OKI Semiconductor

MSM6378A/MSM6379

OTP BUILT-IN VOICE SYNTHESIS LSI

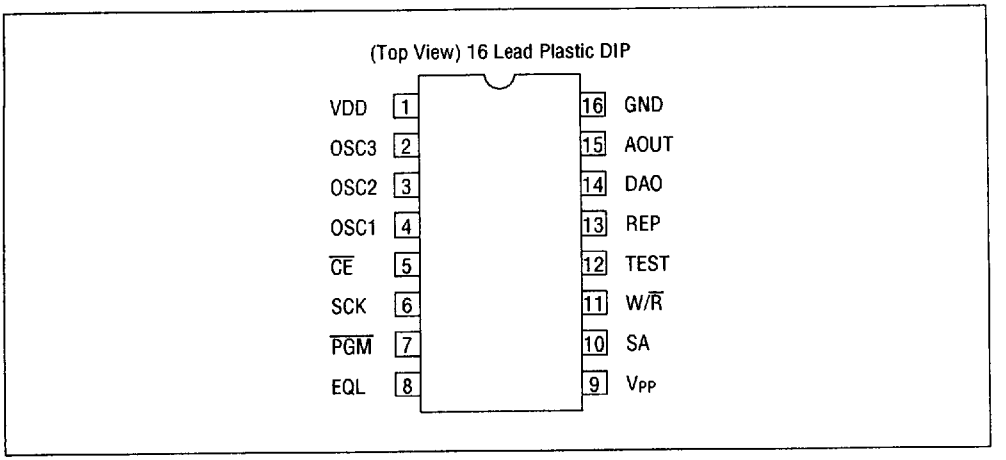
GENERAL DESCRIPTION

The MSM6378A/MSM6379 is an ADPCM voice synthesis LSI with a built-in one-time PROM (OTP). The MSM6378A/MSM6379 reproduces the speech data, which the user has analyzed and recorded using the "ANAWRITER" for an exclusive use, through a speaker driving AMP and speaker. The MSM6378A/MSM6379 can be used in voice cards, small-quantity multi-product toy line-ups, and personal use devices.

FEATURES

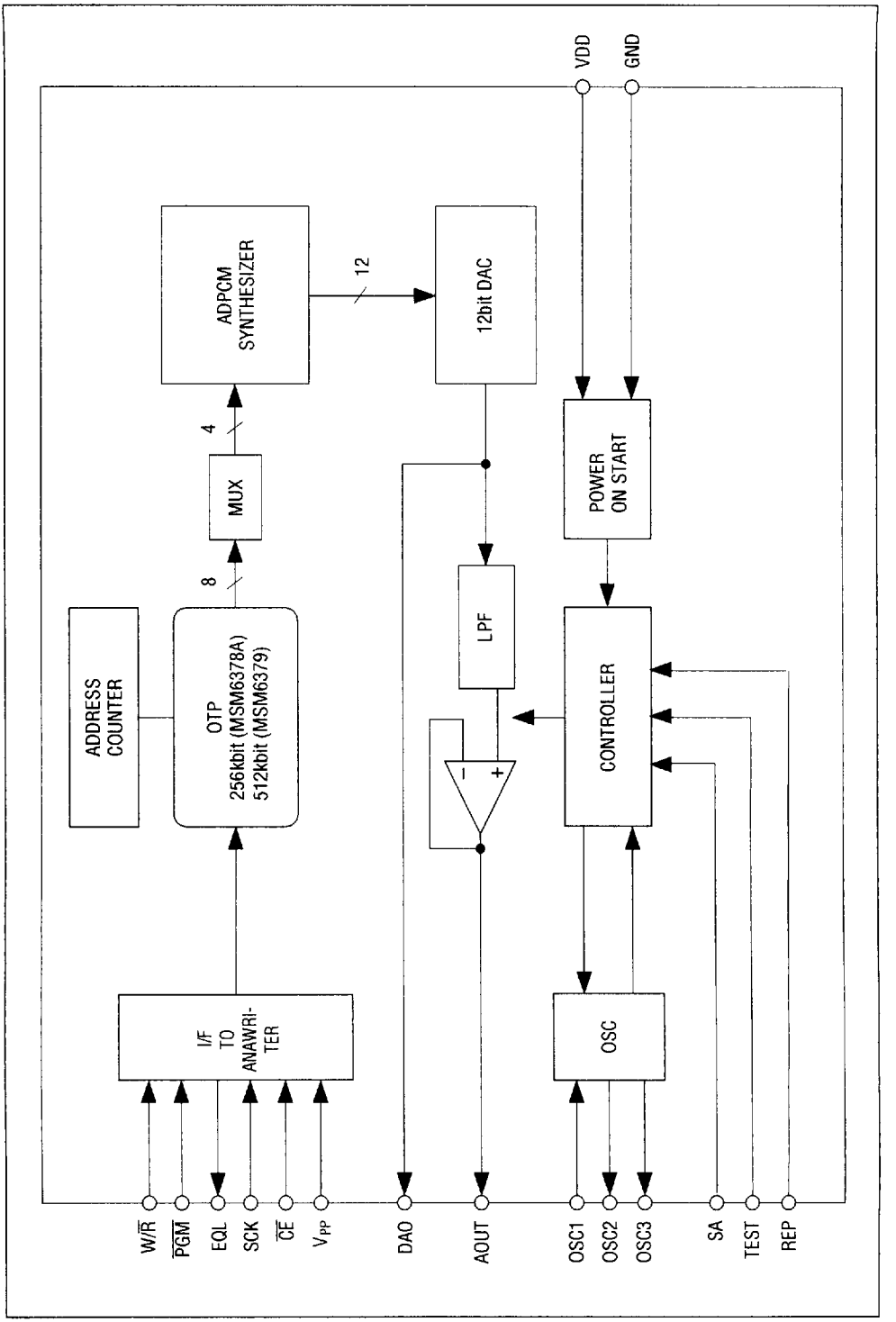
- CMOS
- MSM6379: Built-in 512Kbit OTP (500Kbits for recording)
- MSM6378A: Built-in 256Kbit OTP (244bits for recording)
- 4bit straight ADPCM method
- Built-in low pass filter
- Built-in 12bit DA converter
- Data write time: MSM6379 16 sec.
  MSM6378A 8 sec.
- Oscillation system:
  R/C oscillation or external clock input
- Oscillation frequency: 64 to 256kHz
- Sampling frequency:
  4 to 16kHz (original oscillation frequency/16)
- Activation: Power on start or reactivation after one shot output
- Speech output: one-shot or repeat
- Low current consumption
- Largest speech time:
  MSM6379 32.0 sec. (4kHz sampling)
  MSM6378A 15.6 sec. (4kHz sampling)
- Speech phrase number: One phrase only
- Power supply voltage:
  DAO pin 2.4 to 5.5V
  AOUT pin 2.7 to 5.5V (fsam ≤ 8 kHz)
  3.5 to 5.5V (fsam ≤ 10 kHz)
- Shipping package:
  16pin plastic DIP (DIP 16-P-300W1)
  chip

PIN CONFIGURATION



Note: This is applied to MSM6378ARS and MSM6379RS.

FUNCTIONAL BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS (VPP=VDD at reproduction)

Absolute Maximum Rating

Parameter	Symbol	Condition	Rating	Unit
Power supply voltage	V_{DD}	Ta = 25°C	−0.3~7.0	V
Input voltage	V_{IN}	Ta = 25°C	−0.3~V_{DD}+0.3	V
Storage temperature	T_{stg}	—	−55~125	°C

Operating Range

Parameter	Symbol	Condition	Rating	Unit
Power supply voltage	V_{DD}	GND=0V	DAO pin 2.4~5.5 AOUT pin 2.7~5.5 (fs≤8 kHZ) 3.5~5.5 (fs≥10 kHZ)	V
Operating temperature	T_{OP}	—	−10~70	°C
Oscillation frequency	f_{OSC}	—	64~256	kHZ

DC Characteristics

(V_{DD}=4.5~5.5V GND=0V Ta=0~70°C)

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit
"H" input voltage	V_{IH}	—	0.8×V_{DD}	—	V_{DD}+0.1	V
"L" input voltage	V_{IL}	—	−0.1	—	0.2×V_{DD}	V
"H" input current 1	I_{IH1}	Applies to $\overline{CE}$, SCK, $\overline{PGM}$, SA,W/$\overline{R}$, and TEST pins	20	—	400	µA
"H" input current 2	I_{IH2}	Applies to OSC1 and REP pins	—	—	10	µA
"L" input current	I_{IL}	—	−10	—	—	µA
Operation current consumption	I_{DD}	—	—	7	20	mA
Standby current consumption	I_{DS}	—	—	0.1	10	µA
DA output relative accuracy	$\lvert V_{DAE} \rvert$	No load	—	—	40	mV
DA output impedance	R_{DAO}	—	15	25	35	kΩ
LPF minimum driving resistance	R_{AOUT}	—	50	—	—	kΩ

AC Characteristics

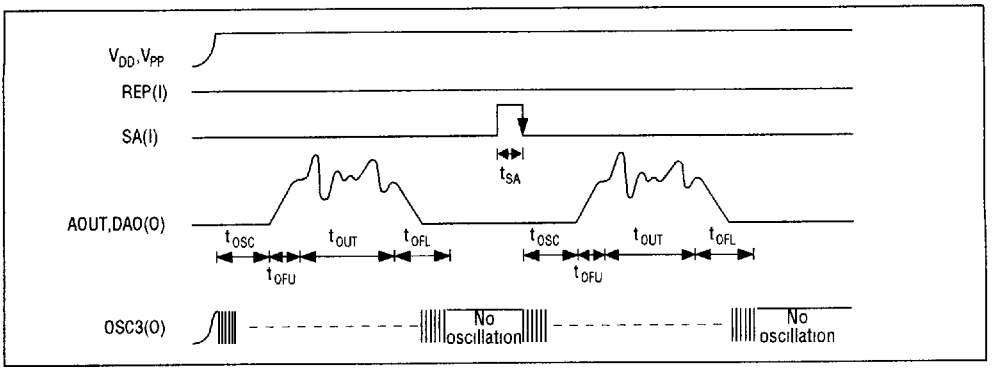
(V_{DD}=4.5~5.5V GND=0V Ta=0~70°C)

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit
Oscillation duty cycle	f_{duty}	—	40	50	60	%
Sampling frequency	fs	fosc/16	4	—	16	kHz
Oscillation stabilization time	tosc	32/fosc	128	—	512	ms
Upper offset time	tOFU	1K/fsam	64	—	256	ms
Lower offset time	tOFL	2K/fsam	128	—	512	ms
MSM6378A speech output time	tOUT1	244Kbit/(4bit×fsam)	3.9	—	15.6	S
MSM6379 speech output time	tOUT2	500Kbit/(4bit×fsam)	8.0	—	32.0	S
SA input pulse width	tSA	—	10	—	—	μs
MSM6378A data write time	tWR1	*Use ANAWRITER	—	8	—	S
MSM6379 data write time	tWR2	*Use ANAWRITER	—	16	—	S

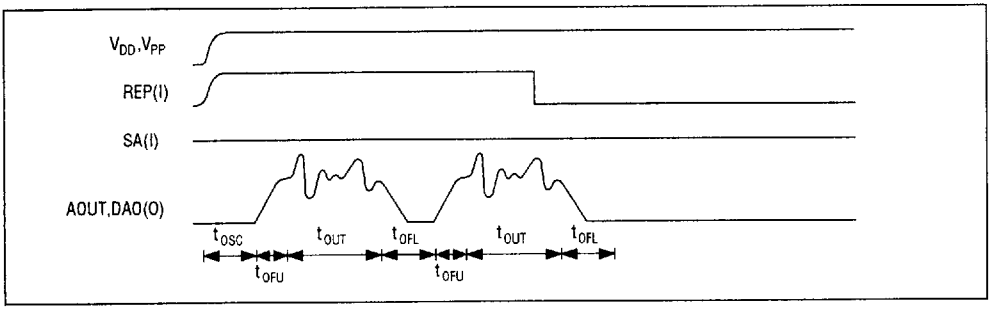
* MSM6378A/6379 guarantees the write only by the ANAWRITER or speech analysis editing tools (AR761 and AR76-202). The anawriter is a registered trademark of Oki Electric Industry Co., Ltd.

TIME CHARTS

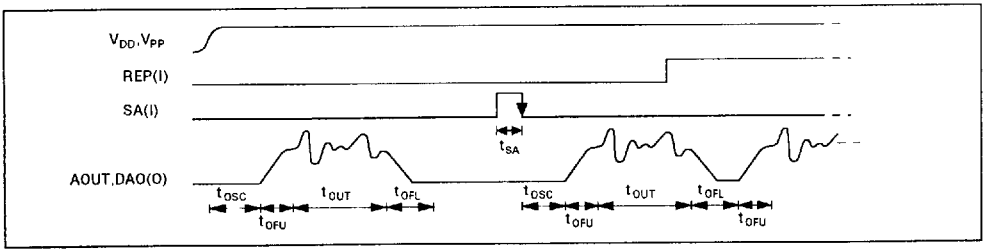
1. Reactivation after One-shot Output



2. One-shot after Repeat

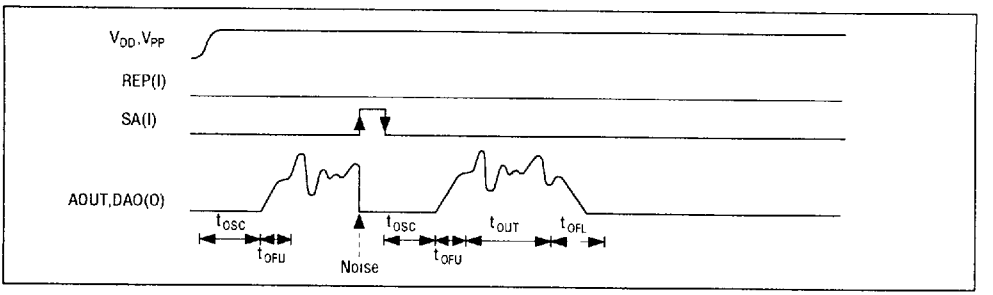


3. Repeat during Speech Output



Note: When REP pin is merely set to "H" level, the speech is not output.

4. Reactivation during Speech Output



Note: When SA pin goes to "H" level during playback, speech is stopped and a noise is output.

PIN DESCRIPTION

Pin Name	I/O	Function
REP	I	Repeat/one-shot selection pin. In power-on or input to SA pin, one-shot is output when REP="L" and repeated speeches are output when REP="H". The speech is not output so long as this pin is merely set to "H" level This pin does not include pull-down resistance.
SA	I	Pin to be reactivated after one-shot output. When a single pulse is applied to SA pin, the LSI is reactivated on the falling edge. This pin includes pull-down resistance.
W/$\overline{R}$	I	Interface pin for the ANAWRITER for exclusive use. Set to "L" or "open" in playback. This pin includes pull-down resistance.
$\overline{PGM}$	I	Same as above (W/$\overline{R}$).
SCK	I	Same as above (W/$\overline{R}$).
$\overline{CE}$	I	Same as above (W/$\overline{R}$).
EQL	O	Interface pin for the anawriter for exclusive use. Set to "open" in playback.
TEST	I	Internal circuit test pin. Set to "L" or "open" in playback. This pin includes pull-down resistance.
OSC1	I	Oscillation RC connection pin or external clock input pin.
OSC2	O	Oscillation RC connection pin. Set to open to input external clock through the OSC1 pin.
OSC3	O	Same as above (OSC2).
DAO	O	DA converter output pin
AOUT	O	LPF output pin.
V_{PP}	–	Power voltage pin for writing the built-in OTP. Set to $V_{PP} = V_{DD}$ or "open" in playback.
V_{DD}	–	Power pin.
GND	–	Ground pin.

FUNCTIONS

1. Number of Phrases

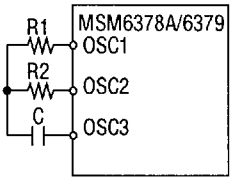
   One word only

2. Relationship Between R, C, Original Oscillation Frequency, and Speech Output Time

C (pF) 3V	C (pF) 5V	R1(kΩ) 3V	R1(kΩ) 5V	R2 (kΩ) 3V	R2 (kΩ) 5V	fosc (kHz)	fsam (kHz)	fCUT (kHz)	tOUT1(sec) MSM6378A	tOUT2(sec) MSM6379
100	100	200	200	56.5	60.5	64	4	1.5	15.6	32.0
100	100	200	200	34.5	36.5	96	6	2.2	10.4	21.3
100	100	200	200	23	25	128	8	2.9	7.8	16.0
100	100	200	200	16.5	18	160	10	3.6	6.2	12.8
100	100	200	200	12.5	14	192	12	4.4	5.2	10.6
100	100	200	200	9.5	11	224	14	5.1	4.5	9.1
100	100	200	200	7.5	9	256	16	5.8	3.9	8.0

$$* t_{OUT1} = \frac{244Kbit}{4bit \times f_{sam}}$$

$$* t_{OUT2} = \frac{500Kbit}{4bit \times f_{sam}}$$



The values of C, R1, and R2 for the above table are for the MSM6378A 16-pin DIP. The oscillation frequency fluctuates with an external resistance and floating capacity. Therefore, since the oscillation frequency fluctuates when the board wiring and packages are different, determine the constant after check with monitoring fosc at OSC3 pin with reference to the above table.

3. Ceramic Oscillator (fosc=256kHz)

- Figure 3-1 shows an external circuit that used the ceramic oscillator CSB256D made by Murata.
- Figure 3-2 shows an external circuit that used the ceramic oscillator KBR-256B made by Kyosera.

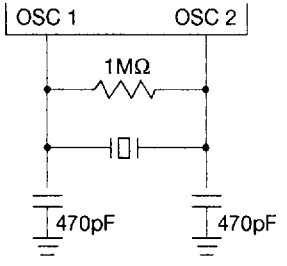


Figure 3-1 Ceramic Oscillator (CSB256D) Connection Circuit

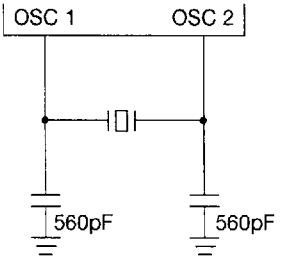


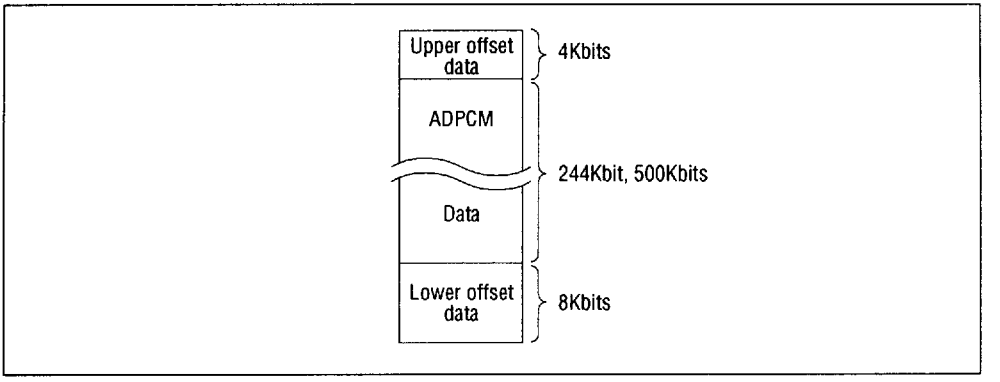
Figure 3-2 Ceramic Oscillator (KBR-256B) Connection Circuit

4. Pop Noise Prevention

To prevent generation of pop noise before and after speech output, the MSM6378A/6379 contains a 12Kbit offset data area in the built-in OTP. The anawriter for exclusive use automatically reads the offset data into the MSM6378A/6379.

5. Activation

The MSM6378A/6379 is activated as soon as the power is turned on (power-on start function). To reactivate from stand-by mode, apply a pulse on the SA pin, and the speech is again output.



6. Repeat

The MSM6378A/6379 repeats when the REP pin is set to "H"level. However, the speech is not output when the REP pin is merely set to "H"level.

8. Speech Output Pin

The MSM6378A/6379 has two speech output pins. The DAO pin is for internal DA converter output, and the AOUT pin is for DAO output via the LPF.

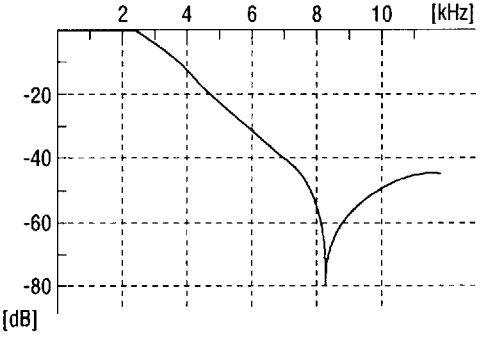
7. Standby Mode

When the REP pin is set to "L"level, the MSM6378A/6379 outputs one-shot speech and enters standby mode after the power is turned on or a pulse is applied to the SA pin. While in standby mode, internal oscillation stops and the OSC3 pin is set to "H"level.

9. LPF Characteristic

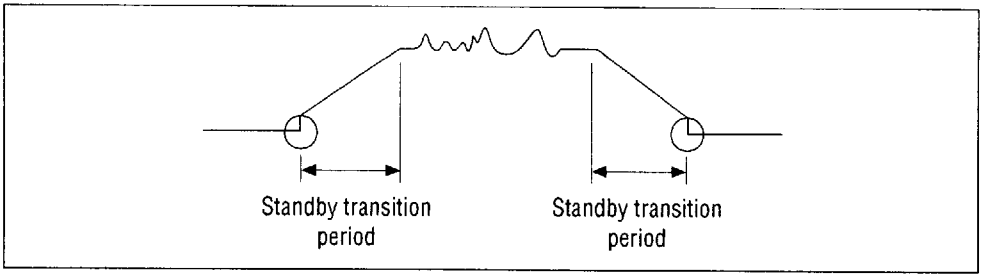
The LPF cut-off frequency (fcut) is always proportional to original oscillation frequency. The following figure shows the LPF characteristic curve at 8kHz sampling frequency (with the original oscillation frequency set to 128kHz).

f_{OSC} (kHz)	f_{sam} (kHz)	f_{CUT} (kHz)
64	4	Approx. 1.5
96	6	Approx. 2.2
128	8	Approx. 2.9
160	10	Approx. 3.6
192	12	Approx. 4.4
224	14	Approx. 5.1
256	16	Approx. 5.8



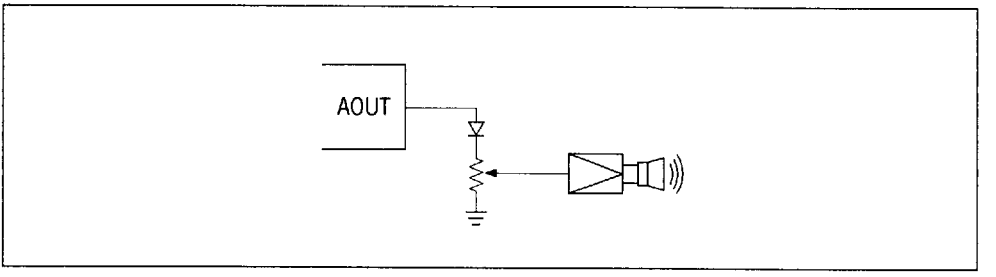
10. Pop Noise of Low-Pass Filter Output

Although the MSM6378A/6379 has a built-in pop noise suppression circuit, the voltage of the circled portion in the figure below may be changed abruptly by approximately 0.7 V when selecting the low-pass filter output and may generate a "pop" sound.



Pop Noise of Low-pass Filter Output

When connecting a diode at the output from AOUT, the "pop" sound can be reduced. The following figure shows its circuit.

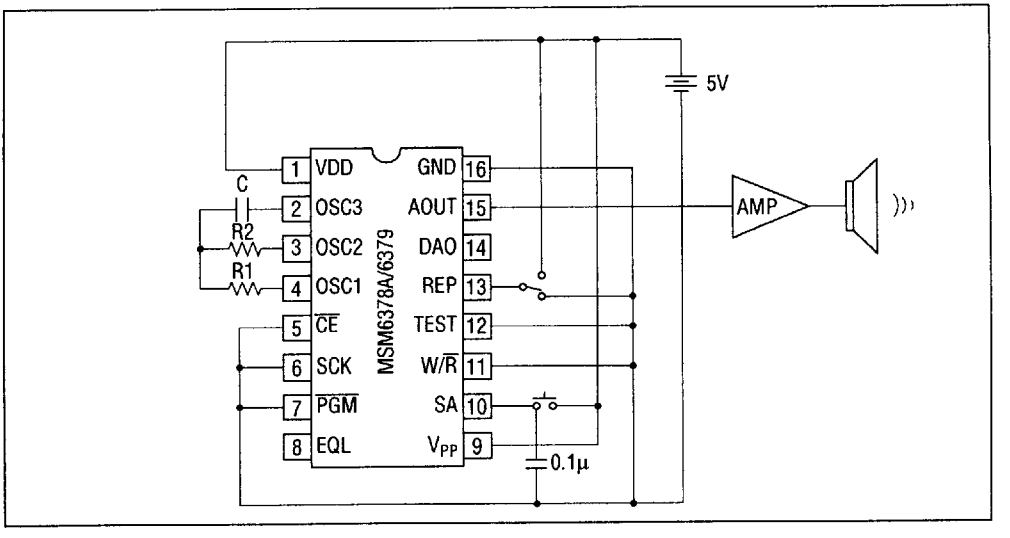


Pop Noise Suppression Circuit

APPLICATION NOTES

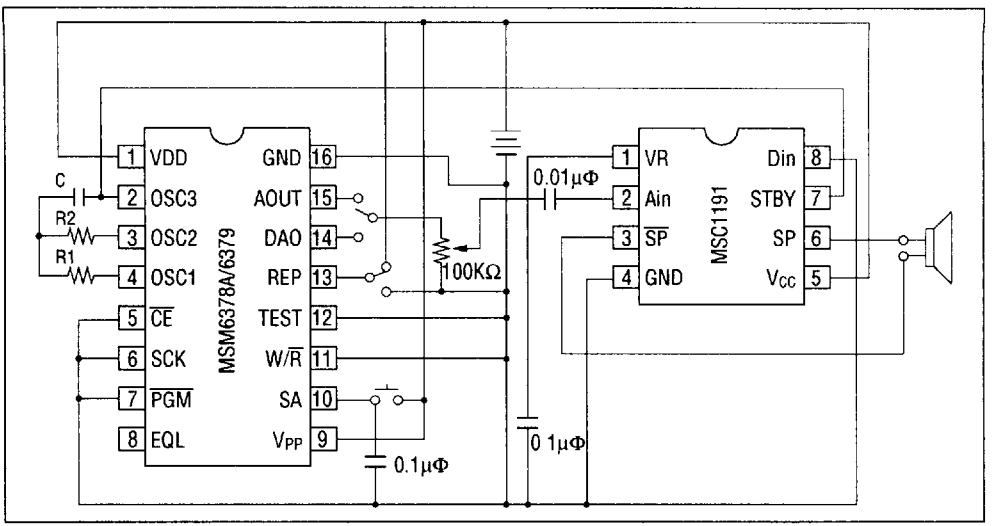
I. Playback

1.1 When Used Standard AMP



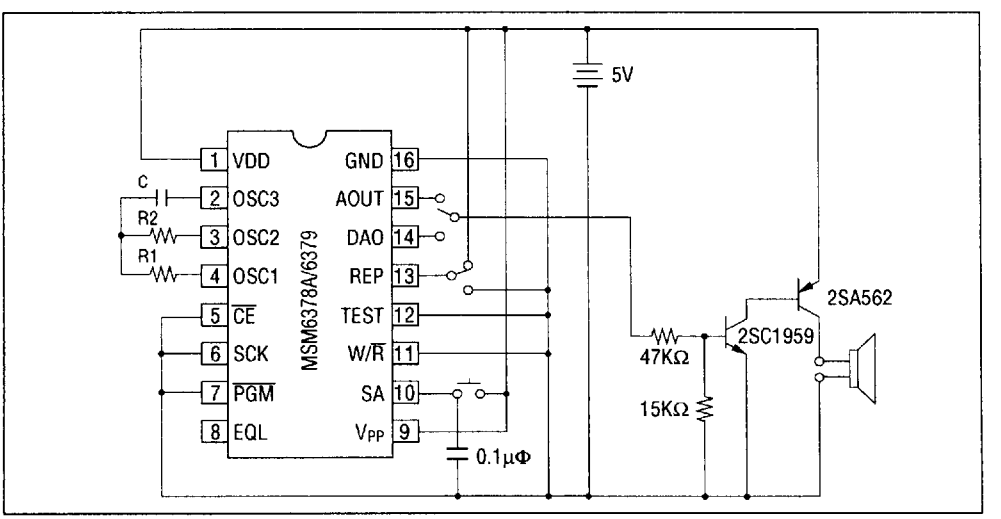
Note: The capacitor connected to the SA pin contributes to noise margin in the case of SA being "open"

1.2 Use of MSC1191 as AMP



Note: * MSC1191 is the most suitable amplifier to drive a speaker for the voice LSI. When MSM6378A terminates the reproduction of speech data, MSC1191 is also put into power save mode automatically

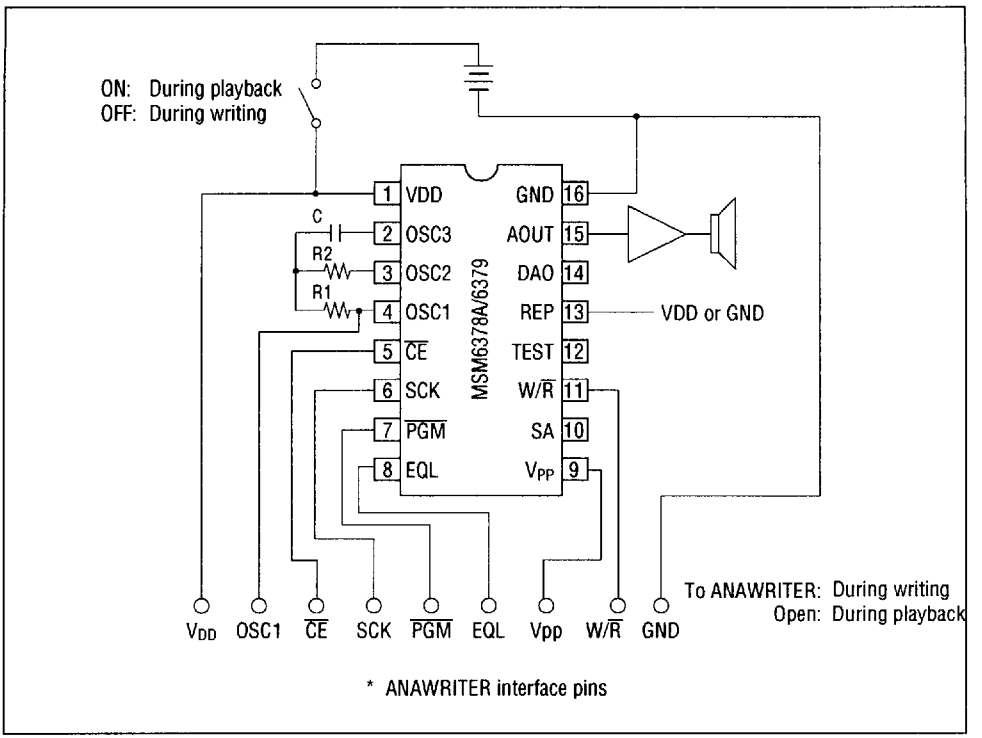
1.3 Use of Tr as AMP



Note: If 5V or less is used, change the constant used to divide the resistor in the output stage.

EXAMPLE OF WRITE CIRCUIT

(equivalent to the playback circuit)



Note: * Be careful about noise margin for input pins that are open during playback.