

PRELIMINARY

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

MITSUBISHI SOUND PROCESSOR ICs

M62431FP

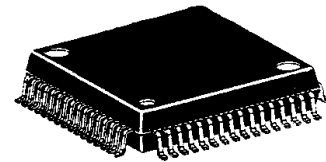
7-ELEMENT GRAPHIC EQUALIZER WITH MICROCOMPUTER INTERFACE

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 $V_{no}(\text{flat}) = 5\mu\text{V}_{rms}$ (typ) <JIS-A>
- Low distortion THD = 0.005% (typ) <HPF400Hz, LPF30kHz>

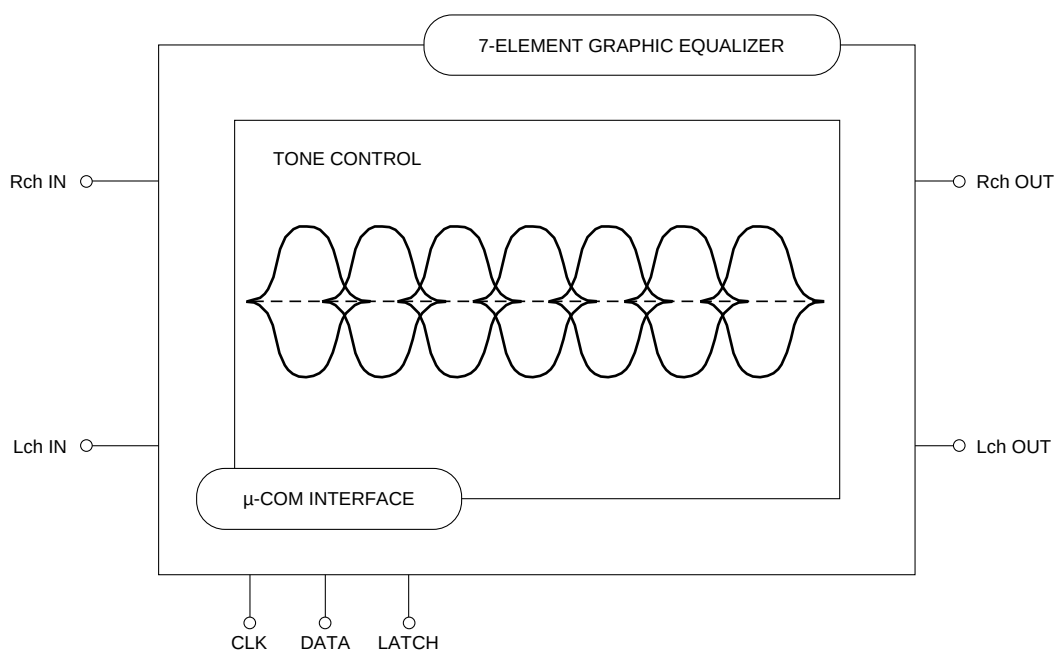


RECOMMENDED OPERATING CONDITION

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, $DV_{DD} \leq AV_{DD}$)

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

SYSTEM CONFIGURATION



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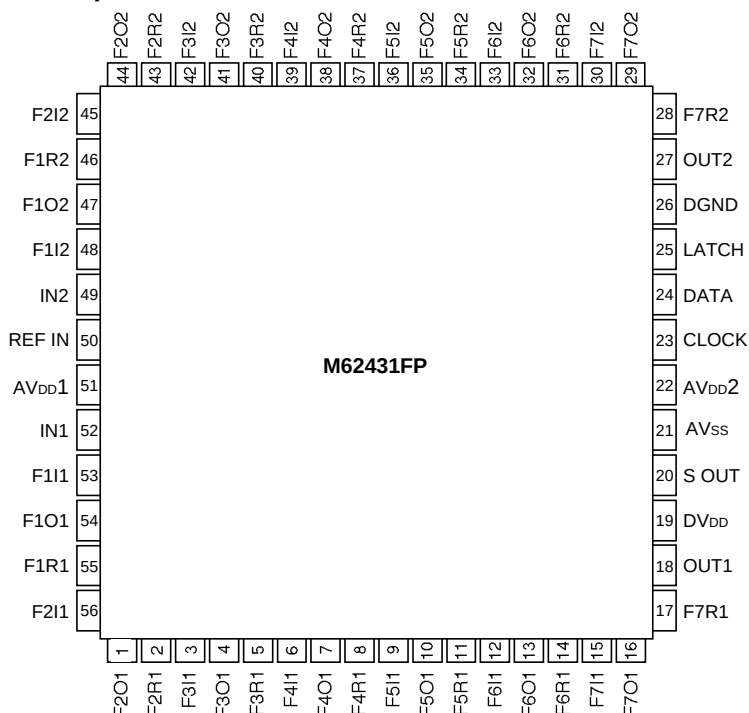
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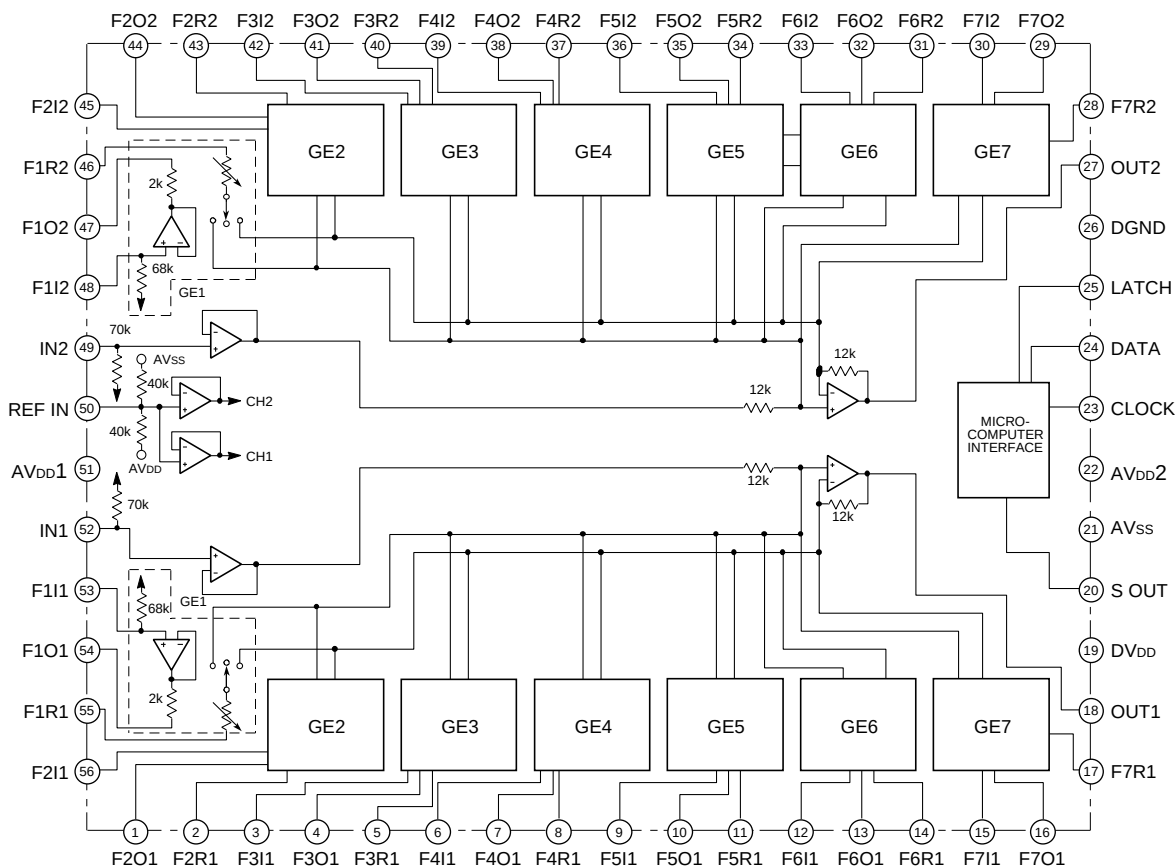
PIN CONFIGURATION (TOP VIEW)



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 $\leq 25^{\circ}\text{C}$	1000	mW
K θ	Thermal derating	Ta $> 25^{\circ}\text{C}$ Equipped with standard board (Note 2)	10.0	mW/ $^{\circ}\text{C}$
Topr	Operating temperature		-20 to +60	$^{\circ}\text{C}$
Tstg	Storage temperature		-40 to +125	$^{\circ}\text{C}$

RECOMMENDED OPERATING CONDITION (Ta=25 $^{\circ}\text{C}$, 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 $\leq$ 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

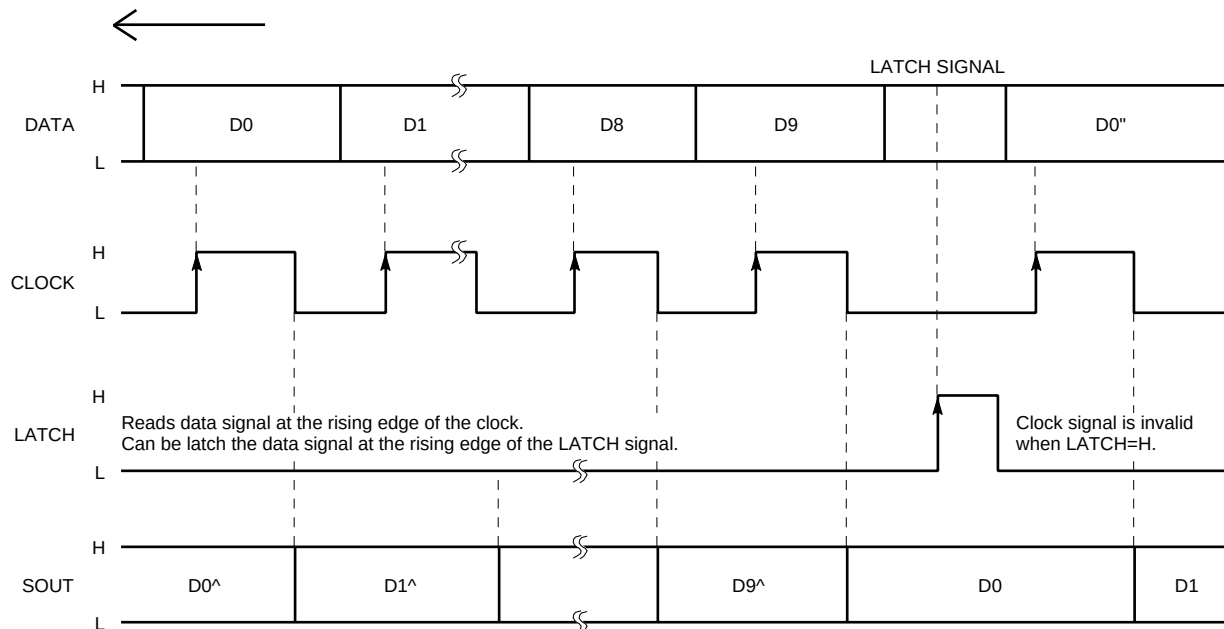
Note 1. When the IC use $\pm$ power supplies, the first, provide to AVDD the supply voltage, and then provide to AVSS.
 The DVDD voltage must not supply before the analog supply voltage provide.

2. Standard circuit board.

- board size : 70mm X 70mm
- board thickness : 1.6mm
- board material : Glass epoxy

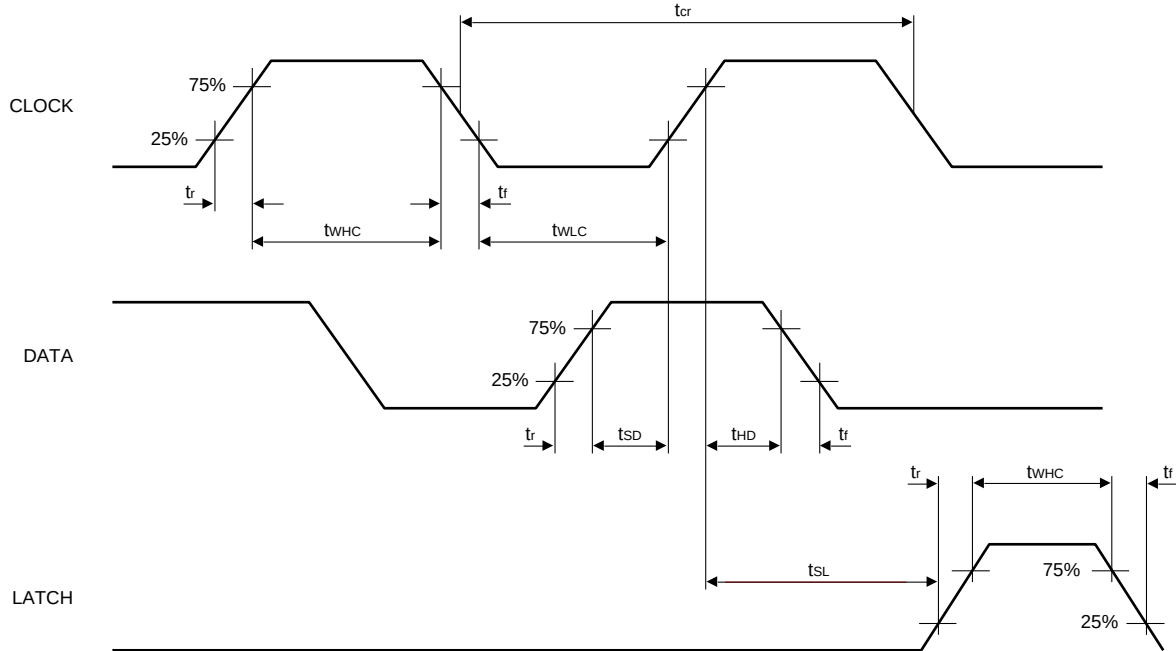
- copper pattern
copper thickness: 18 μm
copper size : 0.25mm (width) X 25mm (length/lead)

RELATIONSHIPS BETWEEN DATA AND CLOCK



7-ELEMENT GRAPHIC EQUALIZER WITH MICROCOMPUTER INTERFACE

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

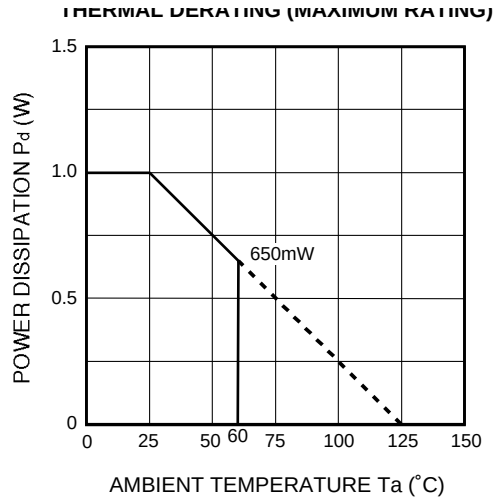
ELECTRICAL CHARACTERISTICS

(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.	
AlDD	Analog positive power circuit current	No signal provided	15	30	45	mA
AISS	Analog negative power circuit current	No signal provided	-45	-30	-15	mA
DIDD	Digital power circuit current	No signal provided	0.05	0.3	1.2	mA
Rin	Input resistance		35	70	120	kΩ
VIM	Maximum input voltage	RL=10kΩ, THD=1%	3.0	3.5	—	Vrms
Vodc	Output pin voltage		-0.3	0	0.3	V
Gv	Transmission gain		-2.0	0	2.0	dB
Vono	Output noise voltage	JIS-A filter No signal provided Rg=10kΩ FLAT	—	5.0	10.0	μVrms
THD	Distortion	Vo=0.5Vrms, RL=10kΩ	—	0.005	0.05	%
CT	Channel crosstalk		—	-100	-70	dB
Gboost	Tone control voltage gain	10dB	8.5	10	11.5	dB
Gcut		-10dB	-11.5	10	-8.5	dB
BALton	Channel balance	Each boost is +10, -10dB with f=1kHz, Vo=1Vrms	-1.5	0	+1.5	dB

7-ELEMENT GRAPHIC EQUALIZER WITH MICROCOMPUTER INTERFACE

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

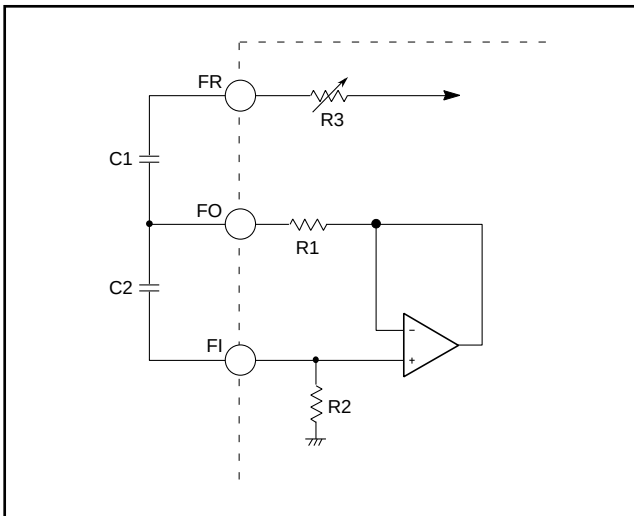


Fig.1 Resonance circuit

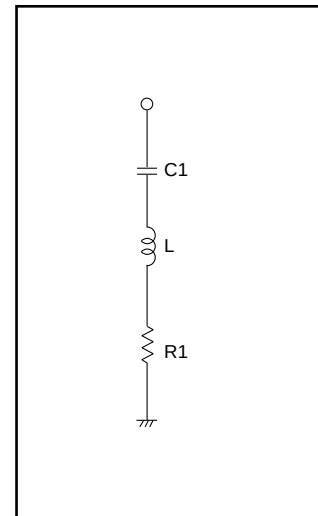


Fig.2 Equivalent circuit using L

Center frequency

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

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

(Example) In mid-band (f=1kHz)
R1=2kΩ, R2=68kΩ
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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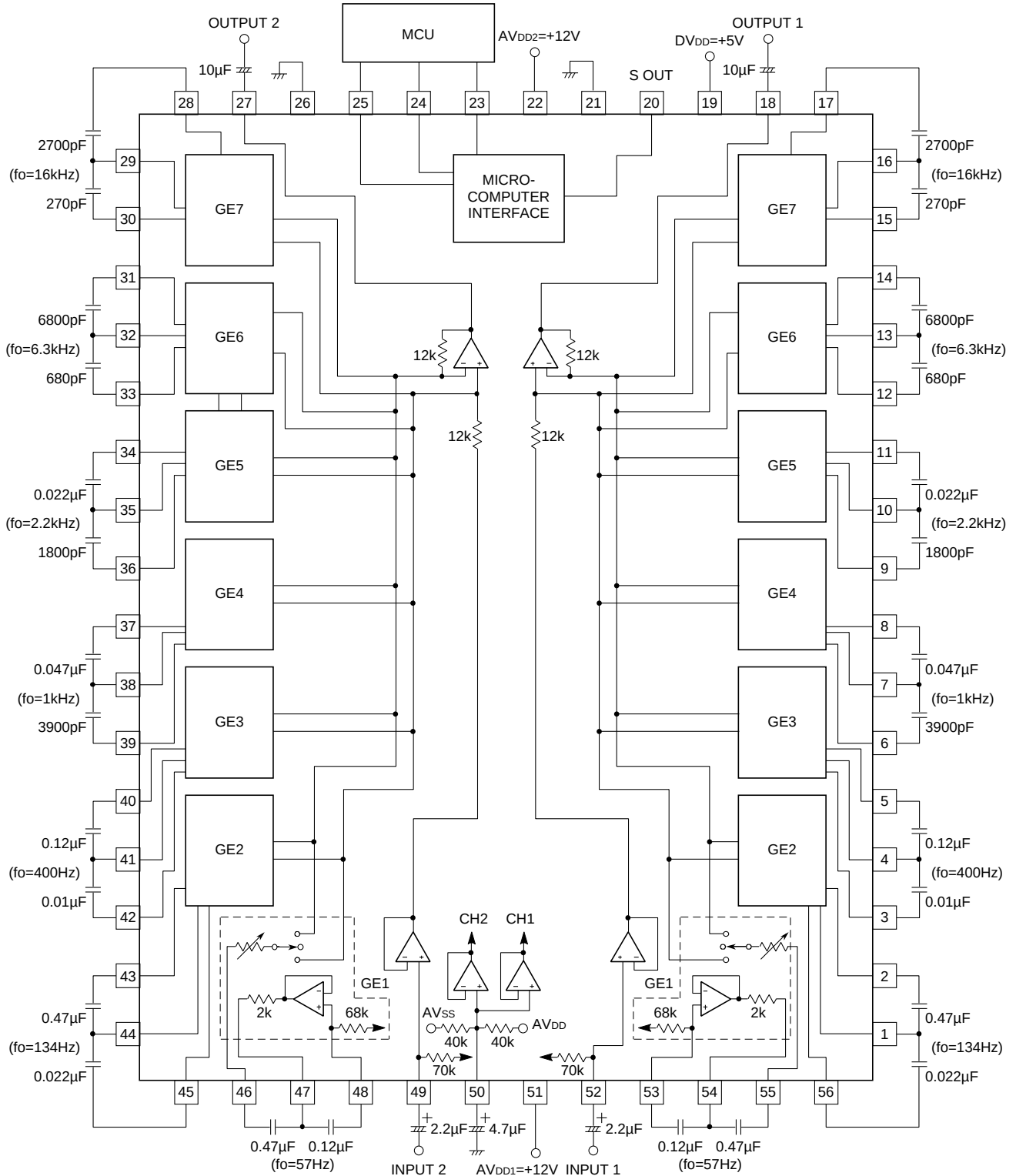
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APPLICATION EXAMPLE

(Single power supply used)



Units Resistance :Ω
Capacitance:F