

# M62417SP

## DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

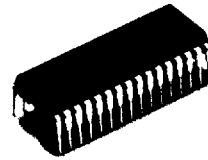
### DESCRIPTION

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]

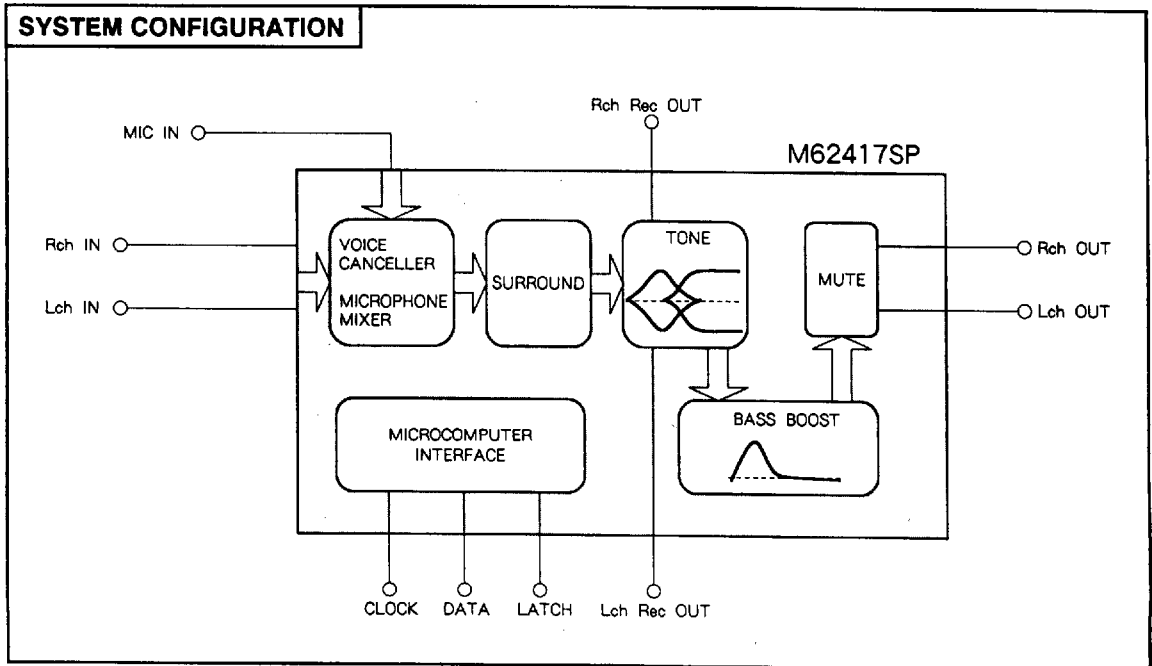


Outline 32P4B

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

### RECOMMENDED OPERATING CONDITIONS

- Supply voltage range.....  $V_{CC}, V_{EE} = \pm 5.0$  to  $\pm 8.0V$
- Rated supply voltage.....  $V_{CC}, V_{EE} = \pm 7.0V$

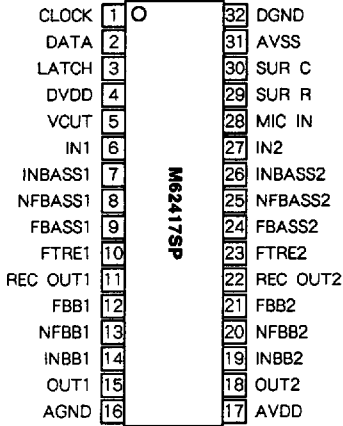


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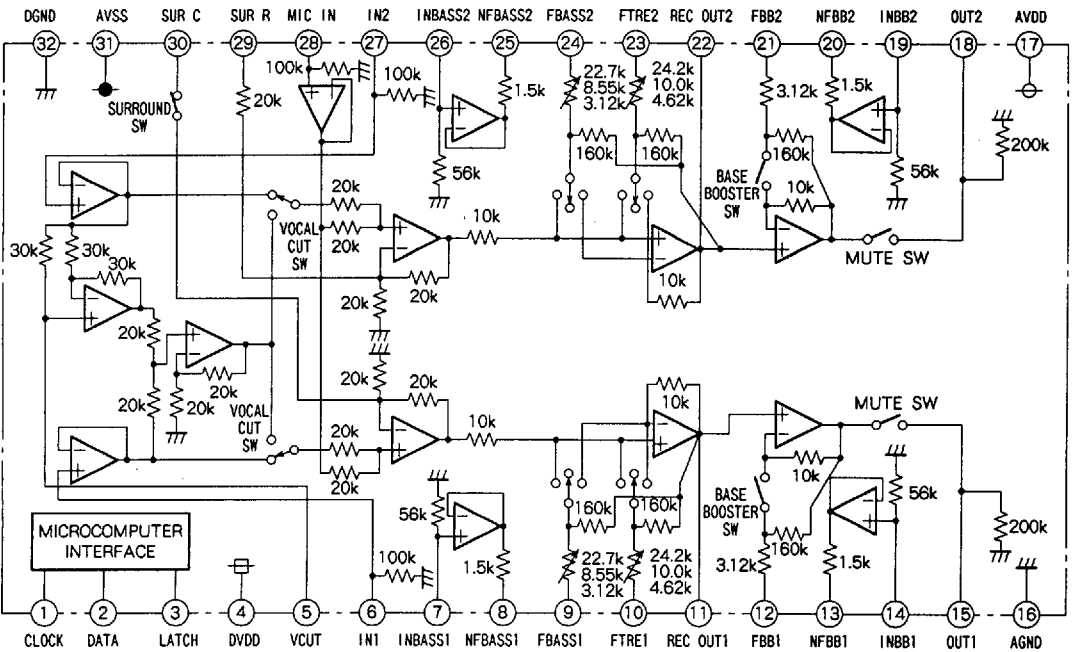
## DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

### PIN CONFIGURATION (TOP VIEW)



Outline 32P4B(SP)

### IC INTERNAL BLOCK DIAGRAM



Unit Resistance : Ω

6249826 0022227 318



## DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

## 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

## DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rated	Unit
$A'_{DD}, AV_{SS}$	Analog supply voltage	$\pm 8.5$	V
$DV_{DD}$	Digital supply voltage	7.0	V
$P_d$	Power dissipation ( $T_a \leq 25^\circ\text{C}$ )	1250	mW
$K_\theta$	Thermal derating ( $T_a > 25^\circ\text{C}$ )	9.5	mW/ $^\circ\text{C}$
$T_{opr}$	Operating temperature	-20 to +75	$^\circ\text{C}$
$T_{stg}$	Storage temperature	-55 to +125	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ ,  $AV_{DD} = 7\text{V}$ ,  $AV_{SS} = -7\text{V}$ ,  $DV_{DD} = 5\text{V}$ , 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	
$I_{DD}$	Circuit current of analog positive power supply	Current at pin ② with $AV_{DD} = 7\text{V}$ , $AV_{SS} = -7\text{V}$ No signal	-	22	-	mA
$I_{SS}$	Circuit current of analog negative power supply	Circuit current at pin ① with $AV_{DD} = 7\text{V}$ , $AV_{SS} = -7\text{V}$ No signal	-	-22	-	mA
$I_{DD}$	Circuit current of digital power supply	Current at pin ④ with $DV_{DD} = 5\text{V}$ No signal	-	1	-	$\mu\text{A}$

## (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	-	$0.3 \cdot DV_{DD}$	V
$V_{IH}$	Input voltage ("H" level)		$0.7 \cdot DV_{DD}$	-	$DV_{DD}$	V
$i_{IL}$	Output voltage ("L" level)	$V_{IN} = 0$	-10	-	10	$\mu\text{A}$
$i_{IH}$	Input current ("H" level)	$V_{IN} = DV_{DD}$	-	-	10	$\mu\text{A}$
$F_{CK}$	CLOCK frequency		-	-	250	kHz
$t_{WHC}$	CLOCK pulse width		4.0	-	-	$\mu\text{S}$
$t_{SD}$	DATA setup time		1.0	-	-	$\mu\text{S}$
$t_{HD}$	DATA hold time		1.0	-	-	$\mu\text{S}$
$t_{WHI}$	LATCH pulse width		2.0	-	-	$\mu\text{S}$
$t_{SI}$	LATCH setup time		1.0	-	-	$\mu\text{S}$

DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

(3) Input/Output characteristics

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
R <sub>IN</sub>	Input resistance	Pin ⑥, ⑦, Ta = 25°C	50	100	200	kΩ
V <sub>IM</sub>	Max. input voltage	Input to pin ⑥, ⑦, ⑧, output from pin ⑨, ⑩	3.0	4.0	-	V <sub>rms</sub>
V <sub>ODC</sub>	Output pin voltage	Pin ⑨, ⑩, no signal	-0.15	0	0.15	V
V <sub>REDC</sub>		Pin ①, ②, no signal	-0.1	0	0.1	V
G <sub>v</sub>	Pass gain	V <sub>IN</sub> = 1V <sub>rms</sub> , flat. pin ⑥, ⑦ - ⑨, ⑩ gains	-1	0	1	dB
V <sub>ONO</sub>	Output noise voltage	JIS-A filter, no signal	-	7.0	20	μV <sub>rms</sub>
V <sub>RECNO</sub>		R <sub>g</sub> = 10kΩ	pin ⑨, ⑩	-	5.5	15
THD	Distortion factor	pin ⑨, ⑩. Vo = 0.5V <sub>rms</sub> , R <sub>L</sub> = 30kΩ	-	0.02	0.8	%
THD <sub>REC</sub>		pin ①, ②. Vo = 0.5V <sub>rms</sub> , R <sub>L</sub> = 10kΩ	-	0.01	0.4	%
CT	Crosstalk between channels	Between pin ⑥, ⑦ - ⑨, ⑩ lines Vo = 1V <sub>rms</sub> , R <sub>L</sub> = 30kΩ	-60	-70	-	dB
CT <sub>REC</sub>		Between pin ⑥, ⑦ - ②, ① lines Vo = 1V <sub>rms</sub> , R <sub>L</sub> = 10kΩ	-60	-70	-	dB

(4) Tone control characteristics

Symbol	Parameter	Test conditions	Limits			Unit	
			Min	Typ	Max		
G <sub>BOOST1</sub>	Tone control voltage gain	f = 1kHz, Vo = 1V <sub>rms</sub> Input pin ⑥, ⑦ - output pin ⑨, ⑩ gain	3dB	2	3	4	dB
G <sub>BOOST2</sub>			6dB	5	6	7	dB
G <sub>BOOST3</sub>			10dB	8.5	10	11.5	dB
G <sub>CUT1</sub>			-3dB	-4	-3	-2	dB
G <sub>CUT2</sub>			-6dB	-7	-6	-5	dB
G <sub>CUT3</sub>			-10dB	-11.5	-10	-8.5	dB
BALTON	Balance between channels	f = 1kHz, Vo = 1V <sub>rms</sub> Each of boost and cut conditions	-1	0	+1	dB	

(5) Bass boost characteristics

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
G <sub>DB</sub>	Bass boost voltage gain	f = 1kHz, Vo = 1V <sub>rms</sub> Pin ⑨, ⑩	8.5	10	11.5	dB
BALDD	Graphic equalizer balance between channels	f = 1kHz, Vo = 1V <sub>rms</sub> Defference in pin ⑨ - ⑩ gain	-1	0	+1	dB

(6) Microphone amplifier input/output characteristics

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
R <sub>micin</sub>	Input resistance	Pin ⑫	50	100	200	kΩ
V <sub>IMmic</sub>	Max. input voltage	FLAT, R <sub>L</sub> = 30kΩ, THD = 1% Measure input at pin ⑫, outputs at pin ⑬, ⑭	3.0	4.0	-	V <sub>rms</sub>
G <sub>Vmic</sub>	Pass gain	pin ⑬, ⑭ - ⑫ voltage gains Vo = 0.5V <sub>rms</sub> , R <sub>L</sub> = 30kΩ	-1	0	2	dB
THD <sub>mic</sub>	Distortion factor	pin ⑬, ⑭ Vo = 0.5V <sub>rms</sub> , R <sub>L</sub> = 30kΩ	-	0.02	0.8	%
BAL <sub>mic</sub>	Balance between channels	Difference in voltage gain between pin ⑬, ⑭	-1	0	1	dB

DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

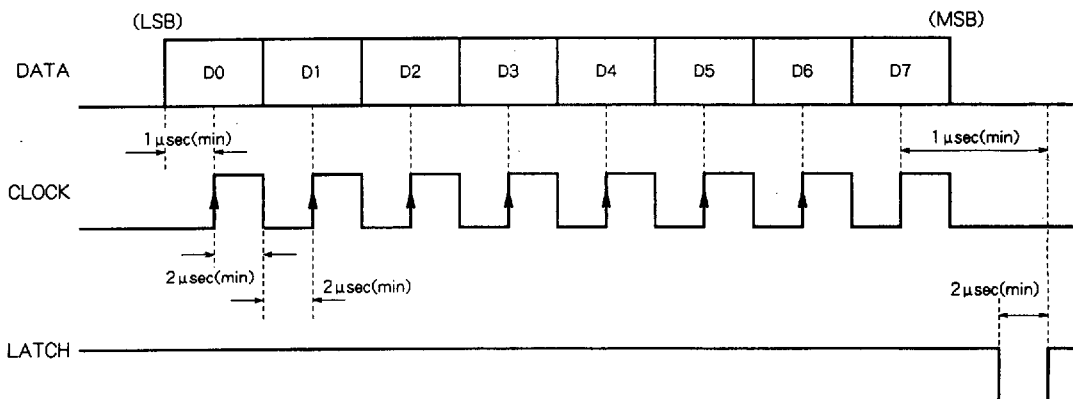
DIGITAL CONTROL SPECIFICATIONS

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	Signal name	Function																																								
D0	Fixed to "0"	D0 Tone boosting/cutting volume	<table border="1"> <thead> <tr> <th>D2</th> <th>D1</th> <th>D0</th> <th>Boosting / cutting volume</th> <th>D2</th> <th>D1</th> <th>D0</th> <th>Boosting / cutting volume</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>+0dB</td> <td>1</td> <td>0</td> <td>0</td> <td>-0dB</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>+3dB</td> <td>1</td> <td>0</td> <td>1</td> <td>-3dB</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>+6dB</td> <td>1</td> <td>1</td> <td>0</td> <td>-6dB</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>+10dB</td> <td>1</td> <td>1</td> <td>1</td> <td>-10dB</td> </tr> </tbody> </table>	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
D2	D1			D0	Boosting / cutting volume	D2	D1	D0	Boosting / cutting volume																																		
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D1	Fixed to "0"	D1	Fixed to "0"																																								
D2	Fixed to "0"	D2	Fixed to "0"																																								
D3	Vocal cut disabled by "0" Vocal cut enabled by "1"	D3	Fixed to "0"																																								
D4	Output mute disabled by "0" Output mute enabled by "1"	D4	Fixed to "0"																																								
D5	Sorround disabled by "0" Sorround enabled by "1"	D5 Tone control mode	<table border="1"> <thead> <tr> <th>D5</th> <th>D6</th> <th>Mode</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>Bass</td> </tr> <tr> <td>1</td> <td>0</td> <td>Treble</td> </tr> </tbody> </table>	D5	D6	Mode	0	1	Bass	1	0	Treble																															
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1	0	Treble																																									
D6	Bass boost disabled by "0" Bass boost enabled by "1"	D6																																									
D7	Mode select Data 0 is selected by "0"	D7	Mode select Data 1 is selected by "1"																																								

DATA TIMING (Recommended conditions)

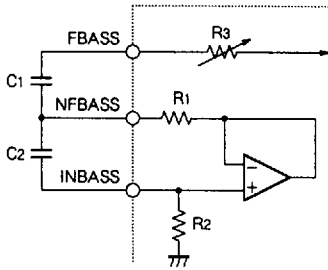


Notes1. CLOCK and LATCH function at raising edges of pulse.  
2. High level : 3.5V min. ; Low level : 1.5V max.

DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

FUNCTION DESCRIPTION

(1) Tone controller equivalent circuit



CENTER FREQUENCY

$$f_0 = 1 / 2 \pi \sqrt{C_1 \cdot C_2 \cdot R_1 \cdot R_2} \text{ [Hz]}$$

$$Q = \sqrt{(C_2 \cdot R_2) / (C_1 \cdot R_1)}$$

EXAMPLE : BASS BAND (f = 150Hz)

$$R_1 = 1.5k \Omega, R_2 = 56k \Omega$$

$$C_1 = 0.82 \mu, C_2 = 0.015 \mu$$

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

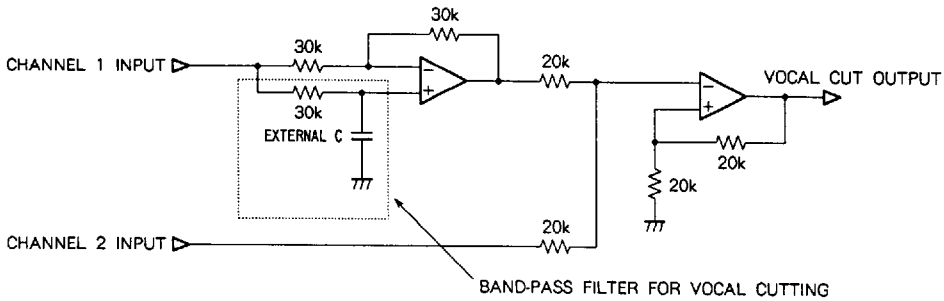


Fig. 2 is equivalent to Fig.1. To convert component constants, the equation below is used.

$$L = C_2 \cdot R_1 \cdot R_2$$

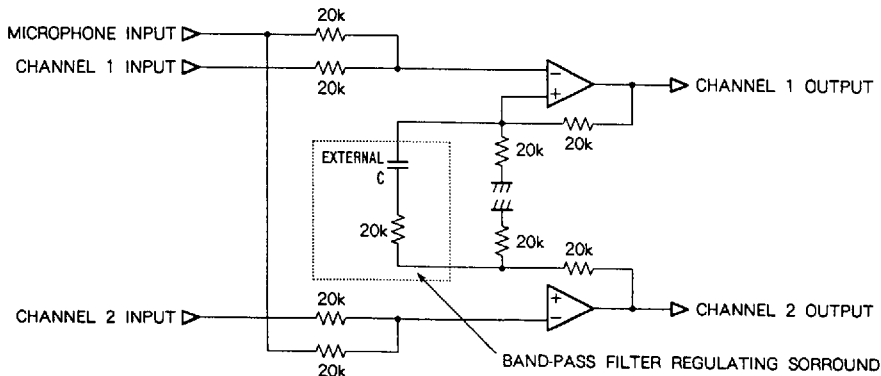
Fig. 2 An equivalent circuit using L

(2) Vocal cut block equivalent circuit



Note. The vocal cut output is monaural.

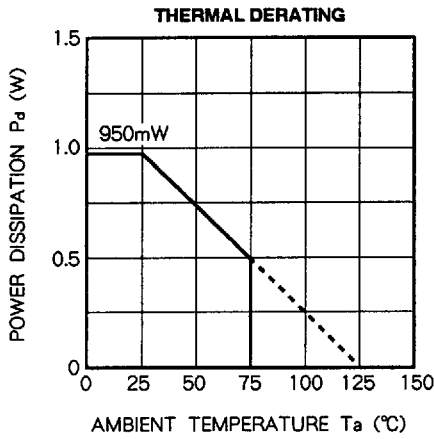
(3) Surround block equivalent circuit



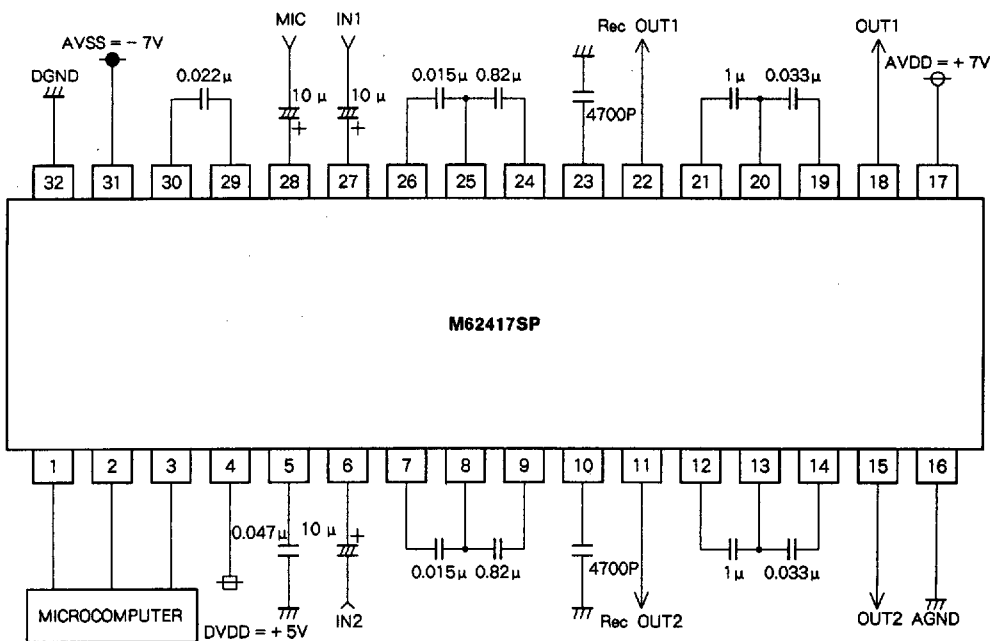
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## DIGITAL SOUND CONTROLLER FOR MINI-COMPONENT STEREO

### TYPICAL CHARACTERISTICS



### APPLICATION EXAMPLE



Unit Capacitance : F