M62417SP

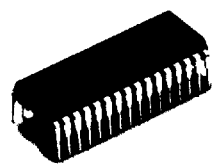
DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

DESCRIPTION

The M62417SP 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 2-band tone control.

FEATURES

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

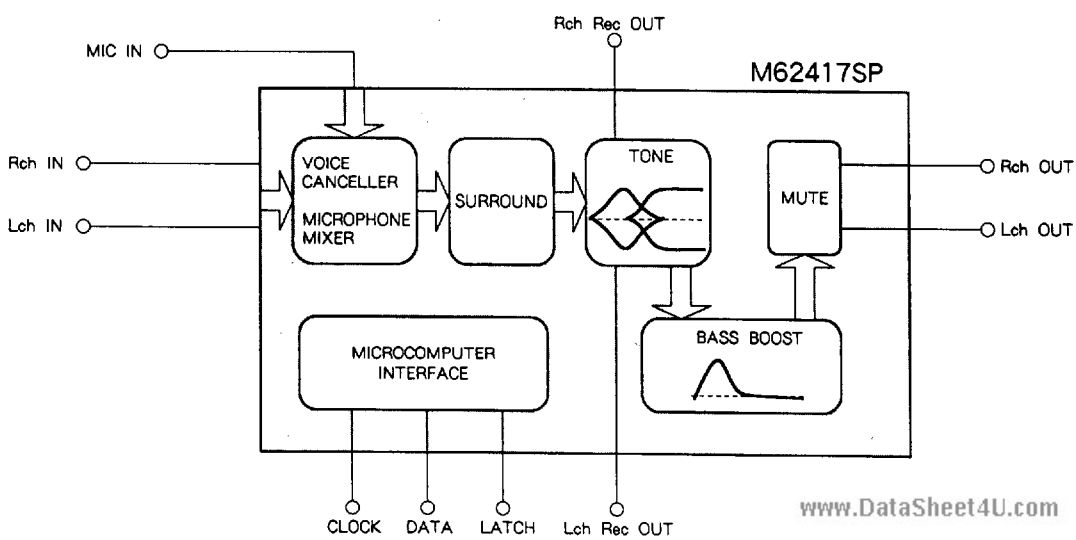


Outline 32P4B
1.778mm pitch 400mil SDIP
(8.9mm × 28.0mm × 3.8mm)

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



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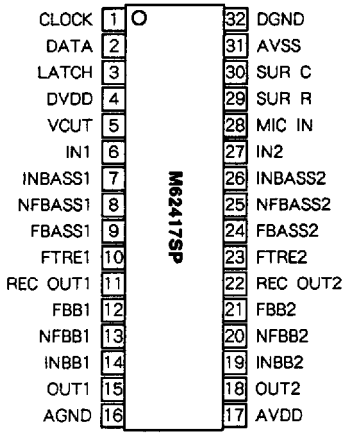
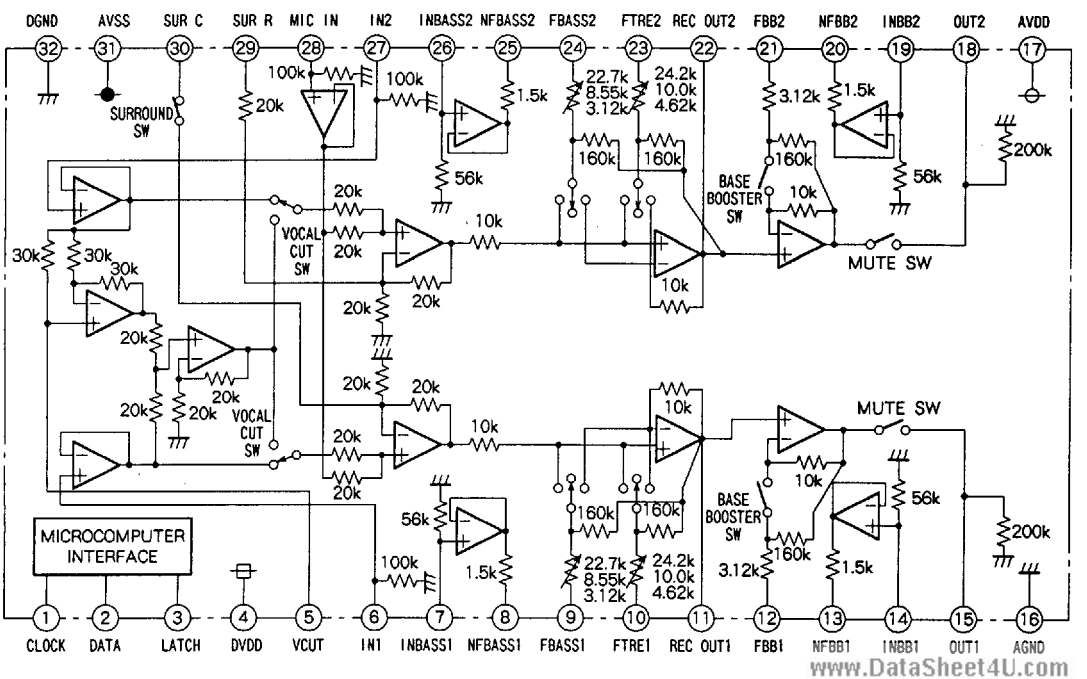
PIN CONFIGURATION (TOP VIEW)



Outline 32P4B(SP)

IC INTERNAL BLOCK DIAGRAM



Unit Resistance : Ω

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PIN DESCRIPTION

Pin No.	Symbol	Function
①	CLOCK	Clock input for serial data transmission
②	DATA	Control data input. Receives data in sync with CLOCK
③	LATCH	Trigger input for data writing. Data is written at positive-going edges
④	DVDD	Power supply to internal logic circuits
⑤	VCUT	Capacitive impedance (band-pass filter) connection pin for vocal cut
⑥	IN1	Channel 1 input
⑦	INBASS1	Input of resonant buffer amp in base section
⑧	NFBASS1	Output of resonant buffer amp in base section
⑨	FBASS1	Resonant impedance (band-pass filter) connection pin for base section
⑩	FTRE1	Resonant impedance (band-pass filter) connection pin for treble section
⑪	REC OUT1	REC output of channel 1
⑫	FBB1	Input of bass boosting resonant buffer amp
⑬	NFBB1	Output of bass boosting resonant buffer amp
⑭	INBB1	Resonant impedance (band-pass filter) connection pin for bass boosting
⑮	OUT1	Channel 1 output
⑯	AGND	Ground of internal analog circuit
⑰	AVDD	Positive power supply to internal analog circuit
⑱	OUT2	Channel 2 output
⑲	INBB2	Input of bass boosting resonant buffer amp
⑳	NFBB2	Output of bass boosting resonant buffer amp
㉑	FBB2	Resonant impedance (band-pass filter) connection pin for bass boosting
㉒	REC OUT2	REC output of channel 2
㉓	FTRE2	Resonant impedance (band-pass filter) connection pin for treble section
㉔	FBASS2	Resonant impedance (band-pass filter) connection pin for base section
㉕	NFBASS2	Output of resonant buffer amp in base section
㉖	INBASS2	Input of resonant buffer amp in base section
㉗	IN2	Channel 2 input
㉘	MIC IN	Microphone input
㉙	SUR R	External C connection pin for setting time constant for surround
㉚	SUR C	External C connection pin for setting time constant for surround
㉛	AVSS	Negative power supply to internal analog circuits
㉜	DGND	Ground of internal logic circuits

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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
AVDD, AVSS	Analog supply voltage	± 8.5	V
DVDD	Digital supply voltage	7.0	V
Pd	Power dissipation (Ta ≦ 25℃)	1250	mW
Kθ	Thermal derating (Ta > 25℃)	9.5	mW/℃
Topr	Operating temperature	−20 to +75	℃
Tstg	Storage temperature	−55 to +125	℃

ELECTRICAL CHARACTERISTICS (Ta = 25℃, AVDD = 7V, AVSS = − 7V, DVDD = 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	
AIDD	Circuit current of analog positive power supply	Current at pin ㉜ with AVDD = 7V, AVSS = − 7V No signal	−	22	−	mA
AISS	Circuit current of analog negative power supply	Circuit current at pin ⑰ with AVDD = 7V, AVSS = − 7V No signal	−	− 22	−	mA
DIDD	Circuit current of digital power supply	Current at pin ④ with DVDD = 5V No signal	−	1	−	μA

(2) Characteristics of the digital block

Symbol	Parameter	Test conditions		Limits			Unit
				Min	Typ	Max	
VIL	Input voltage ("L" level)	CLOCK, DATA, LATCH pins		0	−	0.3·DVDD	V
VIH	Input voltage ("H" level)			0.7·DVDD	−	DVDD	V
IIL	Output voltage ("L" level)	VIN = 0	CLOCK, DATA, LATCH pins	−10	−	10	μA
IIH	Input current ("H" level)	VIN = DVDD		−	−	10	μA
FCIK	CLOCK frequency			−	−	250	kHz
tWHC	CLOCK pulse width			4.0	−	−	μS
tSD	DATA setup time			1.0	−	−	μS
tHD	DATA hold time			1.0	−	−	μS
tWHI	LATCH pulse width			2.0	−	−	μS
tSI	LATCH setup time			1.0	−	−	μS

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(3) Input/Output characteristics

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
R_{IN}	Input resistance	Pin ⑥, ㉗, Ta = 25℃	50	100	200	kΩ
V_{IM}	Max. input voltage	Input to pin ⑥, ㉗, ㉘, output from pin ⑮, ⑱	3.0	4.0	–	Vrms
V_{ODC}	Output pin voltage	Pin ⑮, ⑱, no signal	−0.15	0	0.15	V
V_{RECDC}		Pin ⑪, ㉒, no signal	−0.1	0	0.1	V
G_V	Pass gain	V_{IN} = 1Vrms, flat. pin ⑥, ㉗ − ⑮, ⑱ gains	−1	0	1	dB
V_{ONO}	Output noise voltage	JIS-A filter, no signal, Rg = 10k Ω, pin ⑮, ⑱	–	7.0	20	μVrms
V_{RECNO}		JIS-A filter, no signal, Rg = 10k Ω, pin ⑪, ㉒	–	5.5	15	μVrms
THD	Distortion factor	pin ⑮, ⑱. Vo = 0.5Vrms, R_L = 30k Ω	–	0.02	0.8	%
THD_{REC}		pin ⑪, ㉒. Vo = 0.5Vrms, R_L = 10k Ω	–	0.01	0.4	%
CT	Crosstalk between channels	Between pin ⑥, ㉗ − ⑱, ⑮ lines, Vo = 1Vrms, R_L = 30k Ω	−60	−70	–	dB
CT_{REC}		Between pin ⑥, ㉗ − ㉒, ⑪ lines, Vo = 1Vrms, R_L = 10k Ω	−60	−70	–	dB

(4) Tone control characteristics

Symbol	Parameter	Test conditions		Limits			Unit
				Min	Typ	Max	
G_{BOOST1}	Tone control voltage gain	3dB	f = 1KHz, Vo = 1Vrms, Input pin ⑥, ㉗ − output pin ⑮, ⑱ 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, Vo = 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, Vo = 1Vrms Pin ⑮, ⑱	8.5	10	11.5	dB
B_{ALDD}	Graphic equalizer balance between channels	f = 1kHz, Vo = 1Vrms, Defference in pin ⑮ − ⑱ gain	−1	0	+1	dB

(6) Microphone amplifier input/output characteristics

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
R_{micin}	Input resistance	Pin ㉘	50	100	200	kΩ
V_{IMmic}	Max. input voltage	FLAT, R_L = 30kΩ, THD = 1 %, Measure input at pin ㉘, outputs at pin ⑮, ⑱	3.0	4.0	–	Vrms
G_{Vmic}	Pass gain	pin ⑮, ⑱ − ㉘ voltage gains, Vo = 0.5Vrms, R_L = 30KΩ	−1	0	2	dB
THD_{mic}	Distortion factor	pin ⑮, ⑱ Vo = 0.5Vrms, R_L = 30KΩ		0.02	0.8	%
B_{ALmic}	Balance between channels	Difference in voltage gain between pin ⑮, ⑱	−1	0	1	dB

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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		—	—	BOOST/CUT VOLUME			(LSB)

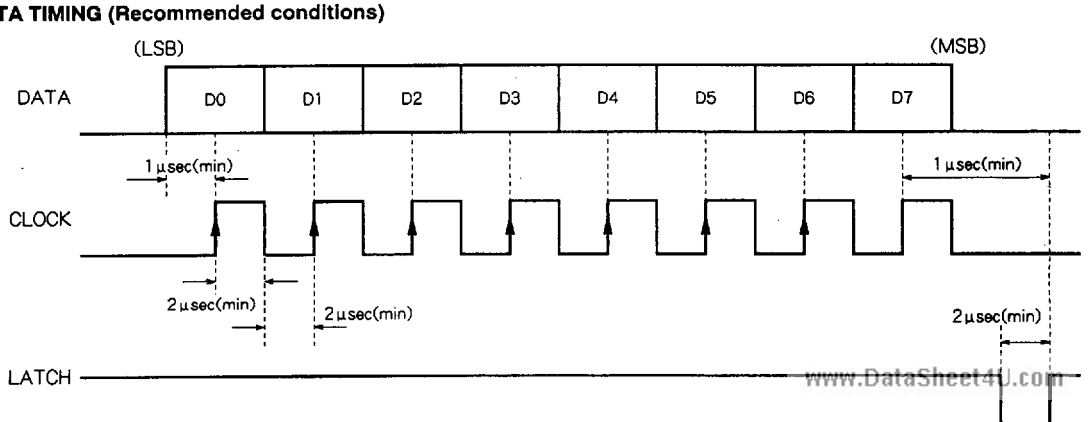
	Signal name	Function
D0	–	Fixed to "0"
D1	–	Fixed to "0"
D2	–	Fixed to "0"
D3	Vocal cut	Vocal cut disabled by "0" Vocal cut enabled by "1"
D4	Output mute	Output mute disabled by "0" Output mute enabled by "1"
D5	Sorround	Sorround disabled by "0" Sorround enabled by "1"
D6	Bass boost	Bass boost disabled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

	Signal name	Function
D0	Tone boosting/ cutting volume	See table below
D1		
D2		
D3	–	Fixed to "0"
D4	–	Fixed to "0"
D5	Tone control mode	See table below
D6		
D7	Mode select	Data 1 is selected by "1"

D2	D1	D0	Boosting / cutting volume	D2	D1	D0	Boosting / cutting volume
0	0	0	+0dB	1	0	0	−0dB
0	0	1	+3dB	1	0	1	−3dB
0	1	0	+6dB	1	1	0	−6dB
0	1	1	+10dB	1	1	1	−10dB

D5	D6	Mode
0	1	Bass
1	0	Treble

DATA TIMING (Recommended conditions)



Notes1. CLOCK and LATCH function at raising edges of pulse.
2. High level : 3.5V min. ; Low level : 1.5V max.

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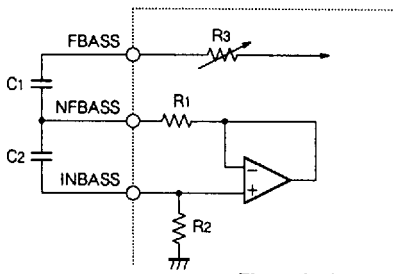
DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

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

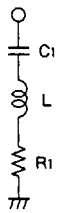
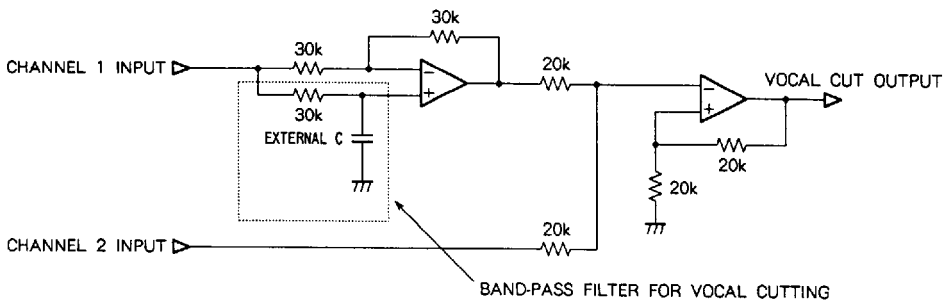


Fig. 2 is equivalent to Fig.1. To convert compoment constants, the equation below is used.

$L = C2 \cdot R1 \cdot R2$

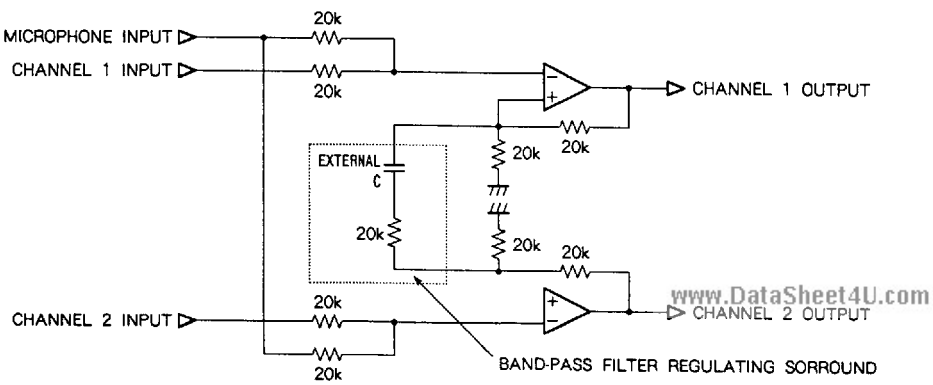
Fig. 2 An equivalent circuit using L

(2) Vocal cut block equivalent circuit



Note. The vocal cut output is monaural.

(3) Surround block equivalent circuit



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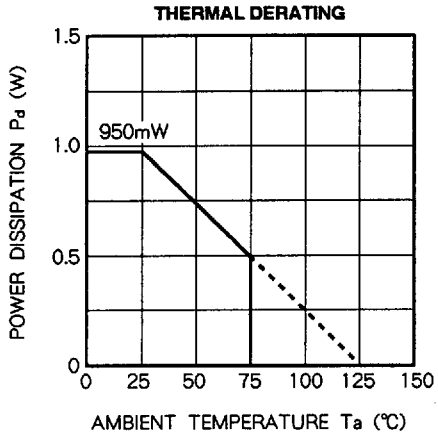
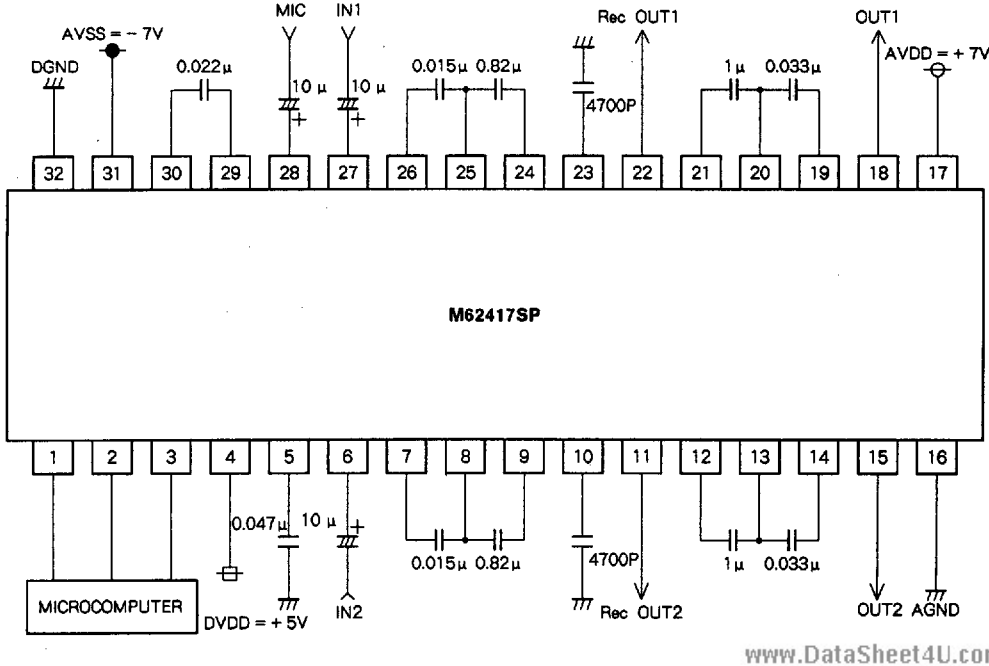
TYPICAL CHARACTERISTICS



APPLICATION EXAMPLE



Unit Capacitance : F