DD}$ )

Outline 56P6N-A  
0.8mm pitch QFP  
(14.0mmX10.0mmX2.8mm)

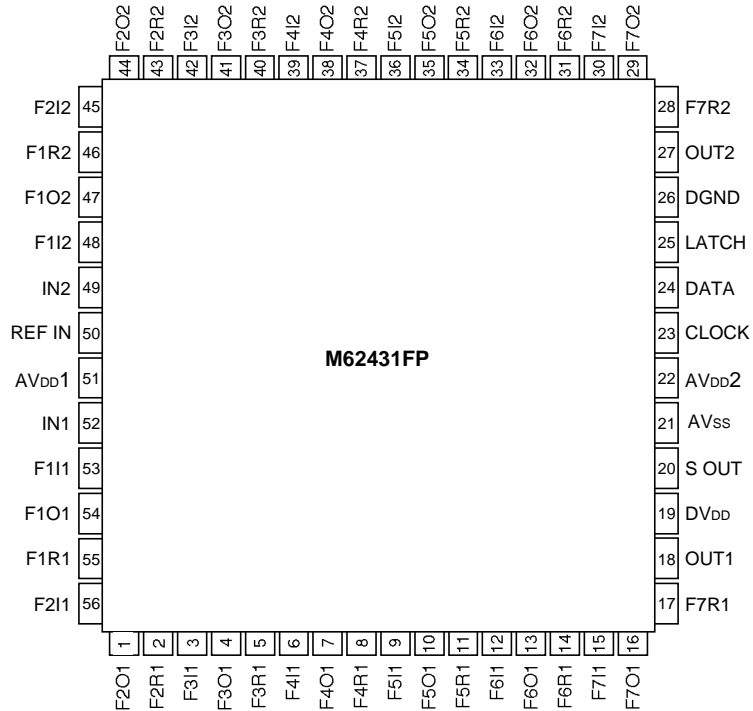


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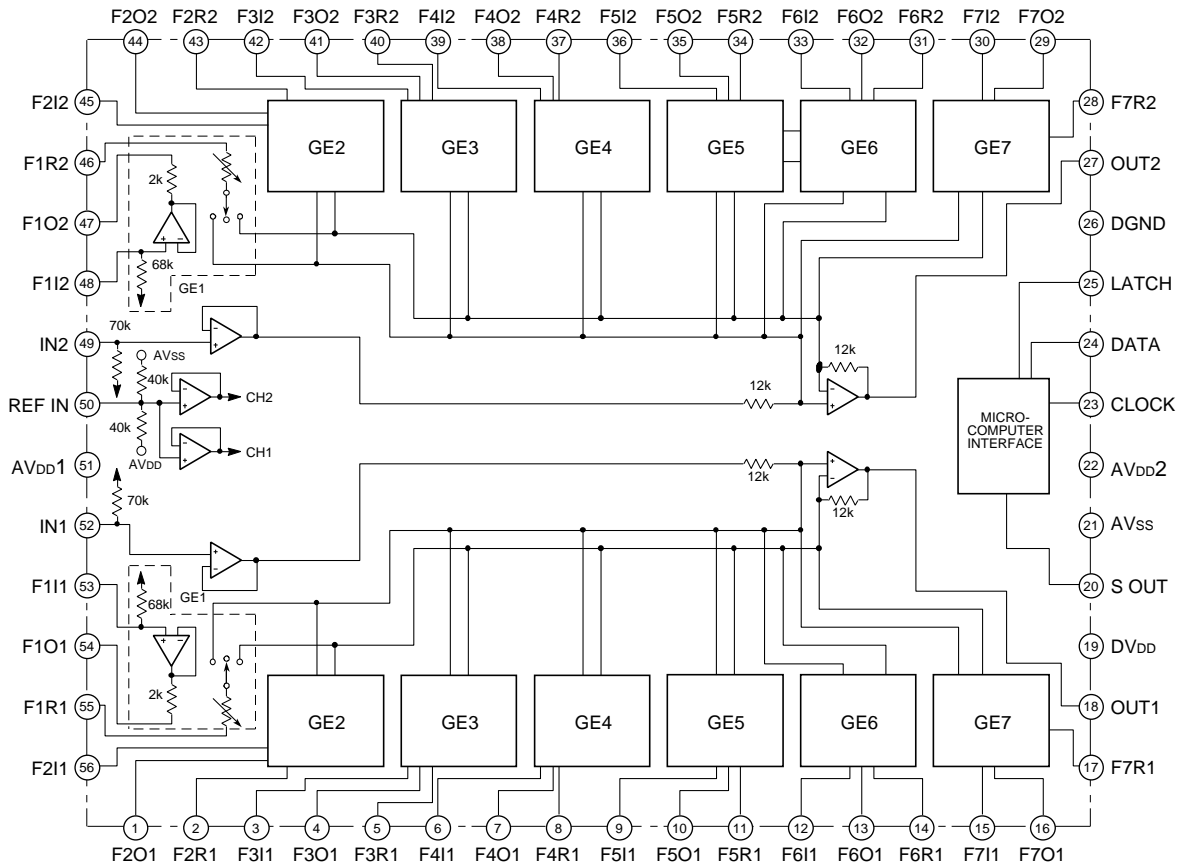
**PIN CONFIGURATION (TOP VIEW)**



Outline 56P6N-A

NC:NO CONNECTION

**IC INTERNAL BLOCK DIAGRAM**



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**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Conditions	Ratings	Unit
AVDD, AVSS	Analog supply voltage		14.6 (single) ±7.3 (± supply)	V
DVDD	Digital supply voltage		7.0	V
Pd	Power dissipation	Ta 25°C	1000	mW
Kθ	Thermal derating	Ta>25°C Equipped with standard board (Note 2)	10.0	mW/°C
Topr	Operating temperature		-20 to +60	°C
Tstg	Storage temperature		-40 to +125	°C

**RECOMMENDED OPERATING CONDITION** (Ta=25 °C, unless otherwise noted)

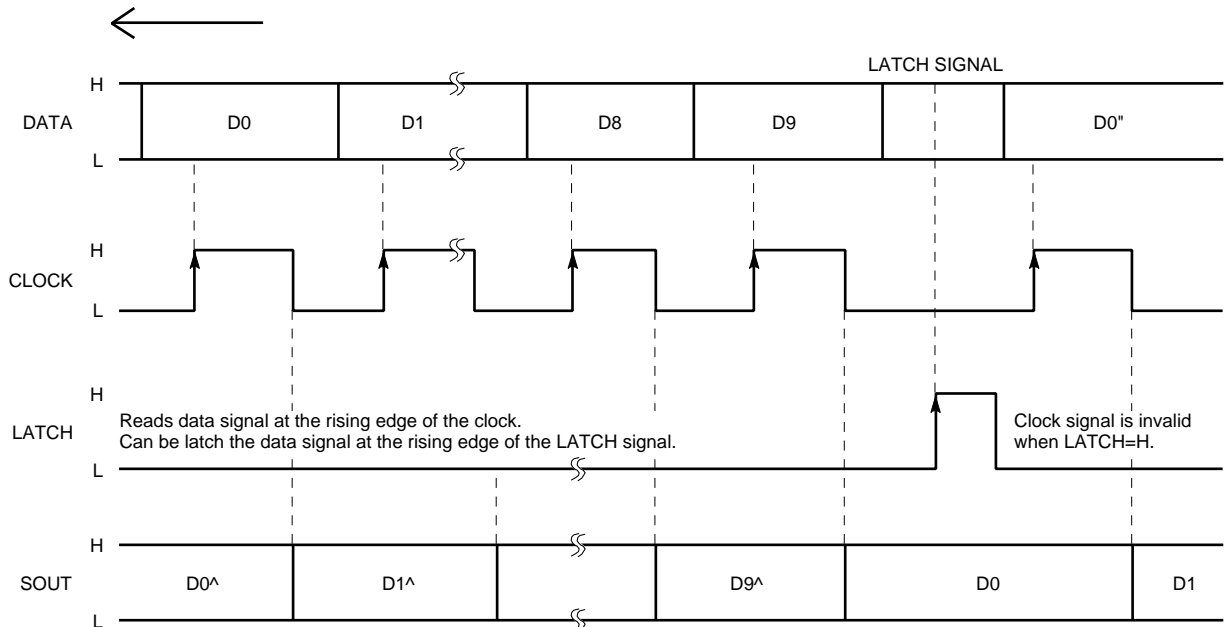
Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
AVDD	Analog positive supply voltage	Note 1	4.5	6.0	7.0	V
AVSS	Analog negative supply voltage	Note 1	-4.5	-6.0	-7.0	V
DVDD	Digital supply voltage	DVDD AVDD	4.5	5.0	5.5	V
VIH	Logic "H" level input voltage	DVDD=5V	DVDDX0.8	—	DVDD	V
VIL	Logic "L" level input voltage	DVDD=5V	0	—	DVDDX0.2	V

Note 1. When the IC use ± power supplies, the first, provide to AVDD the supply voltage, and then provide to AVSS.  
The DVDD voltage must not supply before the analog supply voltage provide.

2. Standard circuit board.

- board size : 70mm X 70mm
- board thickness : 1.6mm
- board material : Glass epoxy
- copper pattern
- copper thickness: 18µm
- copper size : 0.25mm (width) X 25mm (length/lead)

**RELATIONSHIPS BETWEEN DATA AND CLOCK**

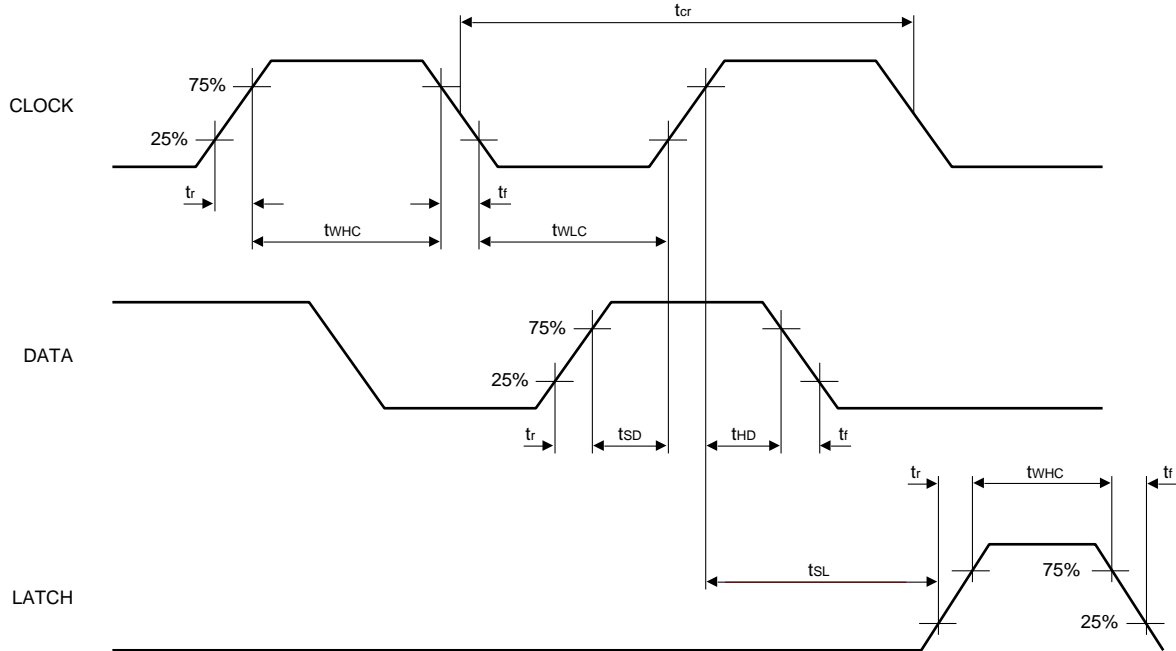


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**TIMINGS OF CLOCKS AND DATA**



**DEFINITION OF TIMING IN DIGITAL PART**

Symbol	Parameter	Limits			Unit
		Min.	Typ.	Max.	
tcr	CLOCK cycle time	4.0	—	—	μsec
twHC	CLOCK pulse width ("H" level)	1.6	—	—	μsec
twLC	CLOCK pulse width ("L" level)	1.6	—	—	μsec
tr	Rising time of CLOCK, DATA, LATCH	—	—	0.4	μsec
tf	Falling time of CLOCK, DATA, LATCH	—	—	0.4	μsec
tSD	DATA setup time	0.8	—	—	μsec
tHD	DATA hold time	0.8	—	—	μsec
tSL	LATCH setup time	1.0	—	—	μsec
twHL	LATCH pulse width	1.6	—	—	μsec

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**DATA INPUT FORMAT**

The 7-band tone control can be set by changing the Band setting of D8/D9.

(Initialize all data when power supply is turned on.)

← Input direction

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9
Tone control setting 1				Tone control setting 2				Band setting	

**(1) Tone control setting table (Gains)**

(Settings except for the settings below are inhibited.)

Tone setting	D0/D4	D1/D5	D2/D6	D3/D7
0dB	0	0	0	0
+2dB	0	0	0	1
+4dB	0	0	1	0
+6dB	0	0	1	1
+8dB	0	1	0	0
+10dB	0	1	0	1
0dB	1	0	0	0
-2dB	1	0	0	1
-4dB	1	0	1	0
-6dB	1	0	1	1
-8dB	1	1	0	0
-10dB	1	1	0	1

**(2) Band setting table**

Setting 1	Setting 2	D8	D9
GE 1	GE 2	0	0
GE 3	GE 4	0	1
GE 5	GE 6	1	0
GE 7	—	1	1

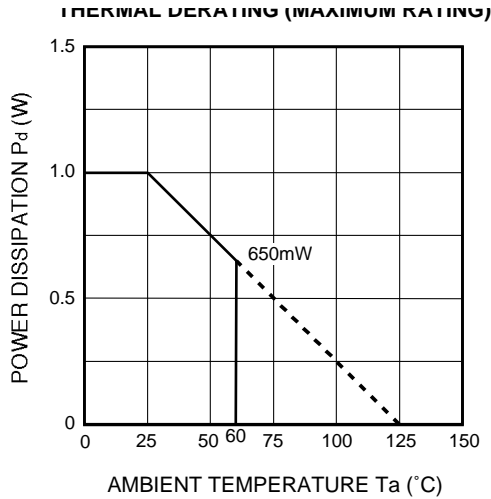
**ELECTRICAL CHARACTERISTICS**

(Ta=25°C, AVDD=6.0V, AVSS=-6.0V, DVDD=5.0V, f=1kHz, unless otherwise noted. Tone control bass boost is set to 0dB.)

Symbol	Parameter	Test conditions	Limits			Unit	
			Min.	Typ.	Max.		
AI <sub>DD</sub>	Analog positive power circuit current	No signal provided	15	30	45	mA	
AI <sub>SS</sub>	Analog negative power circuit current	No signal provided	-45	-30	-15	mA	
DI <sub>DD</sub>	Digital power circuit current	No signal provided	0.05	0.3	1.2	mA	
R <sub>in</sub>	Input resistance		35	70	120	k	
V <sub>IM</sub>	Maximum input voltage	R <sub>L</sub> =10k, THD=1%	3.0	3.5	—	V <sub>rms</sub>	
V <sub>odc</sub>	Output pin voltage		-0.3	0	0.3	V	
G <sub>v</sub>	Transmission gain		-2.0	0	2.0	dB	
V <sub>ono</sub>	Output noise voltage	JIS-A filter No signal provided R <sub>g</sub> =10k FLAT	—	5.0	10.0	μV <sub>rms</sub>	
THD	Distortion	V <sub>o</sub> =0.5V <sub>rms</sub> , R <sub>L</sub> =10k	—	0.005	0.05	%	
CT	Channel crosstalk		—	-100	-70	dB	
G <sub>boost</sub>	Tone control voltage gain	f=1kHz, V <sub>o</sub> =1V <sub>rms</sub>	10dB	8.5	10	11.5	dB
G <sub>cut</sub>			-10dB	-11.5	10	-8.5	dB
BAL <sub>ton</sub>	Channel balance	Each boost is +10, -10dB with f=1kHz, V <sub>o</sub> =1V <sub>rms</sub>	-1.5	0	+1.5	dB	

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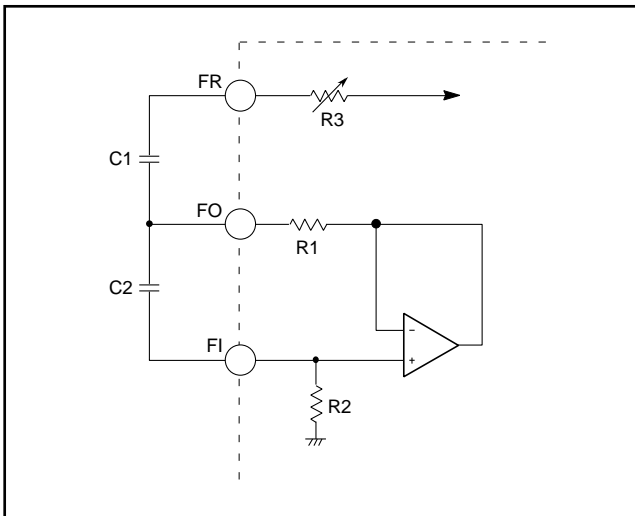
**TYPICAL CHARACTERISTICS**



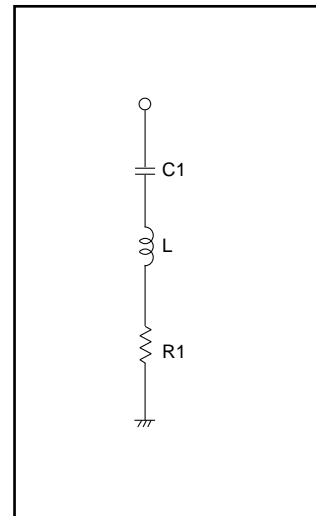
(Note 1) Standard board  
 Size of printed circuit board  
 70mm X 70mm  
 Thickness of printed circuit board  
 1.6mm  
 Material of printed circuit board  
 Glass epoxy  
 Single-side Cu pattern  
 Thickness of Cu  
 18μm  
 Size of Cu pattern  
 0.25mm (Width) X 25mm (length)/lead

**FUNCTION DESCRIPTION**

(1) Tone control circuit block



**Fig.1 Resonance circuit**



**Fig.2 Equivalent circuit using L**

Center frequency

$$f_0 = 1/2 \sqrt{C1 \cdot C2 \cdot R1 \cdot R2} \text{ [Hz]}$$

$$Q = \sqrt{C2 \cdot (R1 \cdot R2) / C1 \cdot (R1 + R3)^2}$$

(Example) In mid-band (f=1kHz)  
 R1=2k , R2=68k  
 C1=3900pF, C2=0.047μF

Figure 1 is equivalent to Figure 2. Part constants are converted by the below expression.

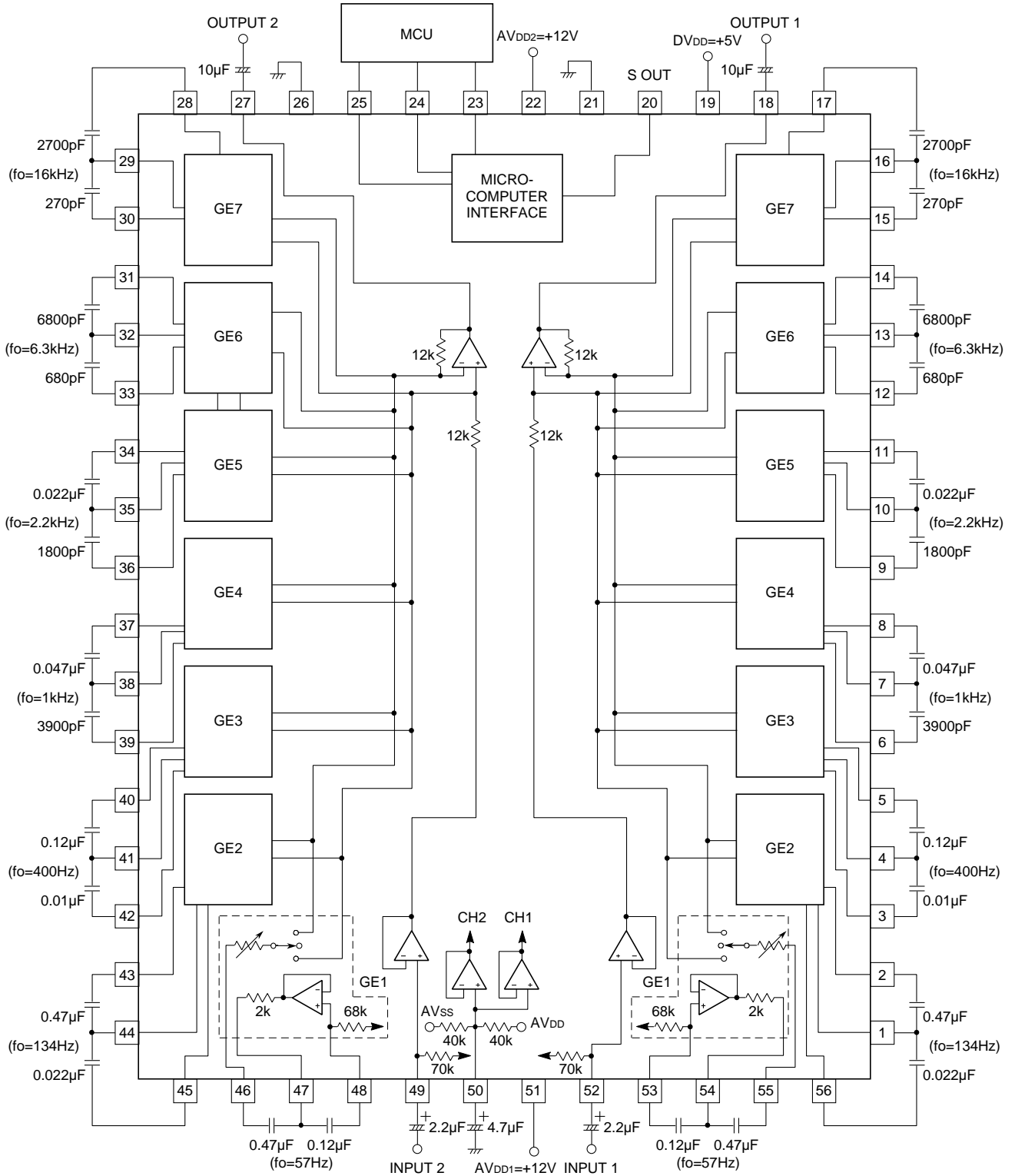
$$L = C2 \cdot R1 \cdot R2$$

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**APPLICATION EXAMPLE**  
**(Single power supply used)**



Units Resistance :  
Capacitance:F