

PRELIMINARY

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

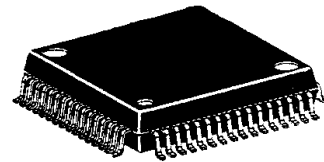
7-ELEMENT GRAPHIC EQUALIZER WITH MICROCOMPUTER INTERFACE

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

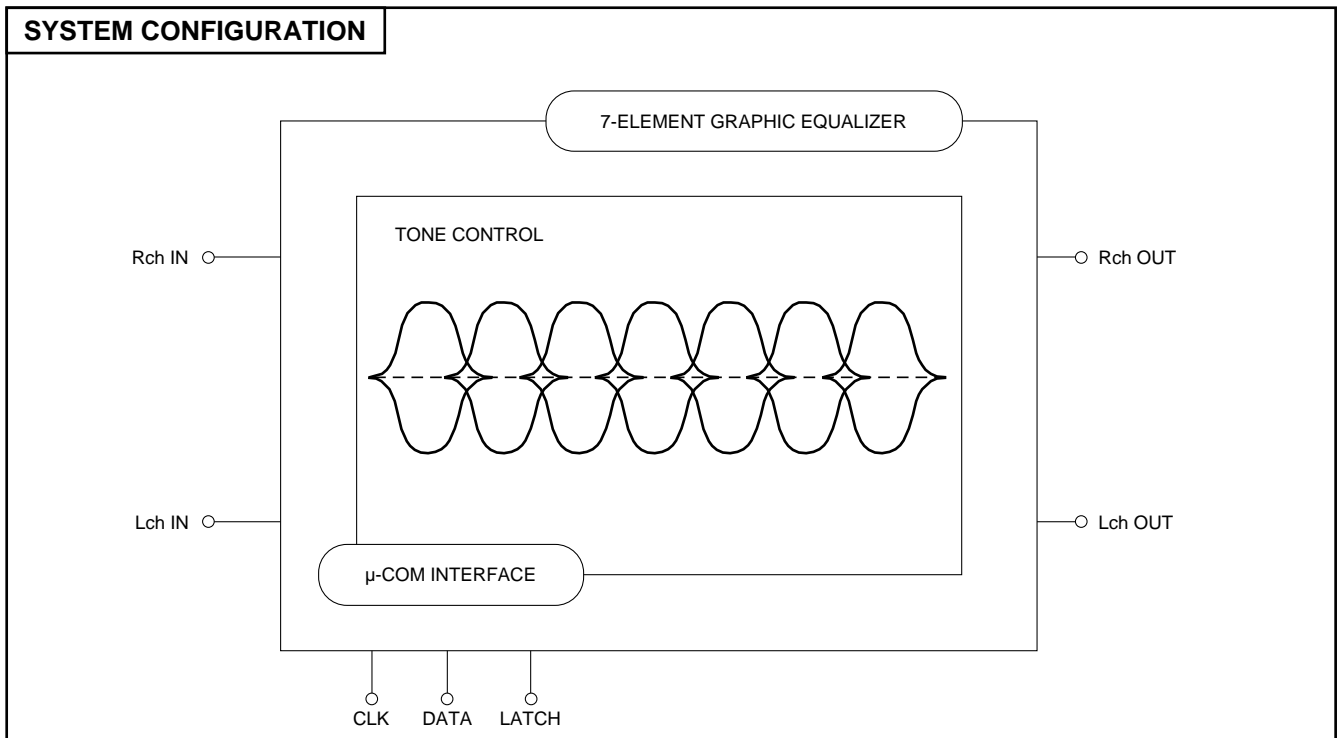
- Be able to operate with serial data from microcomputer
- Can be gaining control of 7-band ($\pm 10\text{dB}$ and 2dB steps)
- Power supply is single power supply or \pm power supplies
- Low noise V_{no} (flat) = $5\mu\text{Vrms}$ (typ) <JIS-A>
- Low distortion THD = 0.005% (typ) <HPF400Hz, LPF30kHz>



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 14V
(Single power supply $AV_{SS} = 0\text{V}$)
 $DV_{DD} = 4.5$ to 5.5V
(However, $DV_{DD} < AV_{DD}$)

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

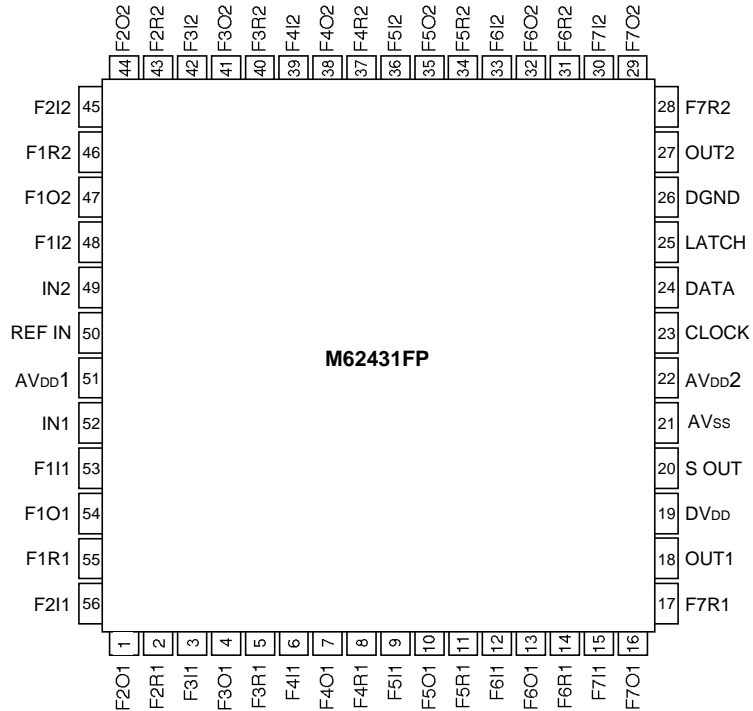


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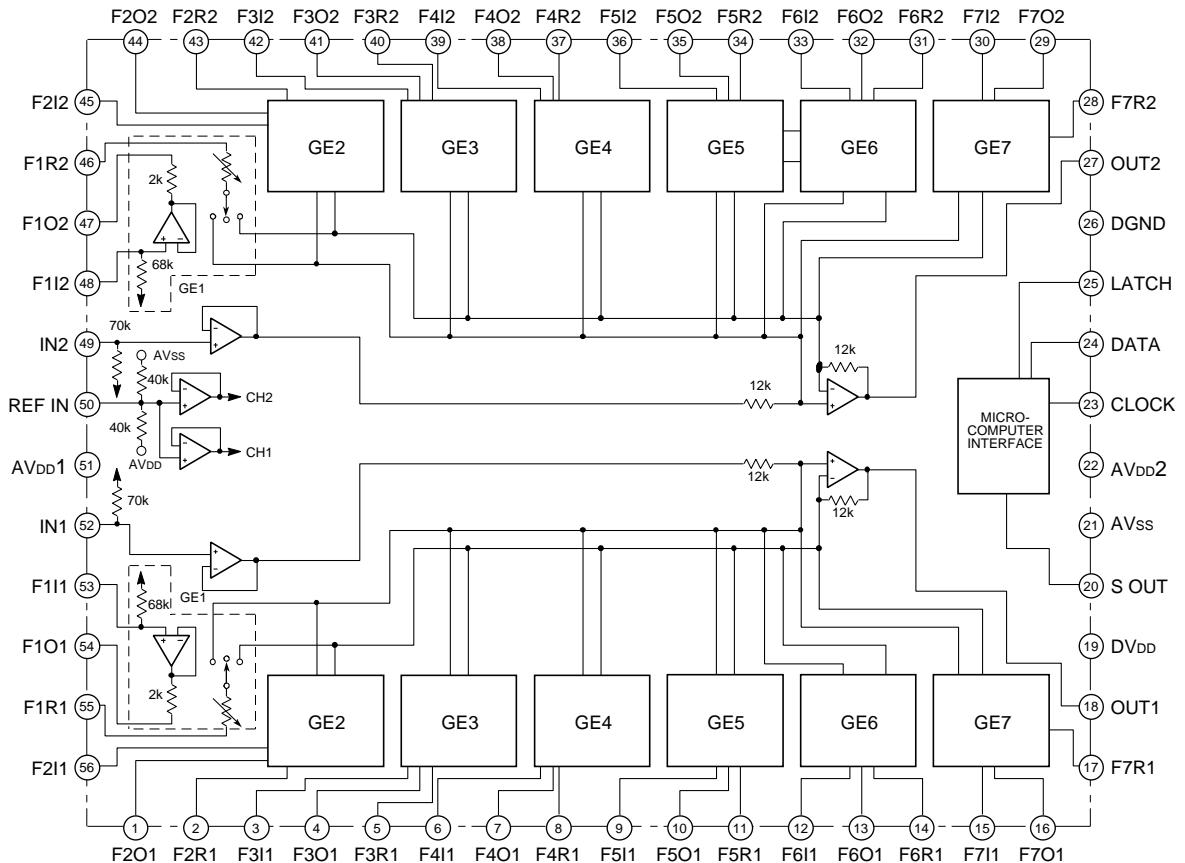
PIN CONFIGURATION (TOP VIEW)



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 (\pm supply)	V
DVDD	Digital supply voltage		7.0	V
Pd	Power dissipation	Ta 25°C	1000	mW
K θ	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)

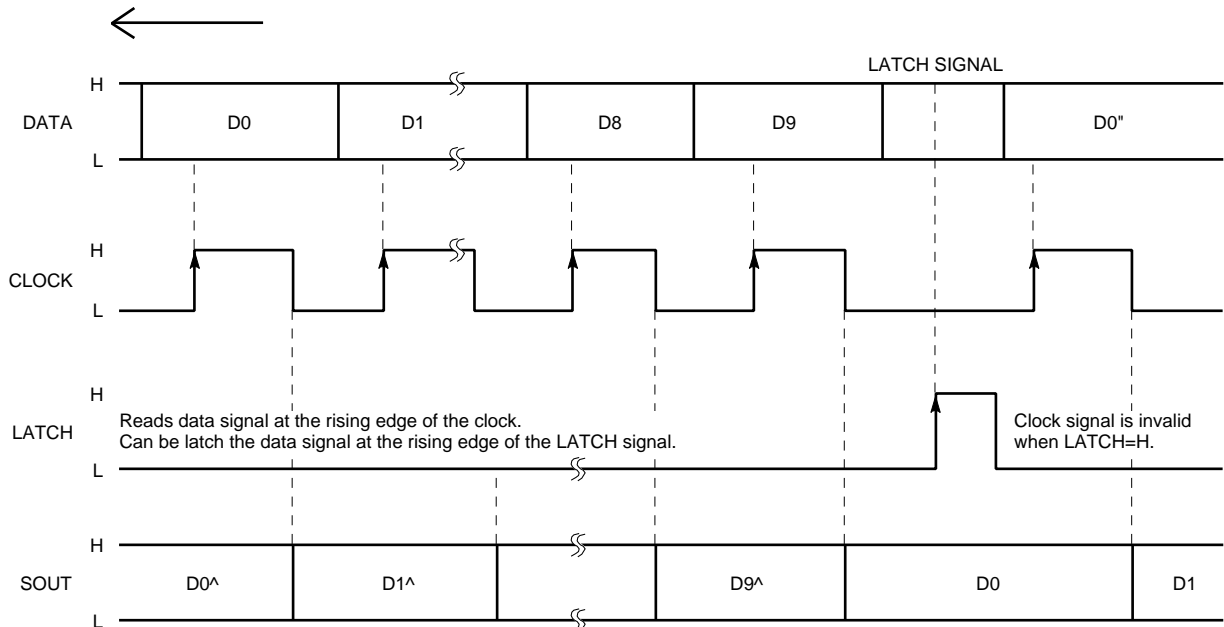
Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
AVDD	Analog positive supply voltage	Note 1	4.5	6.0	7.0	V
AVSS	Analog negative supply voltage	Note 1	-4.5	-6.0	-7.0	V
DVDD	Digital supply voltage	DVDD AVDD	4.5	5.0	5.5	V
VIH	Logic "H" level input voltage	DVDD=5V	DVDD $\times 0.8$	—	DVDD	V
VIL	Logic "L" level input voltage	DVDD=5V	0	—	DVDD $\times 0.2$	V

Note 1. When the IC use \pm 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: 18 μ m
copper size : 0.25mm (width) X 25mm (length/lead)

RELATIONSHIPS BETWEEN DATA AND CLOCK

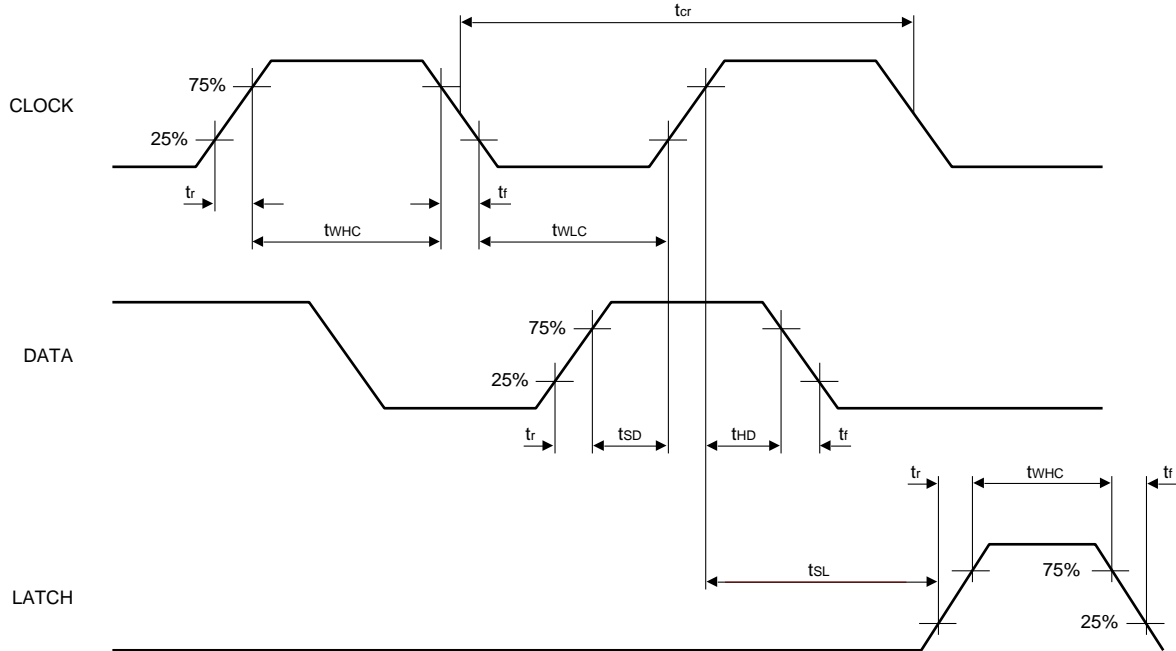


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TIMINGS OF CLOCKS AND DATA



DEFINITION OF TIMING IN DIGITAL PART

Symbol	Parameter	Limits			Unit
		Min.	Typ.	Max.	
t_{cr}	CLOCK cycle time	4.0	—	—	μsec
t_{WHC}	CLOCK pulse width ("H" level)	1.6	—	—	μsec
t_{WLC}	CLOCK pulse width ("L" level)	1.6	—	—	μsec
t_r	Rising time of CLOCK, DATA, LATCH	—	—	0.4	μsec
t_f	Falling time of CLOCK, DATA, LATCH	—	—	0.4	μsec
t_{SD}	DATA setup time	0.8	—	—	μsec
t_{HD}	DATA hold time	0.8	—	—	μsec
t_{SL}	LATCH setup time	1.0	—	—	μsec
t_{WHL}	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.)

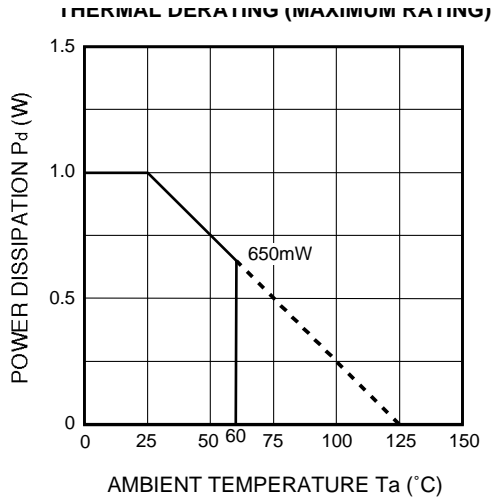
Symbol	Parameter	Test conditions	Limits			Unit	
			Min.	Typ.	Max.		
AI _{DD}	Analog positive power circuit current	No signal provided	15	30	45	mA	
AI _{SS}	Analog negative power circuit current	No signal provided	-45	-30	-15	mA	
DI _{DD}	Digital power circuit current	No signal provided	0.05	0.3	1.2	mA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

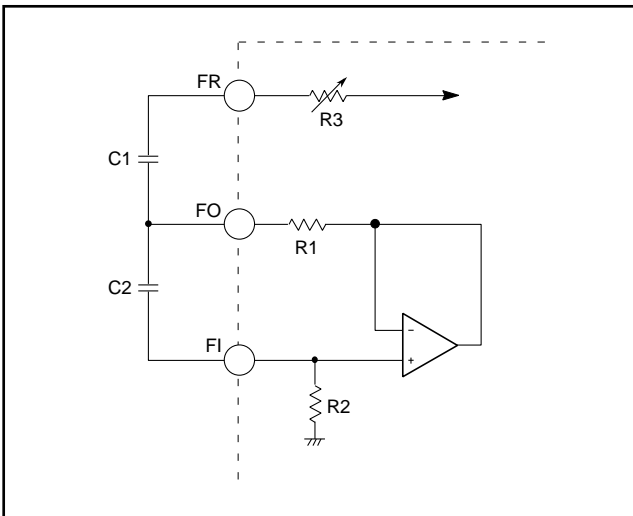


Fig.1 Resonance circuit

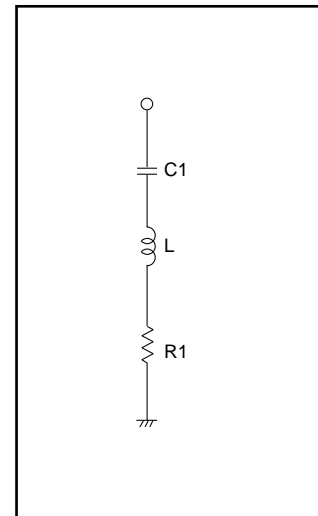


Fig.2 Equivalent circuit using L

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.

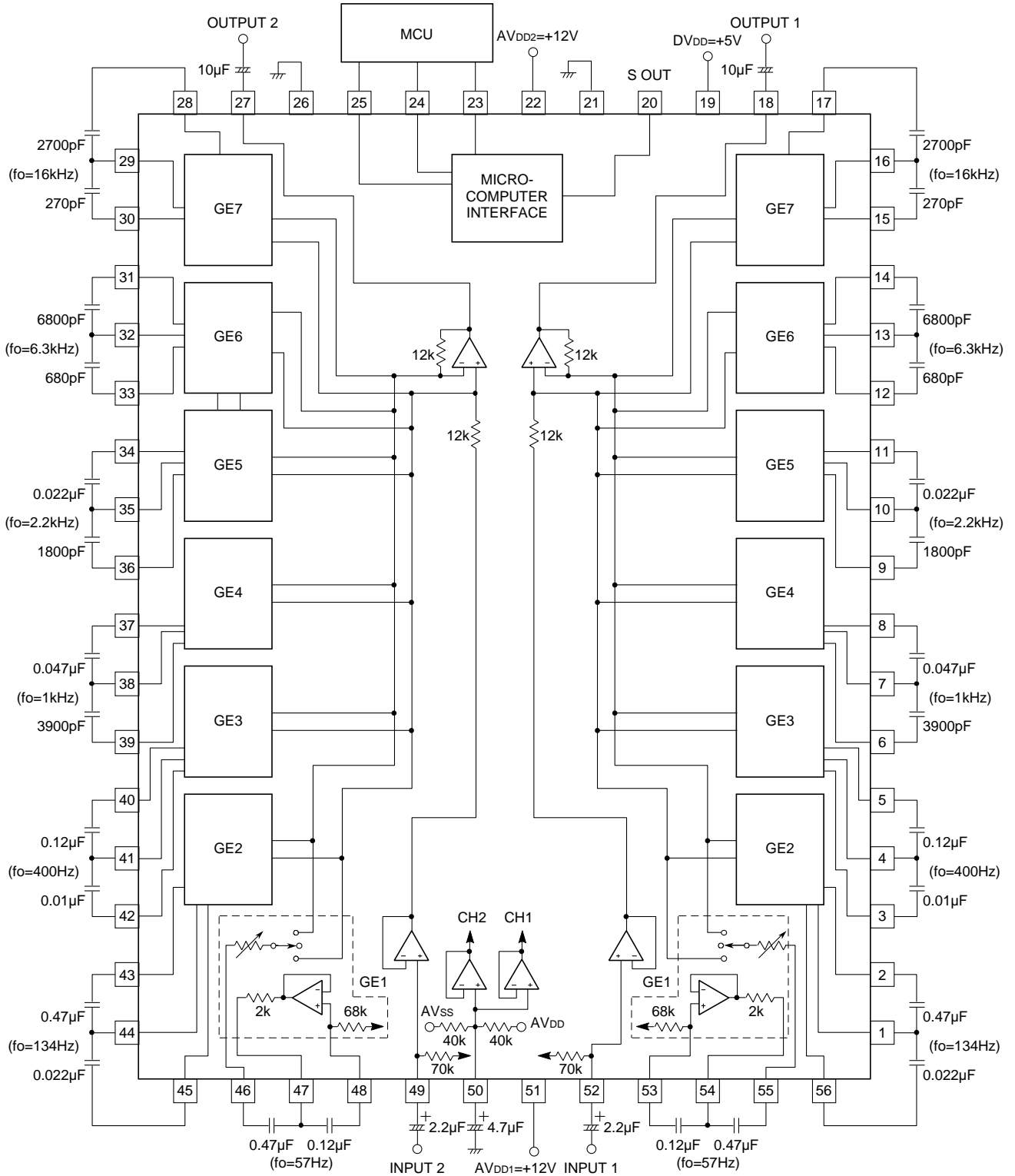
$$L = C2 \cdot R1 \cdot R2$$

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APPLICATION EXAMPLE
(Single power supply used)



Units Resistance :
Capacitance:F