M62431FP

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

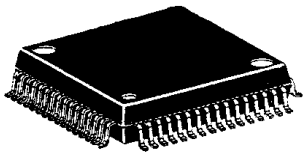
7-ELEMENT GRAPHIC EQUALIZER WITH MICROCOMPUTER INTERFACE

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 (±10dB and 2dB steps)
- Power supply is single power supply or ± power supplies
- Low nose V_{NO} (flat)=5μVrms (typ)<JIS-A>
- Low distortion THD=0.005% (typ)<HPF400Hz, LPF30kHz>

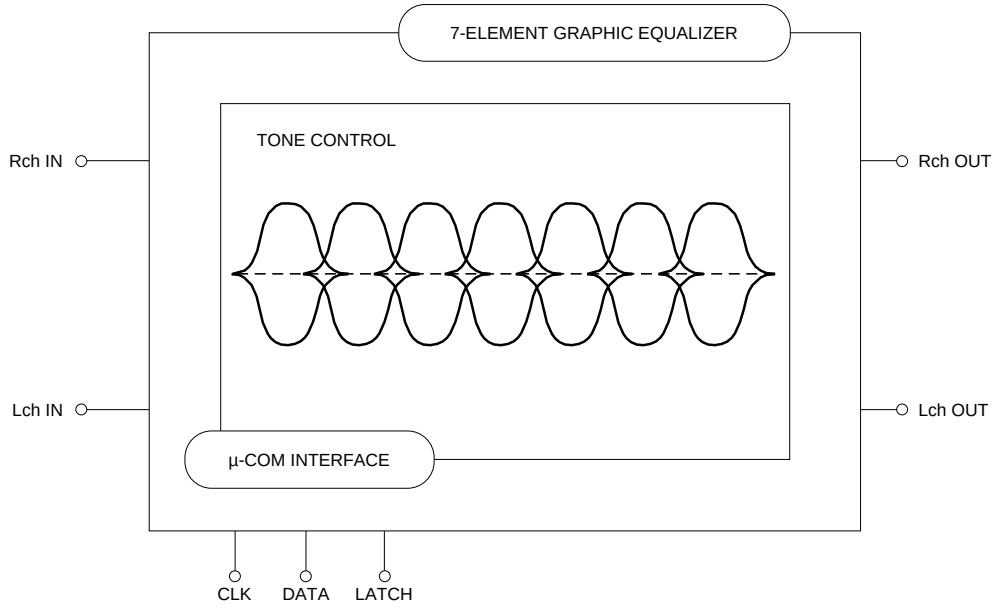


Outline 56P6N-A
0.8mm pitch QFP
(14.0mmX10.0mmX2.8mm)

RECOMMENDED OPERATING CONDITION

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

SYSTEM CONFIGURATION



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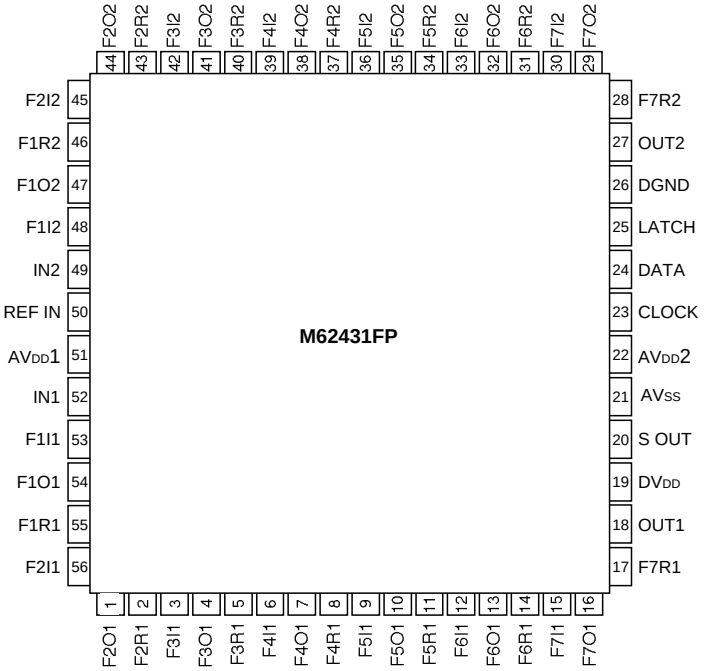
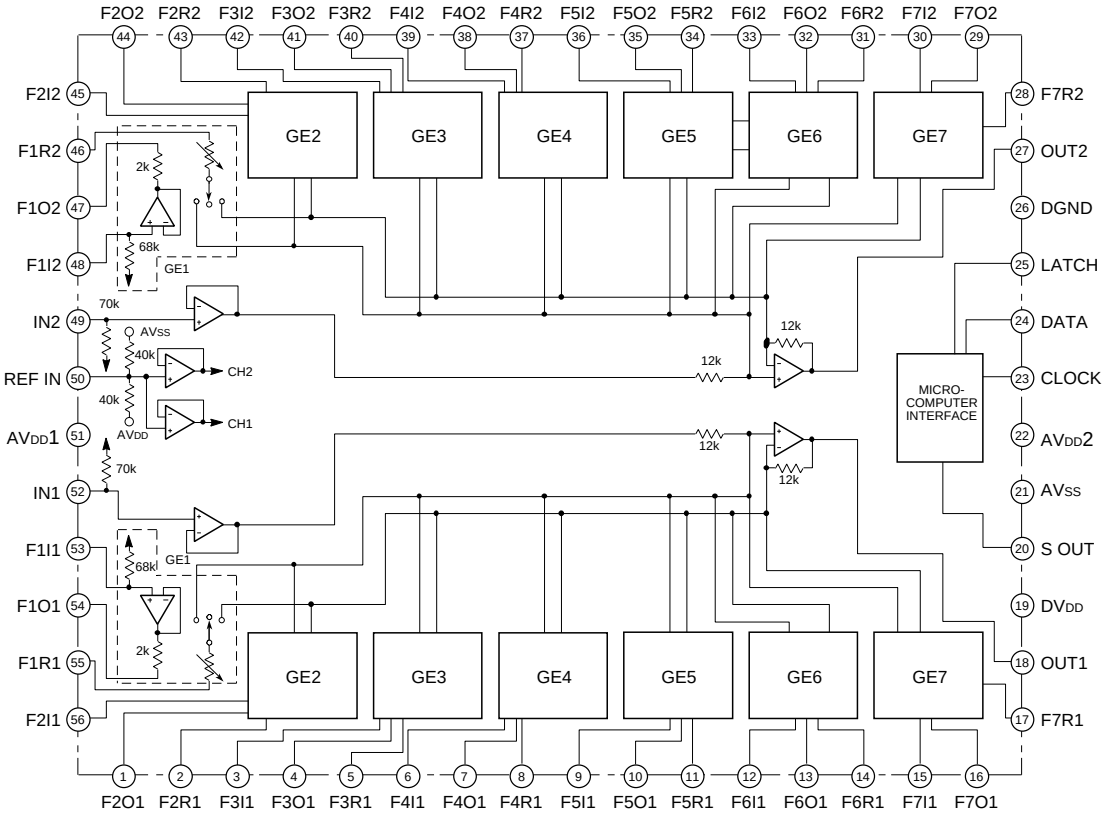
PIN CONFIGURATION (TOP VIEW)



Outline 56P6N-A

NC:NO CONNECTION

IC INTERNAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

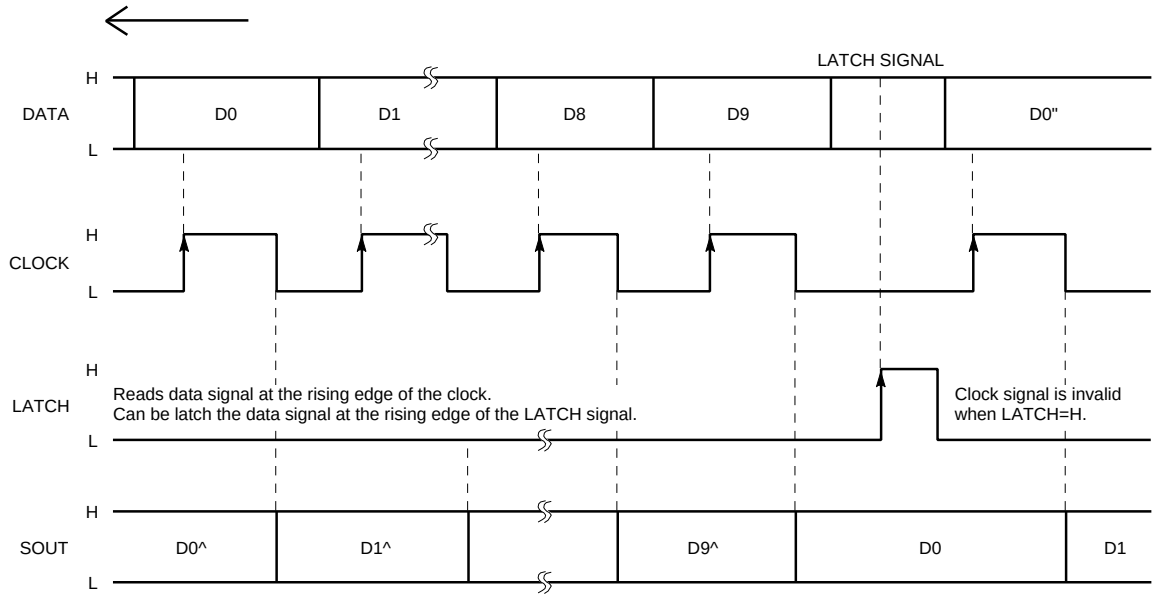
Symbol	Parameter	Conditions	Ratings	Unit
AV_{DD}, AV_{SS}	Analog supply voltage		14.6 (single) ±7.3 (± supply)	V
DV_{DD}	Digital supply voltage		7.0	V
P_d	Power dissipation	Ta≤25˚C	1000	mW
K_θ	Thermal derating	Ta>25˚C Equipped with standard board (Note 2)	10.0	mW/˚C
T_{opr}	Operating temperature		-20 to +60	˚C
T_{stg}	Storage temperature		-40 to +125	˚C

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

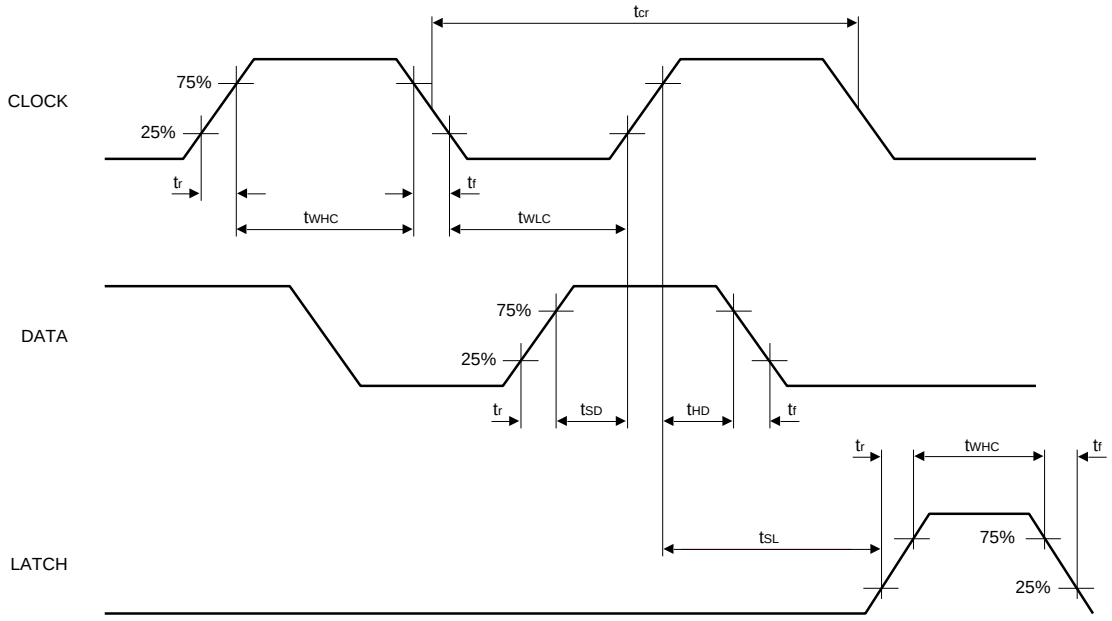
Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
AV_{DD}	Analog positive supply voltage	Note 1	4.5	6.0	7.0	V
AV_{SS}	Analog negative supply voltage	Note 1	-4.5	-6.0	-7.0	V
DV_{DD}	Digital supply voltage	DV_{DD}≤AV_{DD}	4.5	5.0	5.5	V
V_{IH}	Logic "H" level input voltage	DV_{DD}=5V	DV_{DD}X0.8	–	DV_{DD}	V
V_{IL}	Logic "L" level input voltage	DV_{DD}=5V	0	–	DV_{DD}X0.2	V

Note 1.When the IC use ± power supplies, the first, provide to AV_{DD} the supply voltage, and then provide to AV_{SS}.
The DV_{DD} 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



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

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

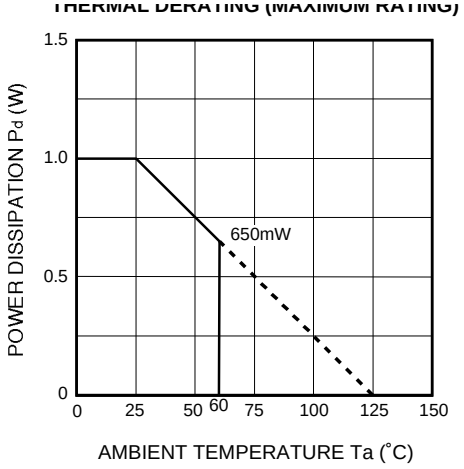
Setting 1	Setting 2	D8	D9
GE 1	GE 2	0	0
GE 3	GE 4	0	1
GE 5	GE 6	1	0
GE 7	–	1	1

ELECTRICAL CHARACTERISTICS

(Ta=25˚C, AV_{DD}=6.0V, AV_{SS}=-6.0V, DV_{DD}=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}	Power	Analog positive power circuit current	No signal provided		15	30	45	mA
AI_{SS}	Power	Analog negative power circuit current	No signal provided		-45	-30	-15	mA
DI_{DD}	Power	Digital power circuit current	No signal provided		0.05	0.3	1.2	mA
Rin	Input/output	Input resistance			35	70	120	kΩ
VIM	Input/output	Maximum input voltage	R_L=10kΩ, THD=1%		3.0	3.5	–	Vrms
Vodc	Input/output	Output pin voltage			-0.3	0	0.3	V
Gv	Input/output	Transmission gain			-2.0	0	2.0	dB
Vono	Input/output	Output noise voltage	JIS-A filter No signal provided Rg=10kΩ FLAT		–	5.0	10.0	µVrms
THD	Input/output	Distortion	Vo=0.5Vrms, R_L=10kΩ		–	0.005	0.05	%
CT	Input/output	Channel crosstalk			–	-100	-70	dB
Gboost	Tone control	Tone control voltage gain	10dB	f=1kHz, Vo=1Vrms	8.5	10	11.5	dB
Gcut	Tone control	Tone control voltage gain	-10dB	f=1kHz, Vo=1Vrms	-11.5	10	-8.5	dB
BALton	Tone control	Channel balance	Each boost is +10, -10dB with f=1kHz, Vo=1Vrms		-1.5	0	+1.5	dB

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

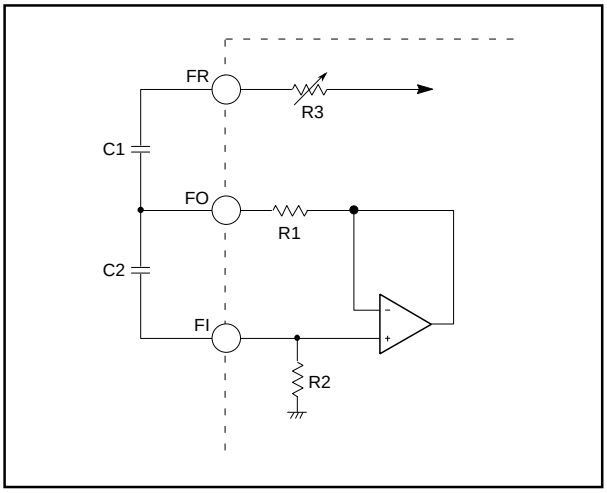


Fig.1 Resonance circuit

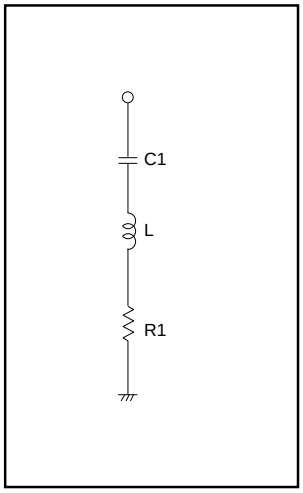


Fig.2 Equivalent circuit using L

Center frequency

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

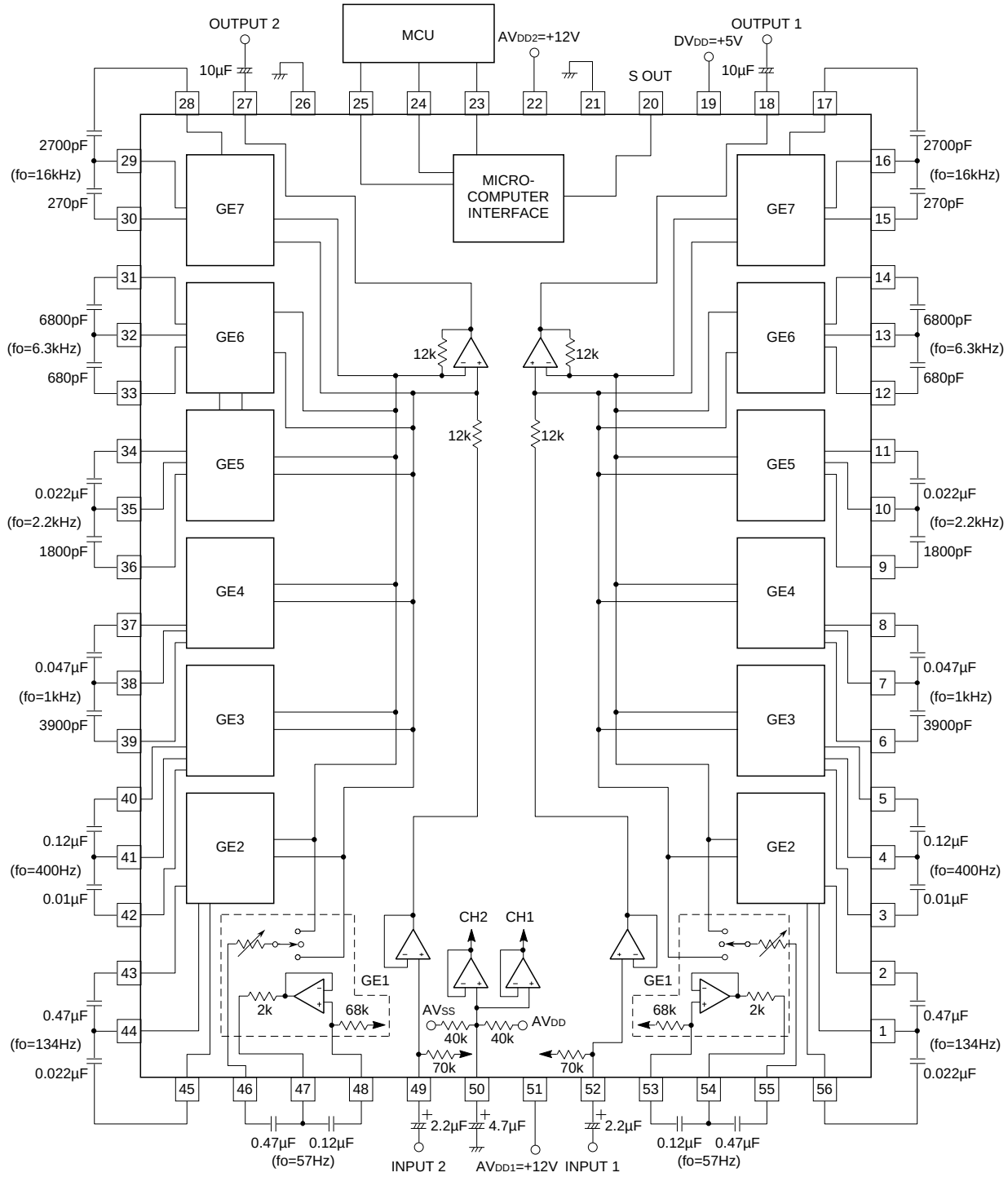
$Q= \sqrt{C2 \cdot (R1 \cdot R2) / C1 \cdot (R1+R3)^2}$

(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.

$L=C2 \cdot R1 \cdot R2$

APPLICATION EXAMPLE
(Single power supply used)



Units Resistance :Ω
Capacitance:F