M62423FP

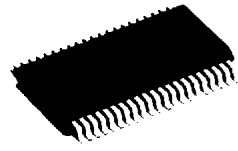
DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

DESCRIPTION

The M62423FP is a digital sound controller IC for miniature unit audio systems.
The IC, with serial data sent from a microcomputer, makes it easy to realize karaoke functions (voice canceling) and tone quality/sound field control such as surround and 3-band tone control.

FEATURES

- 32-pin shrink DIP
- Capable of controlling each function by serial data
  - Bass/treble/Mid ····· 0, ± 3, ± 6, ± 10dB
  - Surround ····· [ON/OFF]
  - Bass boost ····· [ON/OFF]
  - Voice canceling ····· [ON/OFF]
  - Mute ····· [ON/OFF]

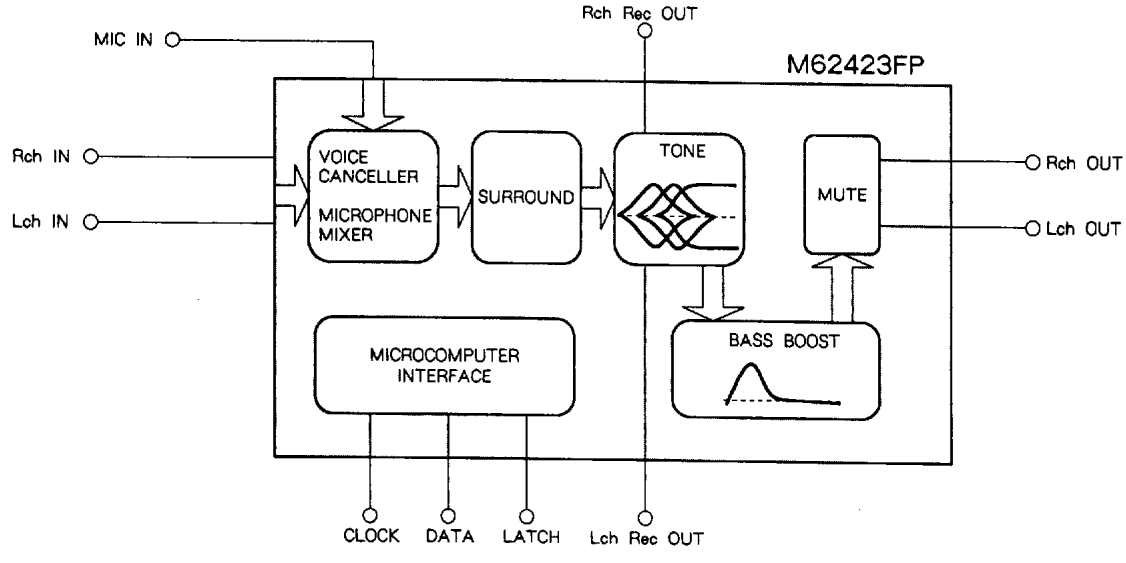


Outline 42P2R-A
0.8mm pitch 450mil SSOP
(8.4mm × 17.5mm × 2.0mm)

RECOMMENDED OPERATING CONDITIONS

Supply voltage range ····· V_{CC}, V_{EE} = ± 5.0 to ± 8.0V
Rated supply voltage ····· V_{CC}, V_{EE} = ± 7.0V

SYSTEM CONFIGURATION



MITSUBISHI ELECTRIC

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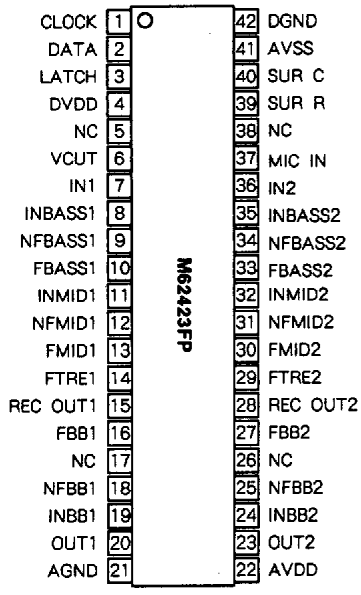
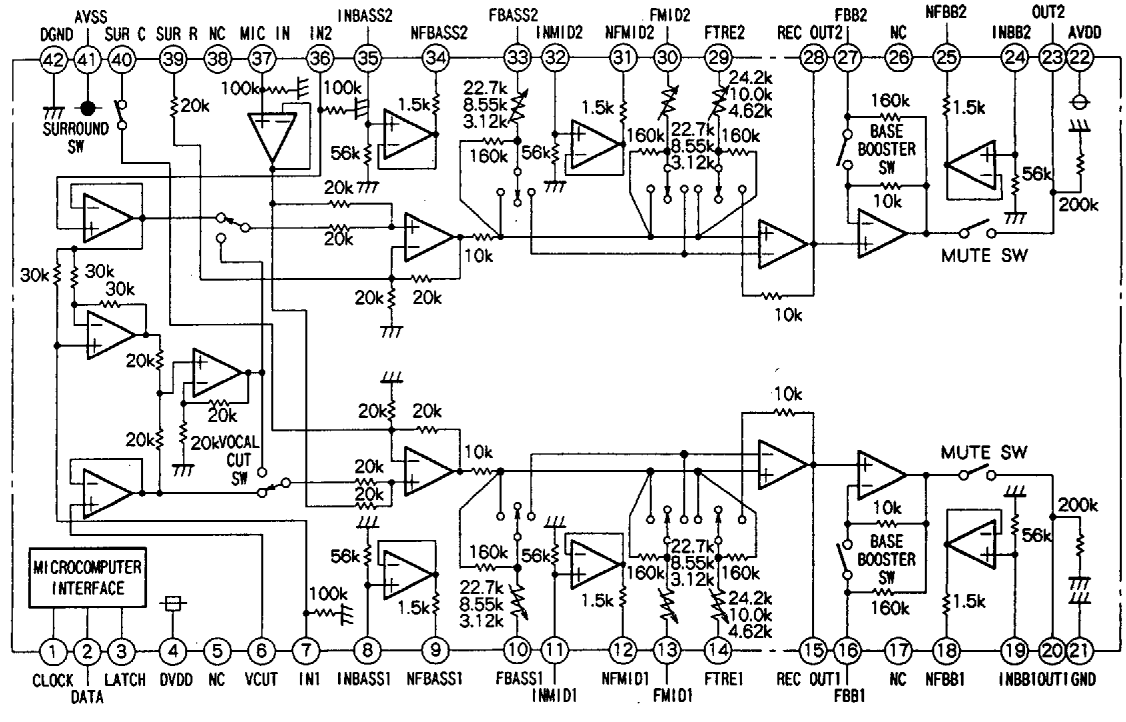
PIN CONFIGURATION (TOP VIEW)



Outline 42P2R-A

NC : NO CONNECTION

IC INTERNAL BLOCK DIAGRAM



Unit Resistance : Ω

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
AV_{DD}, AV_{SS}	Analog supply voltage	± 8.5	V
DV_{DD}	Digital supply voltage	7.0	V
P_d	Power dissipation (Ta ≦ 25℃)	1250	mW
K_θ	Thermal derating (Ta > 25℃)	9.5	mW/℃
T_{opr}	Operating temperature	−20 to +75	℃
T_{stg}	Storage temperature	−55 to +125	℃

ELECTRICAL CHARACTERISTICS (Ta = 25℃, AV_{DD} = 7V, AV_{SS} = − 7V, DV_{DD} = 5V, unless otherwise noted. Tone control and bass boost are set to 0dB.)

(1) Power supply characteristics

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
AI_{DD}	Circuit current of analog positive power supply	Current at pin ㉘ with AV_{DD} = 7V, AV_{SS} = − 7V No signal	−	22	−	mA
AI_{SS}	Circuit current of analog negative power supply	Circuit current at pin ㉑ with AV_{DD} = 7V, AV_{SS} = − 7V No signal	−	− 22	−	mA
DI_{DD}	Circuit current of digital power supply	Current at pin ④ with DV_{DD} = 5V No signal	−	0	−	μA

(2) Characteristics of the digital block

Symbol	Parameter	Test conditions		Limits			Unit
				Min	Typ	Max	
V_{IL}	Input voltage ("L" level)	CLOCK, DATA, LATCH pins		0	−	0.3·DV_{DD}	V
V_{IH}	Input voltage ("H" level)			0.7·DV_{DD}	−	DV_{DD}	V
I_{IL}	Output voltage ("L" level)	V_{IN} = 0	CLOCK, DATA, LATCH pins	−10	−	10	μA
I_{IH}	Input current ("H" level)	V_{IN} = DV_{DD}		−	−	10	μA
F_{CIK}	CLOCK frequency			−	−	250	kHz
t_{WHC}	CLOCK pulse width			4.0	−	−	μS
t_{SD}	DATA setup time			1.0	−	−	μS
t_{HD}	DATA hold time			1.0	−	−	μS
t_{WHI}	LATCH pulse width			2.0	−	−	μS
t_{SI}	LATCH setup time			1.0	−	−	μS

(3) Input/Output characteristics

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
R_{IN}	Input resistance	Pin⑦, ㉖, Ta = 25℃	50	100	200	kΩ
V_{IM}	Max. input voltage	Input to pin⑦, ㉖, ㉗, output from pin㉑, ㉓	3.0	4.0	–	Vrms
V_{ODC}	Output pin voltage	Pin㉑, ㉓, no signal	−0.15	0	0.15	V
V_{RECDC}		Pin⑮, ⑱, no signal	−0.1	0	0.1	V
G_V	Pass gain	V_{IN} = 1Vrms, flat. pin㉑, ㉓−⑦, ㉖ gains	−1	0	1	dB
V_{ONO}	Output noise voltage	JIS-A filter, no signal, Rg = 10k Ω, pin㉑, ㉓	–	7.0	20	μVrms
V_{RECNO}		JIS-A filter, no signal, Rg = 10k Ω, pin⑮, ㉘	–	5.5	15	μVrms
THD	Distortion factor	pin㉑, ㉓. V_O = 0.5Vrms, R_L = 30k Ω	–	0.02	0.8	%
THD_{REC}		pin⑮, ㉘. V_O = 0.5Vrms, R_L = 10k Ω	–	0.01	0.4	%
CT	Crosstalk between channels	Between pin ⑦, ㉖−㉑, ㉓ lines, V_O = 1Vrms, R_L = 30k Ω	−60	−65	–	dB
CT_{REC}		Between pin ⑦, ㉖−⑮, ㉘ lines, V_O = 1Vrms, R_L = 10k Ω	−60	−65	–	dB

(4) Tone control characteristics

Symbol	Parameter	Test conditions		Limits			Unit
				Min	Typ	Max	
G_{BOOST1}	Tone control voltage gain	3dB	f = 1kHz, V_O = 1Vrms, Input pin ⑦, ㉖ − output pin㉑, ㉓ gain	2	3	4	dB
G_{BOOST2}		6dB		5	6	7	dB
G_{BOOST3}		10dB		8.5	10	11.5	dB
G_{CUT1}		−3dB		−4	−3	−2	dB
G_{CUT2}		−6dB		−7	−6	−5	dB
G_{CUT3}		−10dB		−11.5	−10	−8.5	dB
B_{ALTON}	Balance between channels	f = 1kHz, V_O = 1Vrms, Each of boost and cut conditions		−1	0	+1	dB

(5) Bass boost characteristics

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
G_{DD}	Bass boost voltage gain	f = 1kHz, V_O = 1Vrms Pin ㉑, ㉓, R_L = 3.3k	8.5	10	11.5	dB
B_{ALDD}	Graphic equalizer balance between channels	f = 1kHz, V_O = 1Vrms, Defference in pin ㉑−㉓ gain	−1	0	+1	dB

(6) Microphone amplifier input/output characteristics

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
R_{micin}	Input resistance	Pin㉘	50	100	200	kΩ
V_{IMmic}	Max. input voltage	FLAT, R_L = 30kΩ, THD = 1 %, Measure input at pin ㉗, outputs at pin㉑, ㉓	3.0	4.0	–	Vrms
G_{Vmic}	Pass gain	pin㉑, ㉓−㉗ voltage gains, V_O = 0.5Vrms, R_L = 30kΩ	−2	0	2	dB
THD_{mic}	Distortion factor	pin㉑, ㉓ V_O = 0.5Vrms, R_L = 30kΩ	–	0.02	0.8	%
B_{ALmic}	Balance between channels	Difference in voltage gain between pin ㉑, ㉓	−1	0	1	dB

DIGITAL CONTROL SPECIFICATIONS

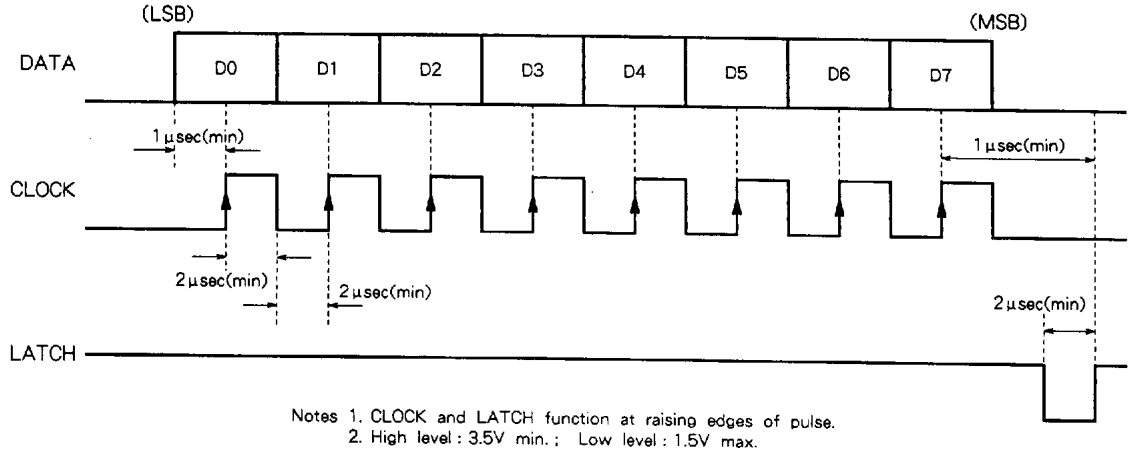
Digital format

	D7	D6	D5	D4	D3	D2	D1	D0	
DATA 0 (MSB)	MODE SELECT 0	BASS BOOST OFF/ON	SURROUND OFF/ON	OUTPUT MUTE OFF/ON	VOCAL CUT OFF/ON	—	—	—	(LSB)
DATA 1 (MSB)	MODE SELECT 1	TONE CONTROL MODE 01 : BASS 10 : TREBLE 11 : MID		—	—	BOOST/CUT VOLUME			(LSB)

	Signal name	Function
D0	–	Fixed to "0"
D1	–	Fixed to "0"
D2	–	Fixed to "0"
D3	Vocal cut	Vocal cut disabled by "0" Vocal cut enabled by "1"
D4	Output mute	Output mute disabled by "0" Output mute enabled by "1"
D5	Sorround	Sorround disabled by "0" Sorround enabled by "1"
D6	Bass boost	Bass boost disabled by "0" Bass boost enabled by "1"
D7	Mode select	Data 0 is selected by "0"

	Signal name	Function
D0	Tone boosting/ cutting volume	D2 D1 D0 Boosting / cutting volume: 0 0 0 +0dB; 0 0 1 +3dB; 0 1 0 +6dB; 0 1 1 +10dB; 1 0 0 −0dB; 1 0 1 −3dB; 1 1 0 −6dB; 1 1 1 −10dB
D1		
D2		
D3	–	Fixed to "0"
D4	–	Fixed to "0"
D5	Tone control mode	D5 D6 Mode: 0 1 Bass; 1 0 Treble; 1 1 MID
D6		
D7	Mode select	Data 1 is selected by "1"

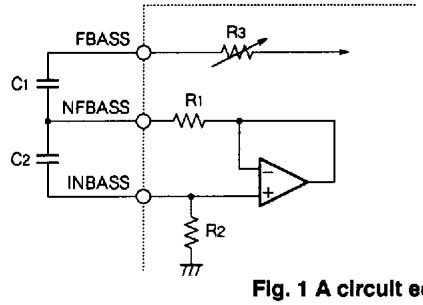
DATA TIMING (Recommended conditions)



Notes 1. CLOCK and LATCH function at raising edges of pulse.
2. High level : 3.5V min. ; Low level : 1.5V max.

FUNCTION DESCRIPTION

(1) Tone controller equivalent circuit



CENTER FREQUENCY

$10 = 1/2\pi\sqrt{C1 \cdot C2 \cdot R1 \cdot R2}$ [Hz]

$Q = \sqrt{(C2 \cdot R2) / (C1 \cdot R1)}$

EXAMPLE : BASS BAND (f = 150Hz)

R1 = 1.5k Ω, R2 = 56k Ω

C1 = 0.82 μ, C2 = 0.015 μ

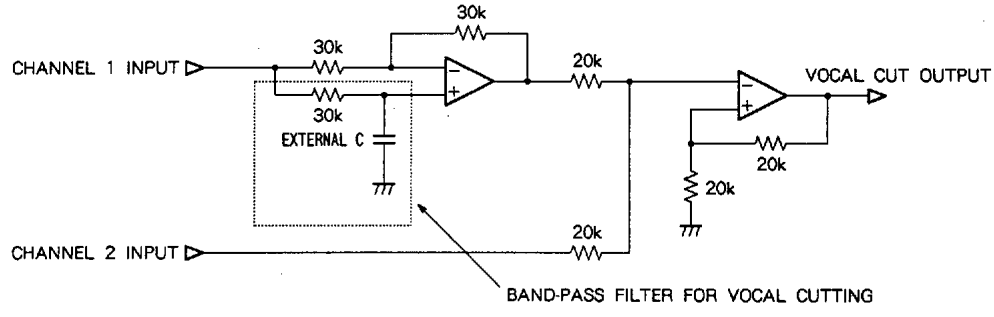
Fig. 1 A circuit equivalent to the inside of the tone controller

Fig. 2 is equivalent to Fig.1. To convert compoment constants, the equation below is used.

$L = C2 \cdot R1 \cdot R2$

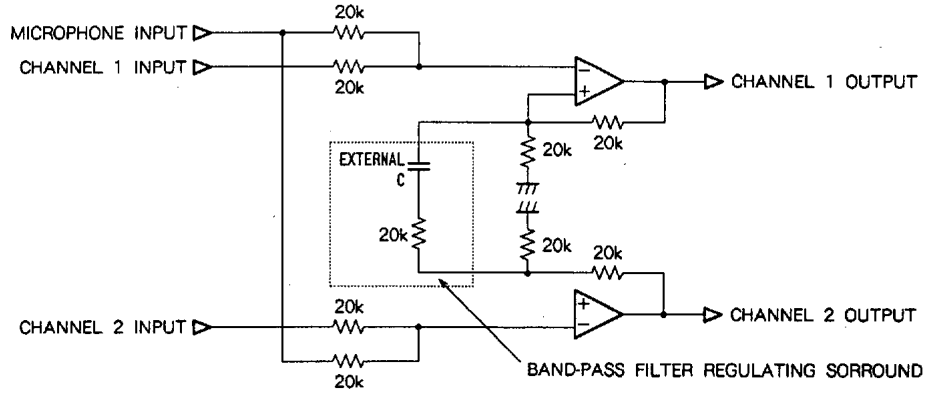
Fig. 2 An equivalent circuit using L

(2) Vocal cut block equivalent circuit

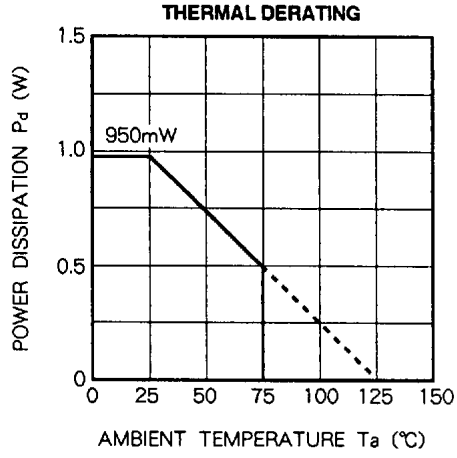


Note. The vocal cut output is monaural.

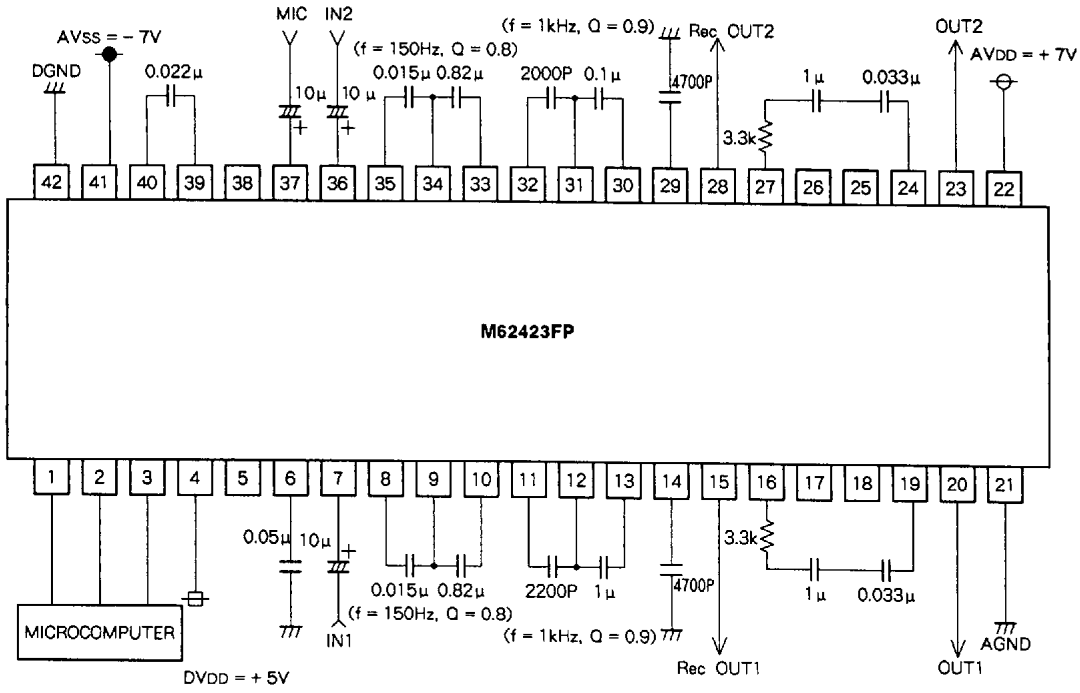
(3) Surround block equivalent circuit



TYPICAL CHARACTERISTICS



APPLICATION EXAMPLE



Unit Capacitance : F