

MSC1191/1192 632-338

DIRECT DRIVE SPEAKER AMPLIFIER

632 338 GENERAL DESCRIPTION

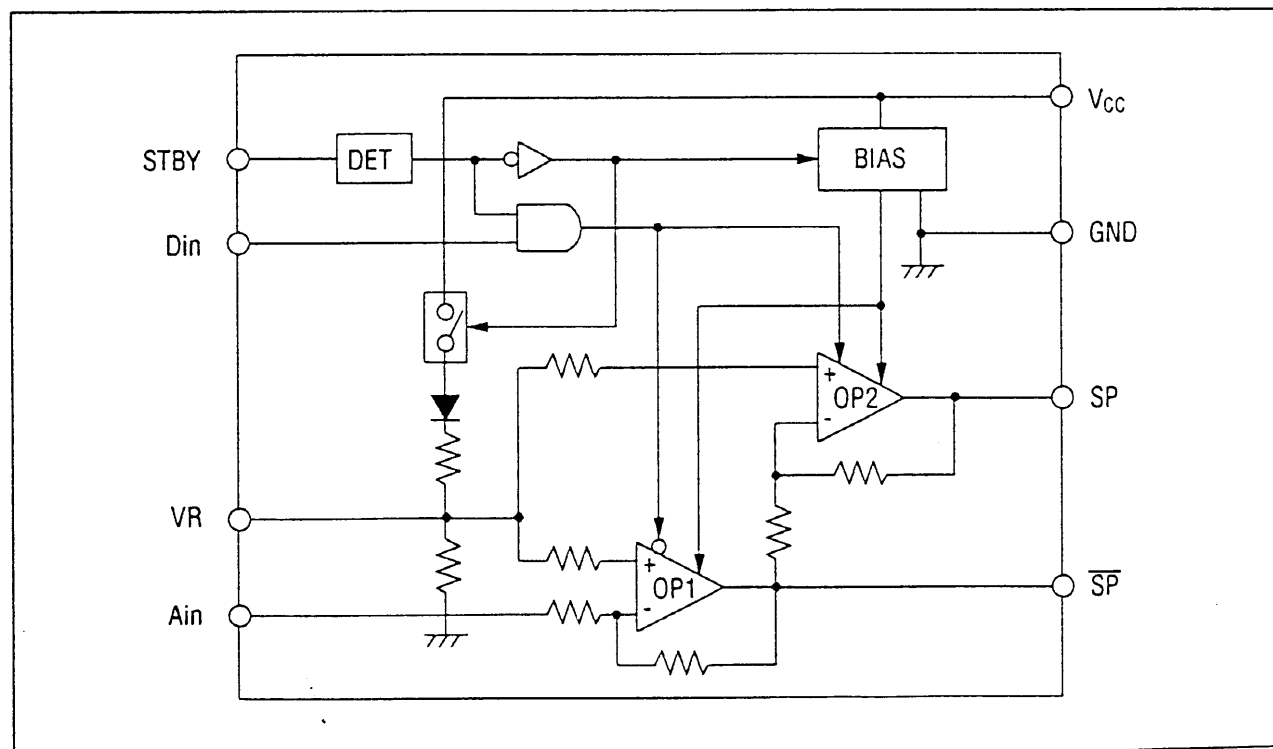
MSC1191/1192 is a low voltage, low current consumption type power amplifier IC developed for driving the speaker in a speech synthesizer application. It directly drives a

speaker without any output coupling capacitance. The MSC1191 is set to the standby state at the "H" level, and MSC1192 at the "L" level.

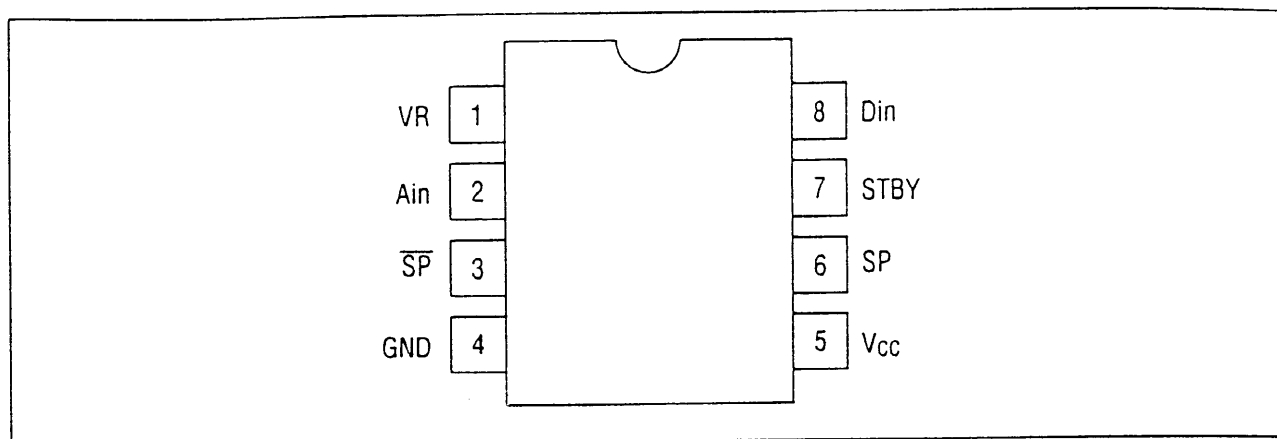
FEATURES

- Low voltage operation :
2.0 to 6.0V single power supply
- Low current consumption:
No-load operation current of
1.5 mA (typ)
- Standby function:
Current consumption of 1 μ A or
less in standby state
- Two input pins:
Analog signal input pin for speech
signal, etc. and digital signal input
pin for alarm signal, etc.
- High output current: 250 mA, peak
- Differential outputs:
A speaker can be connected directly
between differential output pins.
- 8 pin plastic DIP (DIP8-P-300)
- 8 pin plastic SOP (SOP8-P-250-K)
- Die

BLOCK DIAGRAM



PIN CONFIGURATION



- Absolute Maximum Ratings

Characteristic	Symbol	Conditions	Rating	Unit	Pins
Power supply voltage	V_{CC}	$T_a = 25^\circ\text{C}$	$-0.3 \sim +6.5$	V	V_{CC}
Input voltage	V_{IN}	$T_a = 25^\circ\text{C}$	$-0.3 \sim V_{DD} + 0.3$	V	STBY Din, Ain
Maximum output current	$I_{O\text{MAX}}$	$T_a = 25^\circ\text{C}$	± 300 (Note 1)	mA	SP, $\overline{\text{SP}}$
Power dissipation	P_d	$T_a = 25^\circ\text{C}$	660	mW	
Storage temperature	T_{stg}	—	$-45 \sim +125$	$^\circ\text{C}$	

Note 1: Shorting the output pins (SP and $\overline{\text{SP}}$) to V_{CC} or GND will damage the IC.

- Recommended Operating Ranges

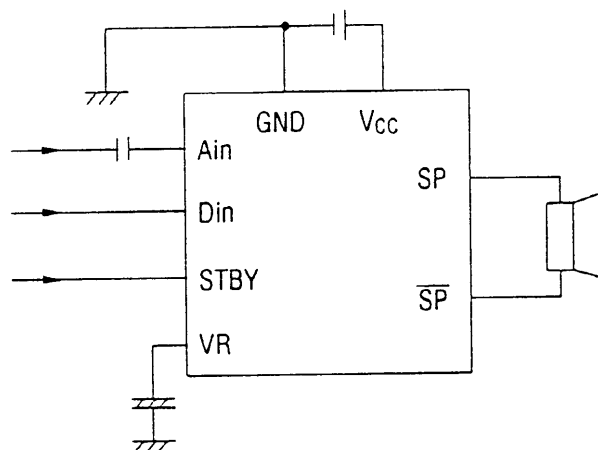
Characteristic	Symbol	Recommended values		Unit	Remarks
		Min.	Max.		
Power supply voltage	V_{CC}	2.0	6.0	V	
Load impedance	R_L	8.0	—	Ω	
Peak load current	I_{O-P}	—	250	mA	
"H" input voltage	V_{IH}	$0.7 V_{CC}$	—	V	
"L" input voltage	V_{IL}	—	$0.3 V_{CC}$	V	
STBY operating frequency	f_{STBY}	8k	4M	Hz	At clock input
Operating temperature	T_{OP}	-10	60	$^\circ\text{C}$	

• Electrical Characteristics

(Ta=25°C)

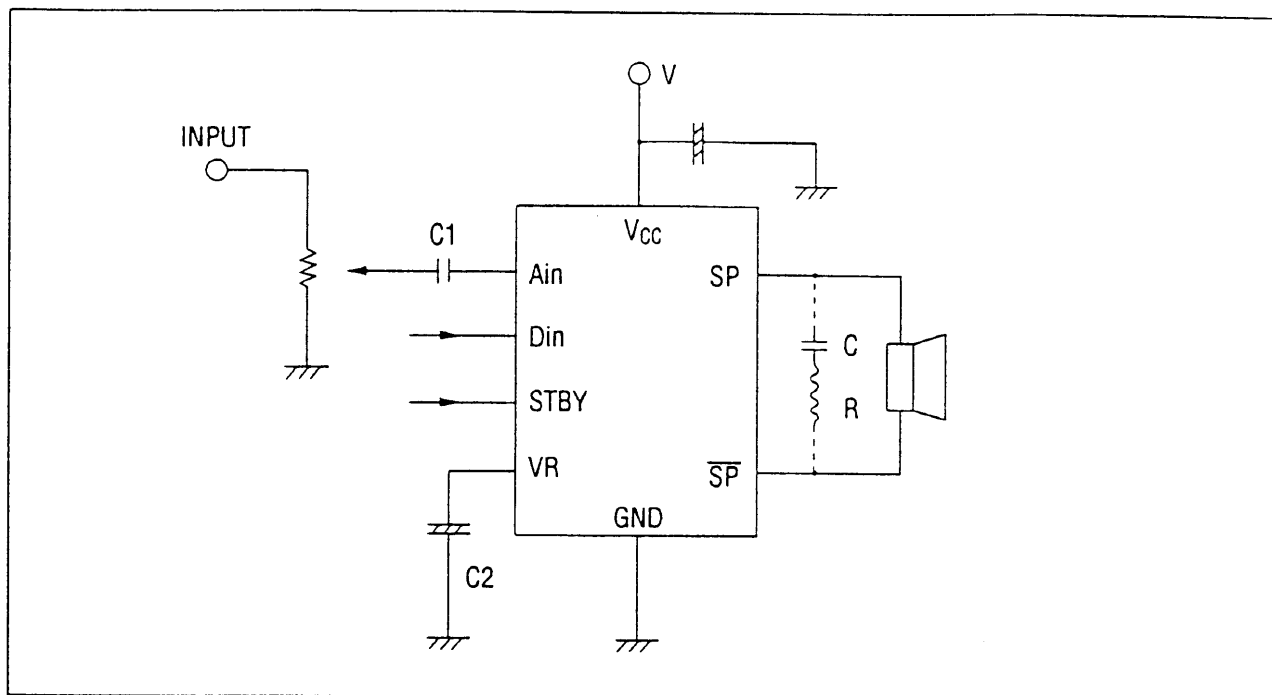
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input/resistance	R_{in}		70	100	130	k Ω
Voltage gain	AV1	$A_{in} \rightarrow \overline{SP}$	-0.35	0	0.35	dB
	AV2	$\overline{SP} \rightarrow SP$	-0.35	0	0.35	dB
	AV3	$A_{in} \rightarrow$ (between $SP - \overline{SP}$)	5.3	6.0	6.7	dB
Output power	P_{out1}	$V_{CC} = 3V$ $R_L = 8\Omega$, THD $\geq 10\%$	100		—	mW
	P_{out2}	$V_{CC} = 6V$ $R_L = 32\Omega$, THD $\geq 10\%$	300		—	mW
Total harmonic distortion rate	THD1	$V_{CC} = 3V$, $R_L = 8\Omega$ $f = 1kHz$, $P_{OUT} = 45mW$	—	0.35	1.0	%
	THD2	$V_{CC} = 6V$, $f = 1kHz$, $P_{OUT} = 125mW$	—	0.17	1.0	%
Ripple elimination ratio	RR	$f = 1kHz$, $C_2 = 1\mu F$	30	37	—	dB
STBY operating frequency	f_{STBY}	At clock input	8K		4M	Hz
Output voltage	V_O	At no signal	Standard value -0.12	$\frac{V_{CC}-0.67V}{2}$	Standard value +0.12	V
Output offset voltage	ΔV_O		—		± 30	mV
Output "H" voltage	VOH1	$A_{in} = V_{CC}$ or GND $I_{out} = -100mA$	$V_{CC} - 1.15$	$V_{CC} - 1.04$	—	V
	VOH2	$D_{in} = "H"$ $I_{out} = -100mA$	$V_{CC} - 1.15$	$V_{CC} - 1.02$	—	V
Output "L" voltage	VOL1	$A_{in} = V_{CC}$ or GND $I_{out} = 100mA$	—	0.17	0.3	V
	VOL2	$D_{in} = "H"$ $I_{out} = 100mA$	—	0.33	0.45	V
"H" input voltage	V_{IH}		$0.7V_{CC}$		—	V
"L" input voltage	V_{IL}		—		$0.3V_{CC}$	V
Input current	I_I	$V_I = GND - V_{CC}$	—		± 0.1	μA
VR equivalent resistance	RVR		18	25	32	k Ω
Circuit current in operation	I_{CC1}	$V_{CC} = 6V$, $R_L = \infty$	1.1	1.5	2.2	mA
	I_{CC2}	$V_{CC} = 6V$, $R_L = \infty$ $D_{IN} = "H"$	2.5	4.5	7.0	mA
Circuit current in standby state	I_{CCS}	$V_{CC} = 6V$	—		1.0	μA

PIN DESCRIPTION



Pin name	Function								
Vcc	Power supply pin								
GND	Ground pin								
Ain	Analog signal input pin for speech signal, etc.								
Din	Digital signal input pin for alarm signal, etc. valid in the standby state. SP = H and $\overline{SP}$ = L for Din =H, and SP = $\overline{SP}$ = HiZ for Din =L.								
STBY	Input pin for bias block on/off to set the whole IC to on and off. <table> <tr> <th>Model</th><th>Status</th></tr> <tr> <td rowspan="2">MSC1191</td><td>"H" Standby</td></tr> <tr> <td>"L" Operation</td></tr> <tr> <td rowspan="2">MSC1192</td><td>"H" Operation</td></tr> <tr> <td>"L" Standby</td></tr> </table> The signal shown at right may be used, or the LSI oscillation output may also be used.	Model	Status	MSC1191	"H" Standby	"L" Operation	MSC1192	"H" Operation	"L" Standby
Model	Status								
MSC1191	"H" Standby								
	"L" Operation								
MSC1192	"H" Operation								
	"L" Standby								
VR	Operating level bias output pin. Connecting a capacitor between this pin and the GND pin reduces the pop noise at power on and improves the ripple elimination ratio.								
SP, $\overline{SP}$	Speaker connecting pins. DC level is $\frac{V_{cc} - 0.67V}{2}$								

APPLICATION CIRCUIT EXAMPLE



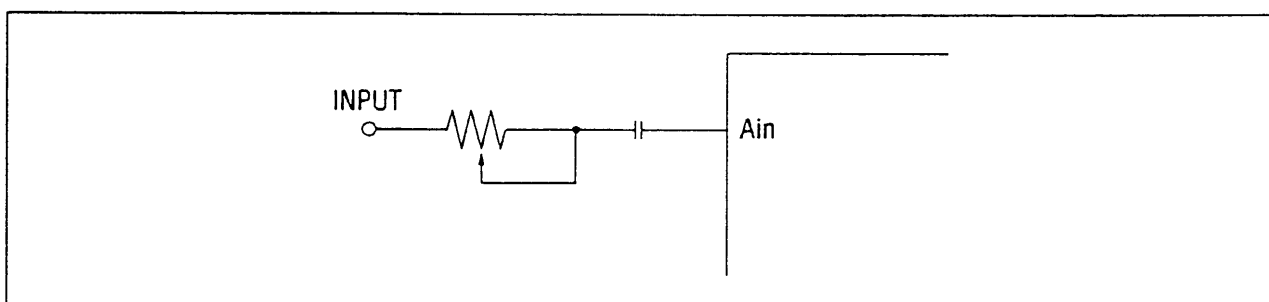
- C1 is the AC coupling capacitance. Low cut off frequency f_c can be obtained by the following equation:

$$f_c \cong \frac{1}{2 * \pi * C1 * 100k} \quad (\text{Hz})$$

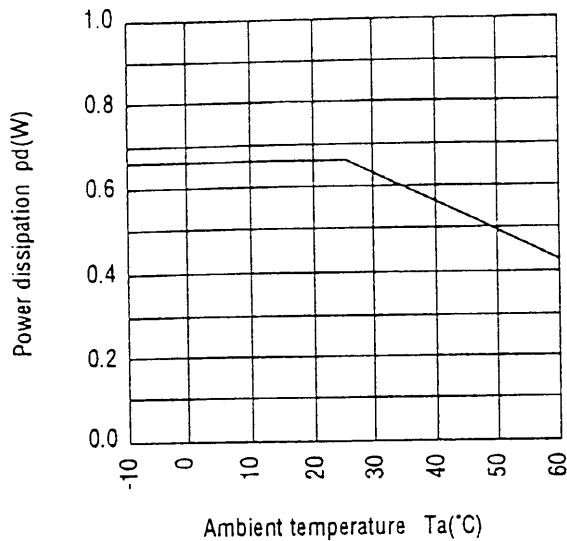
- C2 shall be 50 to 100 times the value of C1.
- C and R are for prevention of parasitic oscillation. Select proper values according to the speaker used. Gener-

ally recommended values are $C = 0.02 \mu\text{F}$ and $R = 6$ to 10Ω .

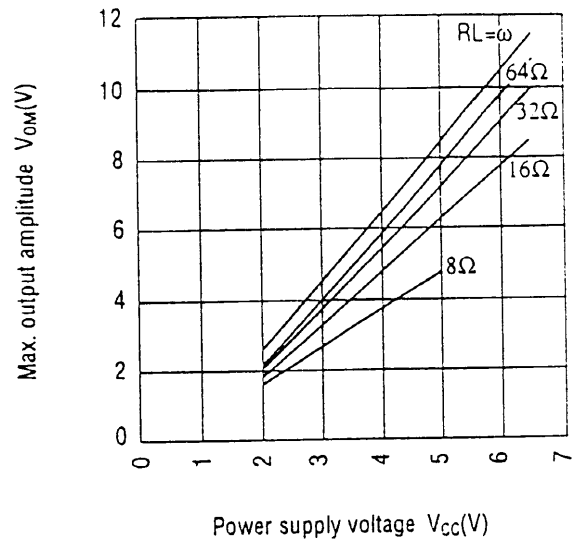
- When the Din and STBY functions are not to be used, fix $\text{Din} = \text{L}$ and $\text{STBY} = \text{L}$ for MSC1191, and $\text{Din} = \text{L}$ and $\text{STBY} = \text{H}$ for MSC1192.
- Sound volume control is also possible as shown below. This method is effective when the signal source impedance is high.



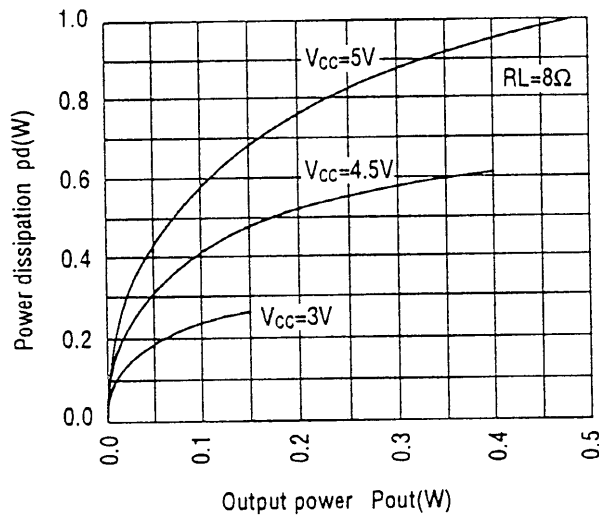
Power dissipation vs ambient temperature



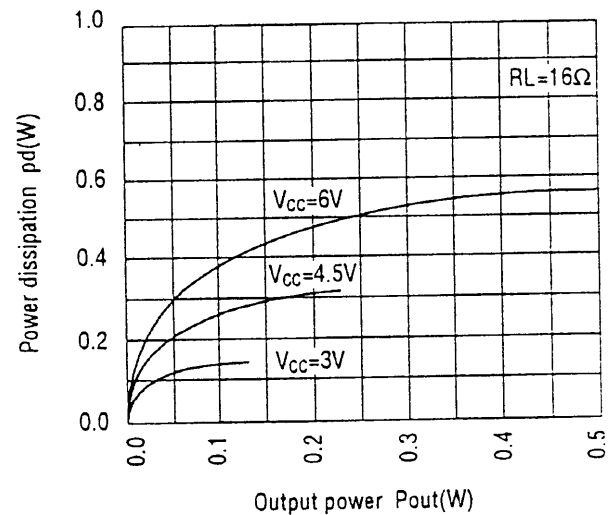
Max. output amplitude vs power supply voltage (example)



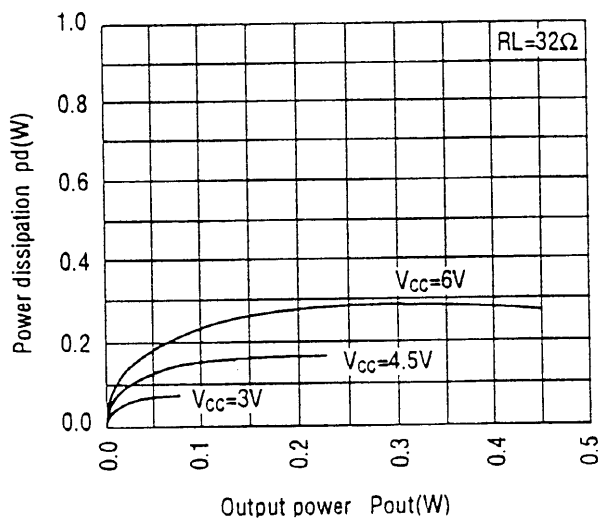
Power dissipation vs output power (example)



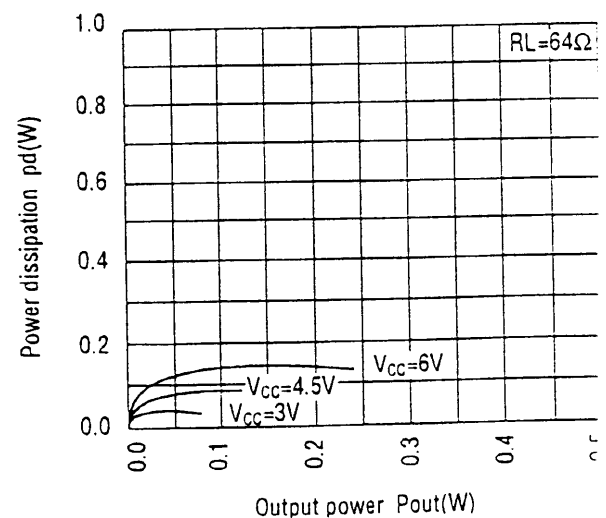
Power dissipation vs output power (example)



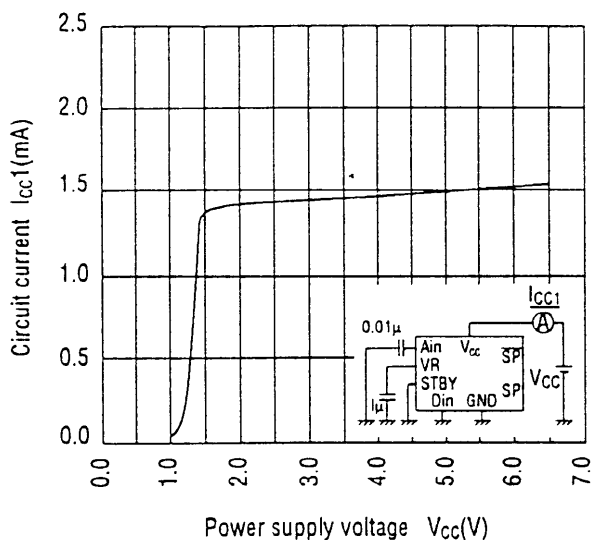
Power dissipation vs output power (example)



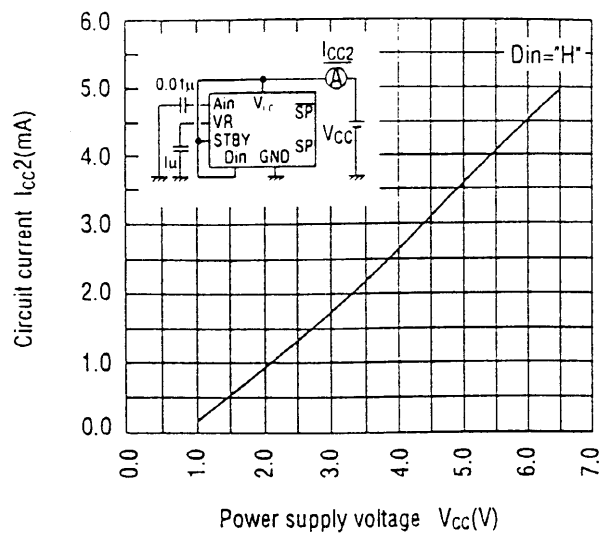
Power dissipation vs output power (example)



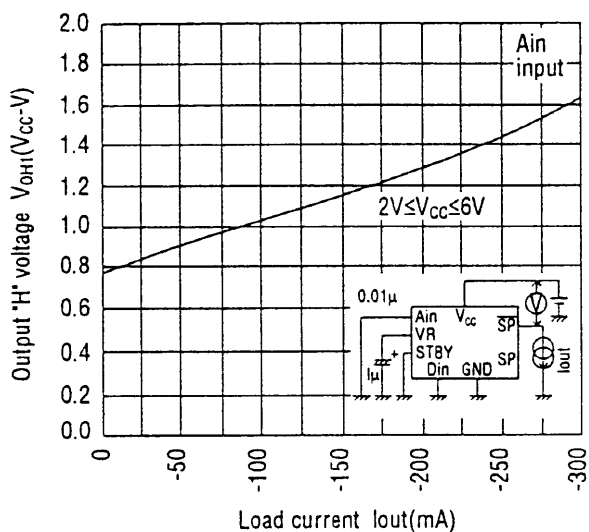
Circuit current vs power supply voltage (example)



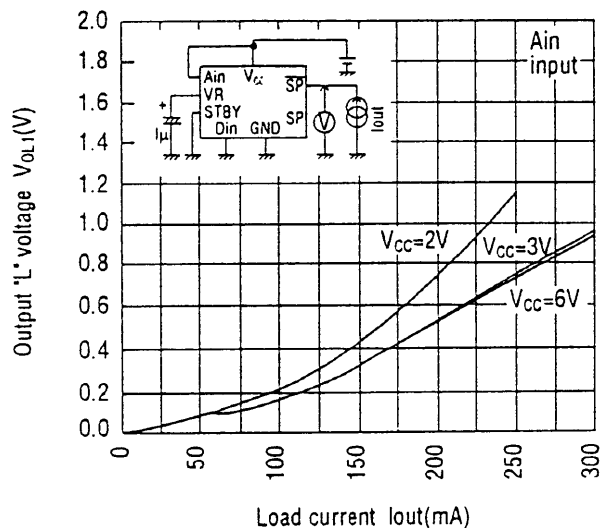
Circuit current vs power supply voltage (example)



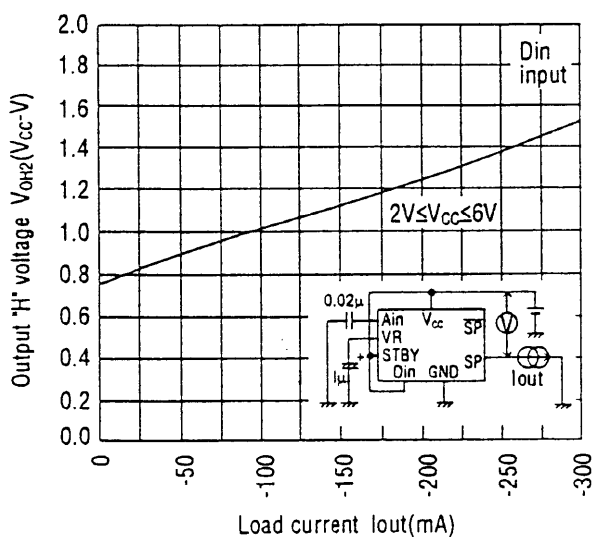
Output voltage vs load current (example)



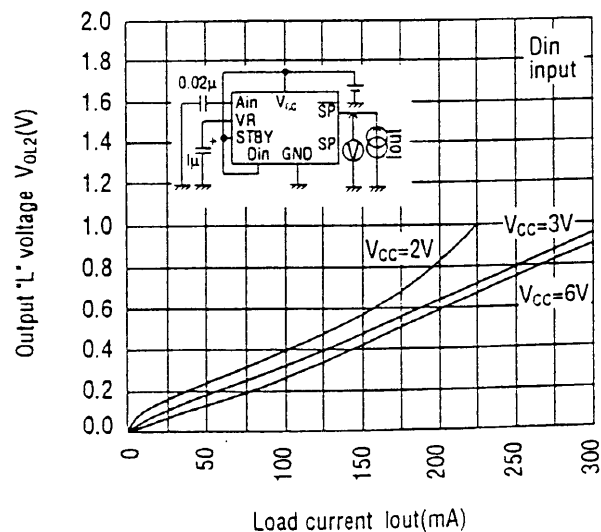
Output voltage vs load current (example)



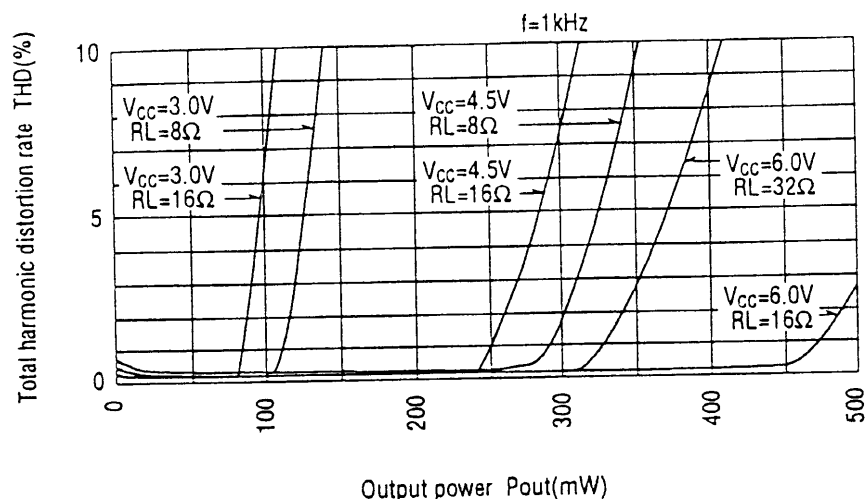
Output voltage vs load current (example)



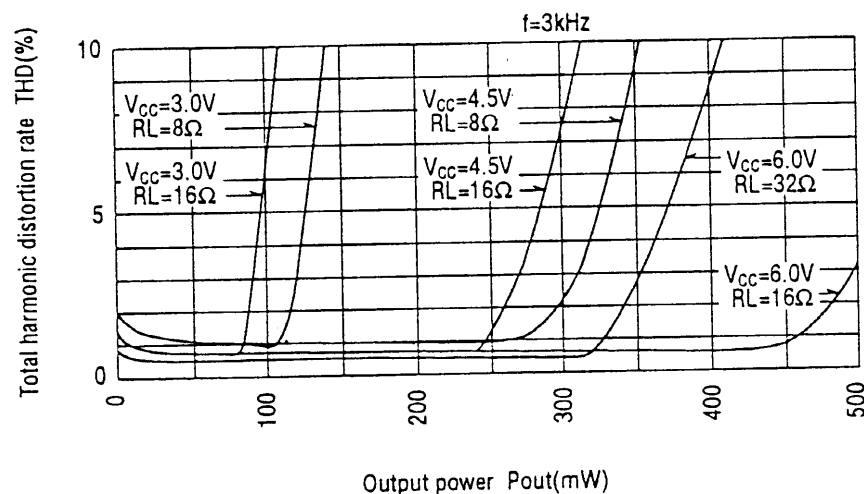
Output voltage vs load current (example)



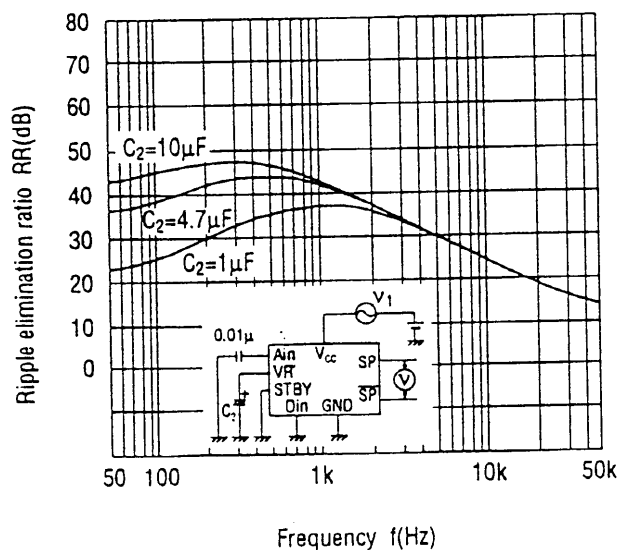
Total harmonic distortion rate vs output power (example)



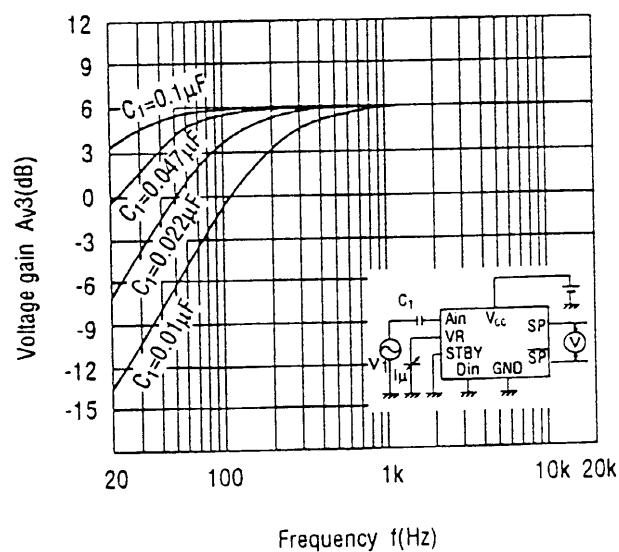
Total harmonic distortion rate vs output power (example)



Ripple elimination ratio vs frequency (example)



Voltage gain vs frequency (example)



MSC1191/1192 PAD LAYOUT

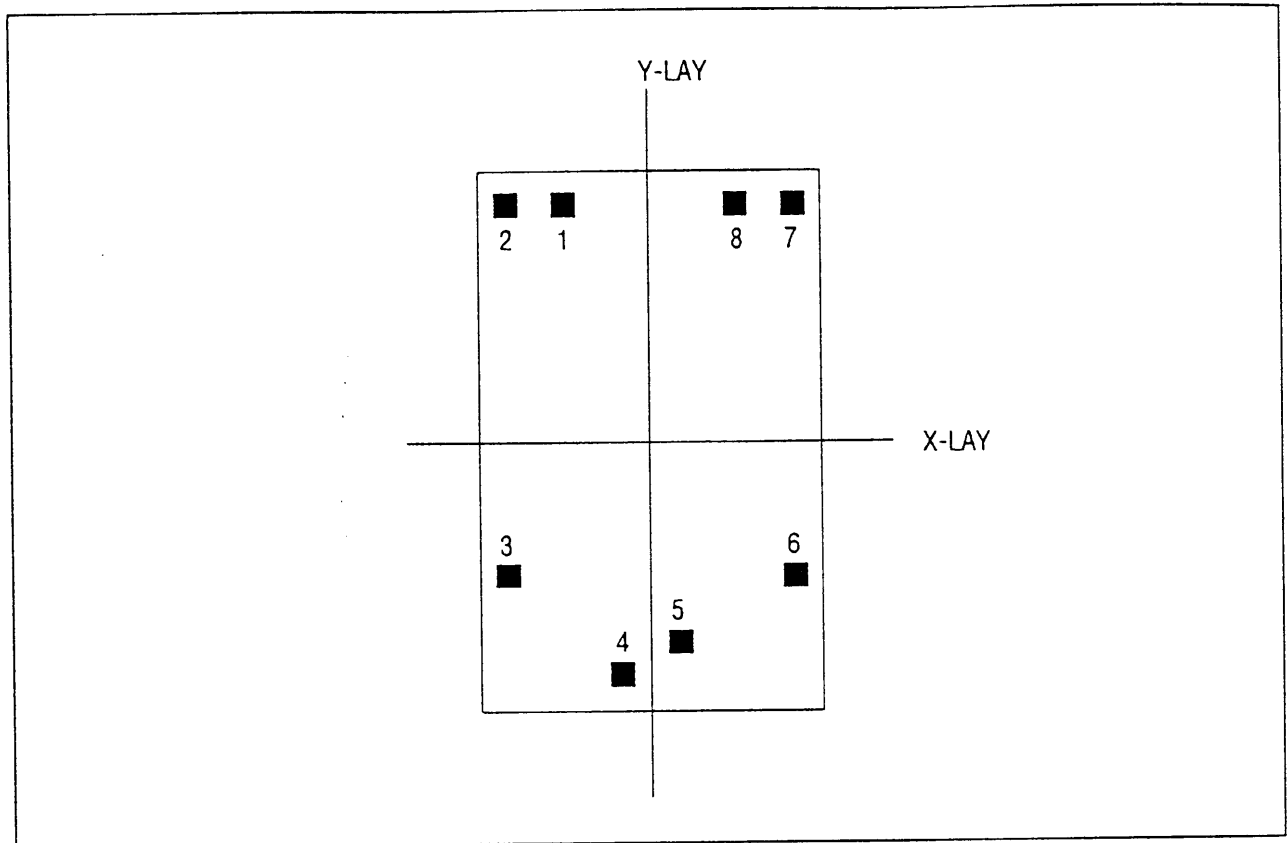
Die size : X = 1.84 mm Y = 2.6 mm

Die thickness : $350 \pm 30 \mu\text{m}$

Pad size : $112 \times 112 \mu\text{m}$

Substrate Voltage: GND

Pad location diagram



Pad Positions (the die center is located at X=0, Y=0)

(Unit: μm)

PAD No.	PAD Name	X-AXIS	Y-AXIS
1	VR	-442	1134
2	Ain	-754	1134
3	$\overline{\text{SP}}$	-754	-754
4	GND	-126	-1134
5	Vcc	126	-998
6	SP	754	-754
7	STBY	754	1134
8	Din	442	1134