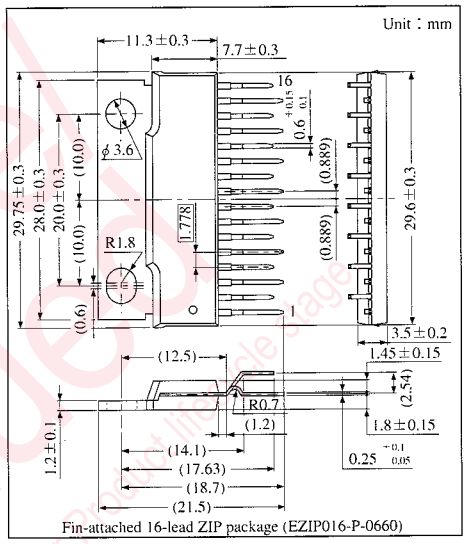
AN7190K

Dual 20W BTL Low Frequency Power Amplifier IC for Output

■ Overview

The AN7190K is an audio power IC developed for sound output of car audio (20W×2 ch.).

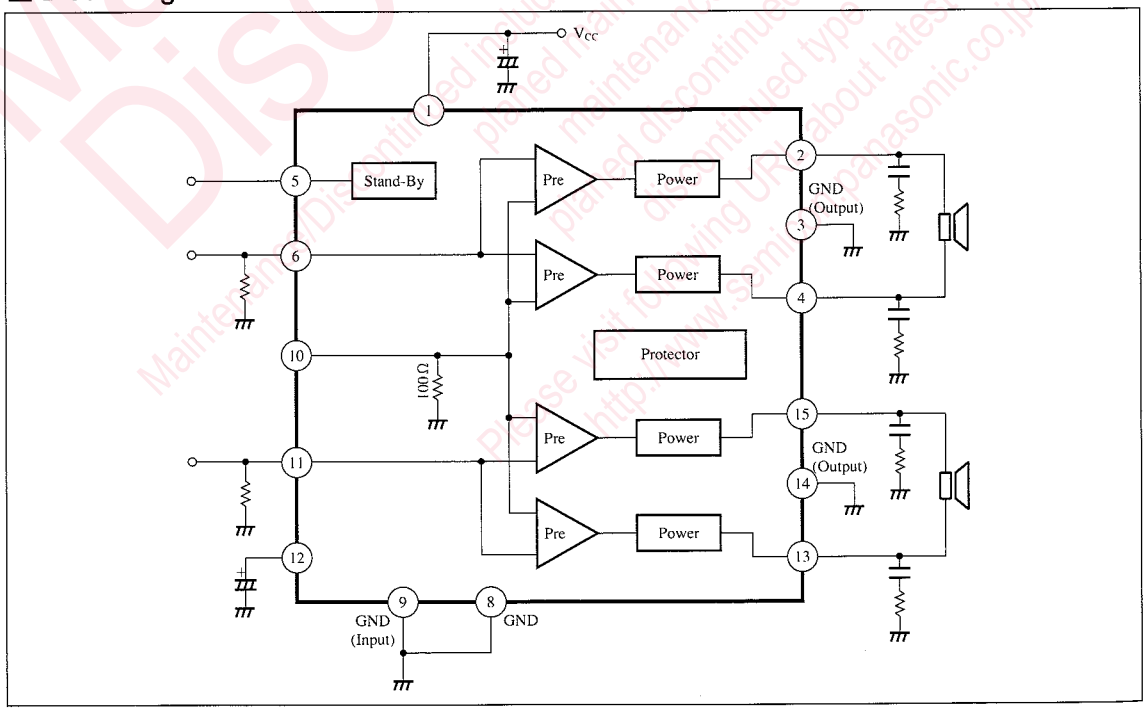
High density mounting is possible and it can contribute to cost reduction, because it requires fewer external components. It incorporates various protective circuits to provide high reliability and breakage resistance. Particularly, it has realized power surge withstand voltage of 100V (typ.)



■ Features

- Improved breakage resistance performance
  - Power surge withstand voltage : 80Vor more (typ. 100V)
  - Short-circuit breakdown withstand voltage : 25V or more
- Quite fewer external components required
  - NF (Negative Feedback) electrolytic capacitor not required
  - BS (Boot-strap) electrolytic capacitor not required
  - Input coupling electrolytic capacitor not required
- With stand-by function
- With beep sound input pin
- Various protective circuits built-in
  - Protection from atmospheric and ground faults, load short-circuit, over-voltage and over-current, and temperature protection

■ Block Diagram



■ Pin Name

Pin No.	Pin Name	Pin No.	Pin Name
1	V_{CC}	9	GND (Input)
2	Ch.1 Output (+)	10	Beep Sound Input
3	GND (Output Ch.1)	11	Ch.2 Input
4	Ch.1 Output (−)	12	Ripple Filter
5	Stand-by	13	Ch.2 Output (−)
6	Ch.1 Input	14	GND (Output Ch.2)
7	NC	15	Ch.2 Output (+)
8	GND (Board)	16	NC

Note) Do not apply voltage or current to NC pin from outside.

■ Absolute Maximum Ratings (Ta=25℃)

Parameter	Symbol	Rating	Unit
Supply Voltage	V_{CC}	25	V
Supply Current	I_{CC}	9.0	A
Peak Supply Voltage	V_{surge}	80	V
Power Dissipation Note 1)	P_D	32.5	W
Operating Ambient Temperature	T_{opr}	−30 ~ +85	℃
Storage Temperature	T_{stg}	−55 ~ +150	℃

Note 1) Ta=85℃

■ Recommended Operating Range (Ta=25℃)

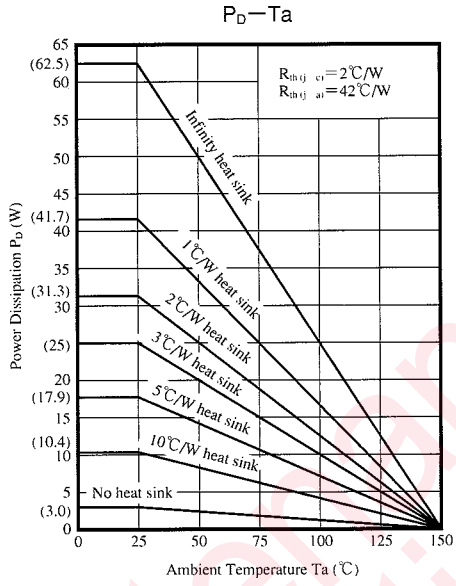
Parameter	Symbol	Range
Operating Supply Voltage Range	V_{CC}	8.0V ~ 18.0V

■ Electrical Characteristics (V_{CC}=13.2V, $f_{req.}$=1kHz, Ta=25℃±2℃)

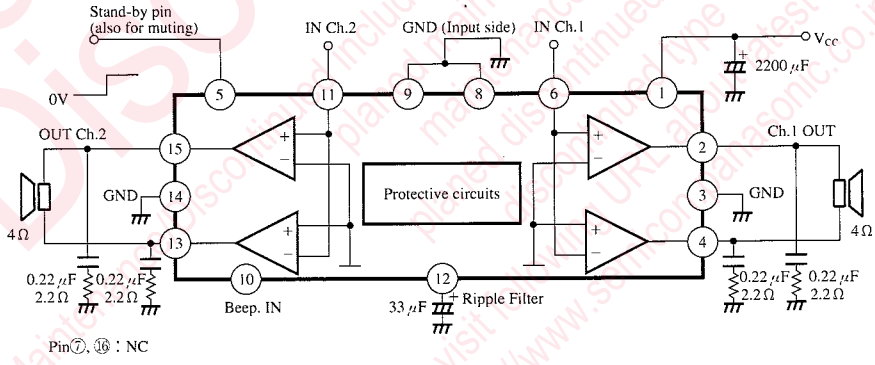
Parameter	Symbol	Condition	min.	typ.	max.	Unit
Quiescent Current	I_{CQ}	V_{IN}=0mV, R_L=4Ω	—	150	250	mA
Stand-by Current	I_{STB}	V_{IN}=0mV, R_L=4Ω	—	1	10	μA
Output Noise Voltage Note 1)	V_{NO}	R_g=4.7kΩ, R_L=4Ω	—	0.4	0.7	mVrms
Voltage Gain 1	G_{V1}	V_{IN}=20mV, R_L=4Ω	38	40	42	dB
Total Harmonics Distortion 1	THD1	V_{IN}=20mV, R_L=4Ω	—	0.07	0.4	%
Max. Output Power 1	P_{O1}	THD=10%, R_L=4Ω	15	17	—	W
Ripple Rejection Ratio Note 1)	RR	R_L=4Ω, Vr=1Vrms, fr=120Hz, R_g=0Ω,	55	60	—	dB
Channel Balance	CB	V_{IN}=20mV, R_L=4Ω	—	0	1	dB
Crosstalk Note 1)	CT	V_{IN}=20mV, R_L=4Ω, R_g=4.7kΩ	55	65	—	dB
Output Offset Voltage	V_{off}	R_g=4.7kΩ, R_L=4Ω	−300	0	300	mV
Input Impedance	Zi	V_{IN}=±0.3V_{DC}	25	30	35	kΩ
Voltage Gain 2	G_{V2}	V_{IN}=20mV, R_L=2Ω	38	40	42	dB
Total Harmonics Distortion 2	THD2	V_{IN}=20mV, R_L=2Ω	—	0.12	0.8	%
Max. Output Power 2	P_{O2}	THD=10%, R_L=2Ω	15	20	—	W

Note 1) Measured through 15Hz to 30kHz (12dB/OCT) filter

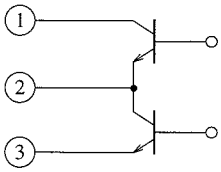
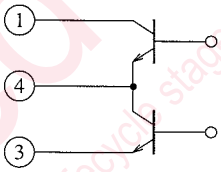
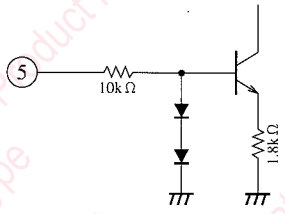
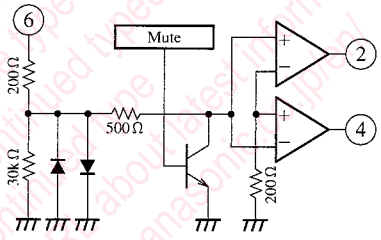
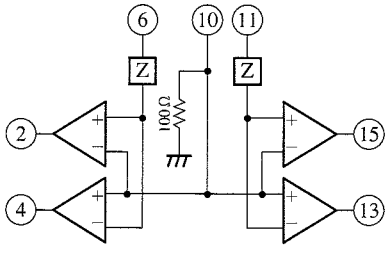
■ Characteristic Curve



■ Application Circuit

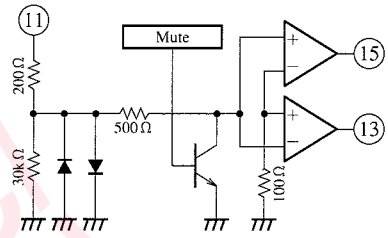
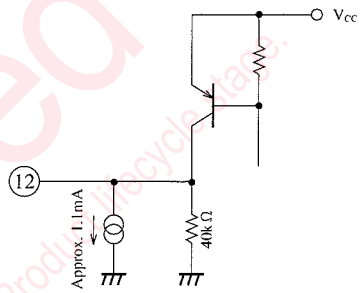
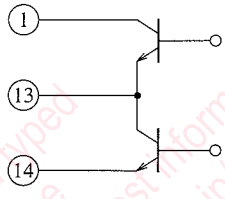
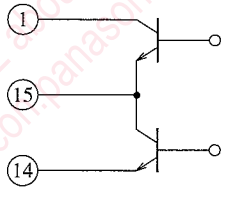


■ Pin Description

Pin No.	Pin Name	DC Voltage	Pin Description	Equivalent Circuit
1	Supply Pin	13.2V	Supply connecting pin	
2	Output Ch.1	6.6V	Ch.1 positive-phase output pin	
3	GND (Output)	0V	Ground pin for Ch.1 output	
4	Output Ch.1	6.6V	Ch.1 reverse-phase output pin	
5	Stand-by	—	Stand-by changeover pin	
6	Input Ch.1	0～5mV	Ch.1 input signal applied pin: Input impedance 30kΩ	
7	NC	—	Non-connection	
8	GND	0V	Board	
9	GND (Input)	0V	Ground pin for input	
10	Beep Sound Input	0～5mV	Beep sound signal input pin: Input impedance 100Ω	

Note) Do not apply voltage to NC pin from outside.

■ Pin Description (Cont.)

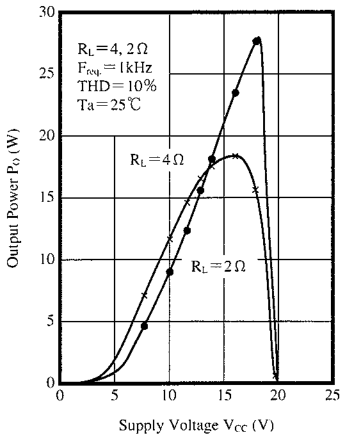
Pin No.	Pin Name	DC Voltage	Pin Description	Equivalent Circuit
11	Input Ch.2	0～5mV	Ch.2 input signal applied pin: Input impedance 30kΩ	
12	Ripple Filter	V_{CC}−0.3V	Ripple filter pin	
13	Output Ch.2	6.6V	Ch.2 reverse-phase output pin	
14	GND (Output)	0V	Ground pin for Ch.2 output	——
15	Output Ch.2	6.6V	Ch.2 positive-phase output pin	
16	NC	——	Non-connection	——

Note) Do not apply voltage to NC pin from outside.

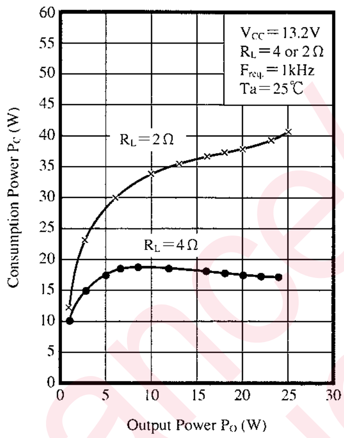
■ Precautions on use

1. Always attach an outside heat sink to use the AN7190K. In addition, the outside heat sink must be fastened onto a chassis for use.
2. Connect the radiation fin to the GND potential.
3. Prevent atmospheric and ground fault, and load short-circuit.
4. The temperature protection circuit gets actuated when Tj＝approx. 150℃, but it is automatically reset when the chip temperature drops below the above set level.
5. The overvoltage protective circuit starts the protective operation at V_{CC}＝approx. 20V.
6. Take into consideration the heat radiation design particularly when V_{CC} is set high or when the load is 2Ω.
7. When the beep sound function is not used, connect the beep sound input pin (Pin⑩) with Pin⑨.

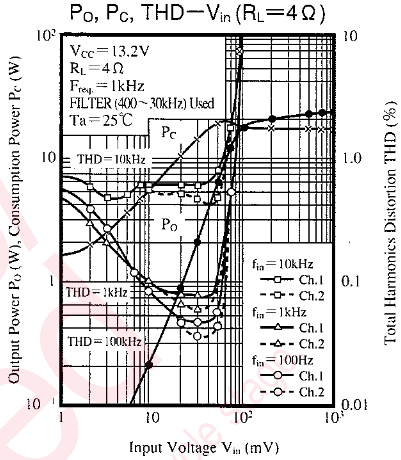
$P_O - V_{CC}$



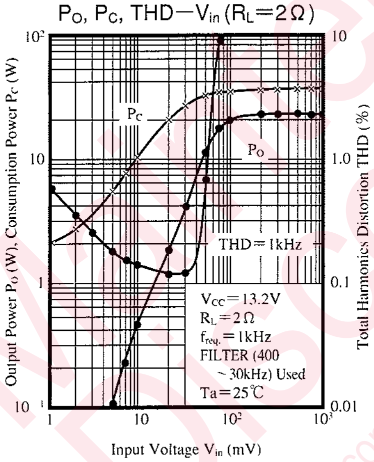
$P_C - P_O$



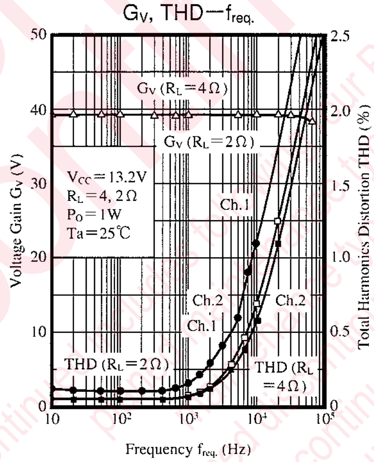
$P_O, P_C, THD - V_{in}$ ($R_L = 4\Omega$)



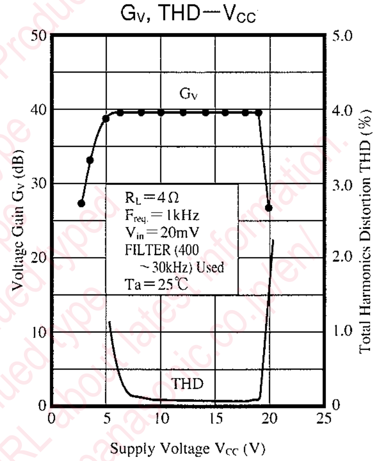
$P_O, P_C, THD - V_{in}$ ($R_L = 2\Omega$)



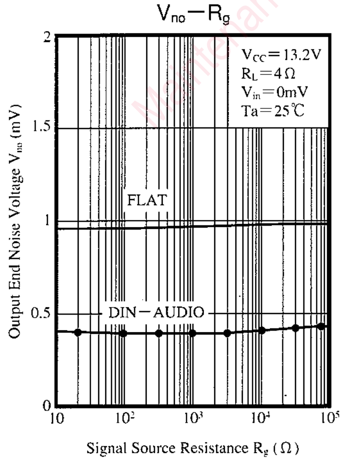
$G_V, THD - f_{req.}$



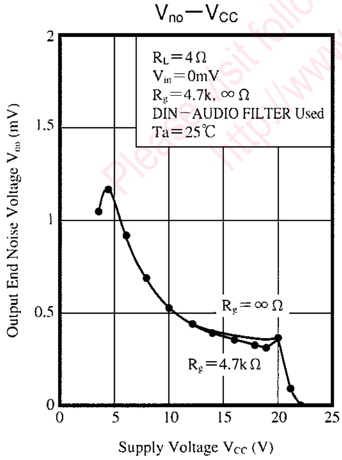
$G_V, THD - V_{CC}$



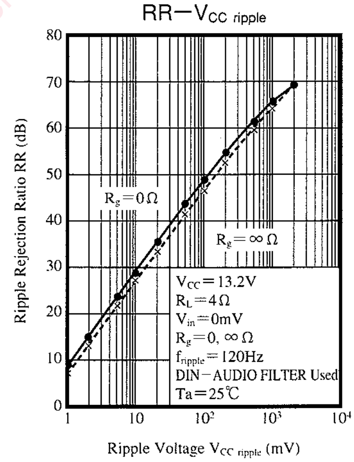
$V_{no} - R_g$



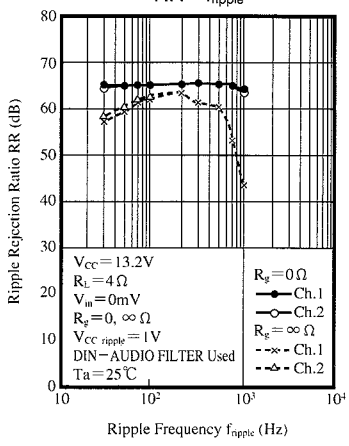
$V_{no} - V_{CC}$



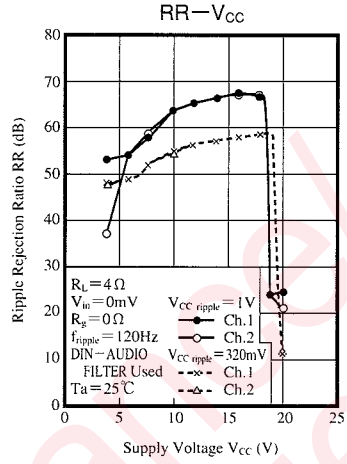
$RR - V_{CC\ ripple}$



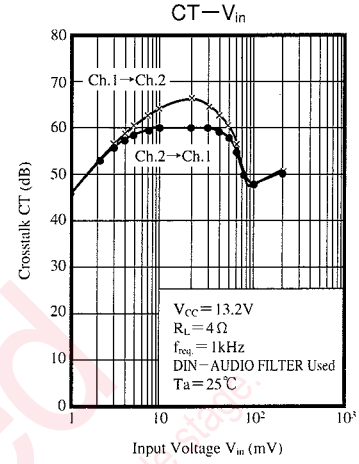
RR—f_{ripple}



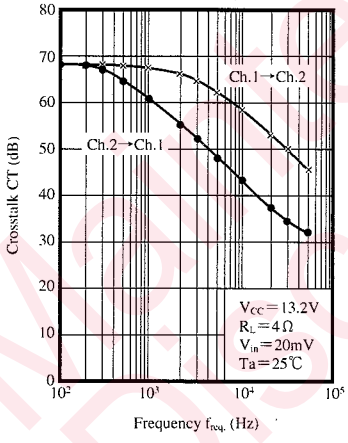
RR—V_{CC}



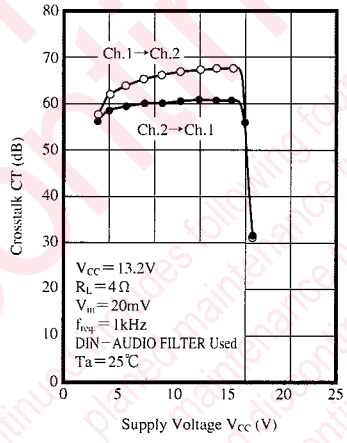
CT—V_{in}



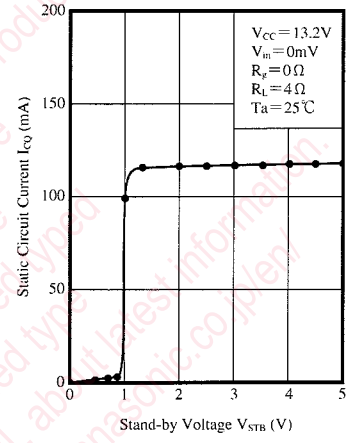
CT—$F_{req.}$



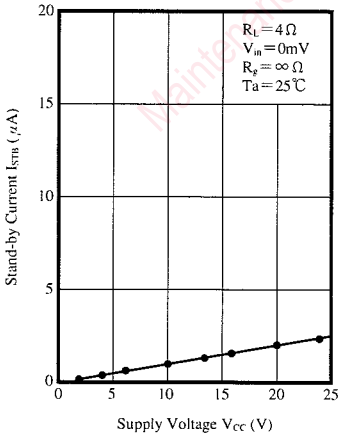
CT—V_{CC}



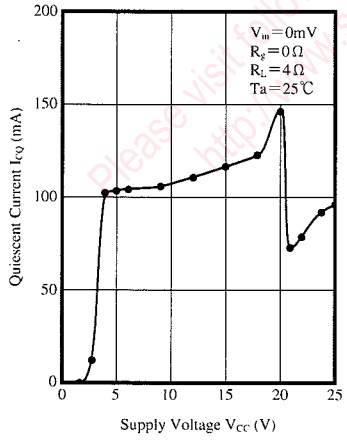
I_{CQ}—V_{STB}



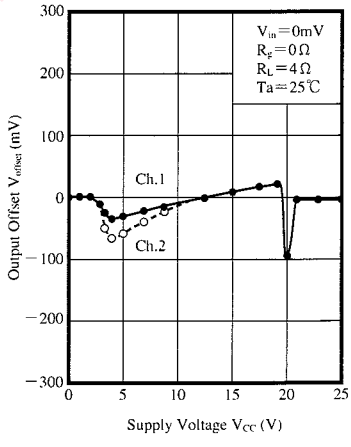
I_{STB}—V_{CC}



I_{CQ}—V_{CC}



V_{offset}—V_{CC}



■ Operational Description

(1) Stand-by Function

a) Power can be turned on or off by setting Pin⑤ (stand-by pin) high or low.

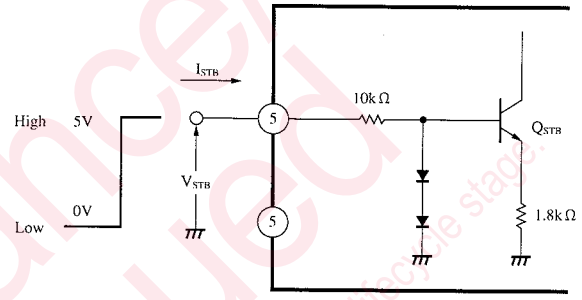
b) The stand-by pin has threshold voltage of approx. 1V, however, has temperature dependency of approx. −2mV/℃. It is recommended that it should be used within the range shown in the above table.

c) Stand-by function at high level is shown in the right figure. The current approximately expressed by the following equation is flown in the chip.

$$I_{STB} = \frac{V_{STB} - 1.4}{10} \text{ (mA)}$$

(only under ordinary temperature)

Stand-by	Pin level	Pin voltage (V)	Power
ON	Low	0 ~ 0.3	OFF
OFF	High	3 ~ V_{CC}	ON



d) Transistor Q_{STB} is not saturated when $V_{CC} > 8V$.

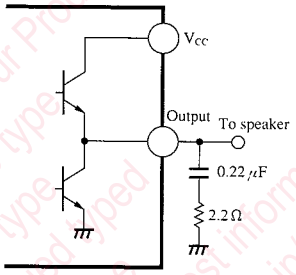
e) Power is off, with stand-by pin open.

(2) Oscillation Countermeasures

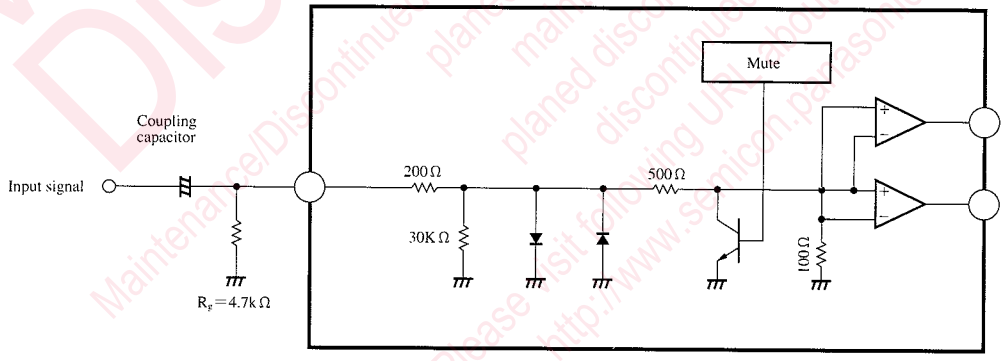
a) In order to increase the oscillation allowance, insert the serial connection of capacitor and resistor between output pin and GND, as shown in the right figure. Use the same GND as for output.

b) Capacitor for oscillation prevention

Use a polyester film capacitor with little fluctuation in temperature and frequency characteristics.



(3) Input Pin



a) When the input signal has a wave form of reference voltage other than 0V potential, connect a coupling capacitor (of several μF) for DC cut in series with the input pin. Check low frequency characteristics when a capacitor of smaller capacitance is used.

b) 10kΩ or less of signal source impedance R_g can reduce the output noise.

c) Change of signal source impedance R_g fluctuates the output offset voltage. Particular care must be taken, when the volume or similar devices are directly connected to the input pin. The product standards guarantee the value when V_{CC} = 13.2V, R_g = 4.7kΩ. Use the AN7190K with this value.

(4) Ripple Filter

a) In order to suppress the fluctuation of supply voltage, connect a capacitor of approx. 33 μF between Pin⑫ of RF pin and GND.

b) Relation between RR (Ripple Rejection Ratio) and a Capacitor

The larger capacitance the capacitor of the ripple filter has, the greater effect of suppressing the supply voltage fluctuation (the greater ripple rejection ratio) can be obtained.

c) Relation between Rise Time and a Capacitor

The larger capacitance the capacitor of the ripple filter has, the longer time it takes from the power ON (STB—OFF) to the sound release.

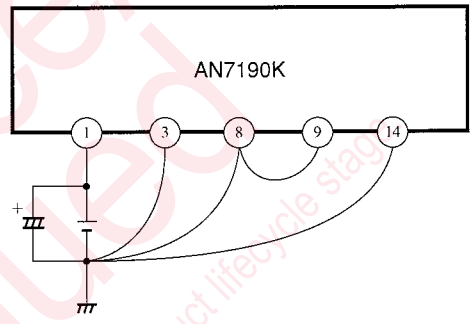
(5) GND Pin

a) Short each of the GND pins, Pin③, ⑧, ⑨ and ⑭ at the outside of the AN7190K.

b) For each GND pin, the one-point earth with reference of GND connection of electrolytic capacitor between the supply and GND is effective to decrease the distortion. Even in the worst case, ground Pins⑧ and ⑨ of input GND separately from all the other GND pins.

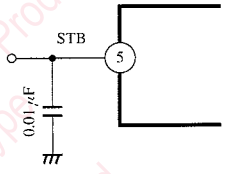
c) Only Pin⑧ is connected with the board (sub).

d) The heat sink is not connected to GND pin directly with Au wire. Grounding the heat sink causes no trouble.



(6) Shock Noise

No shock noise is released. However, STB switch may release slight shock noise. In this case, insert a capacitor of approx. 0.01 μF between STB pin, Pin⑤ and GND.



(7) Mute Function

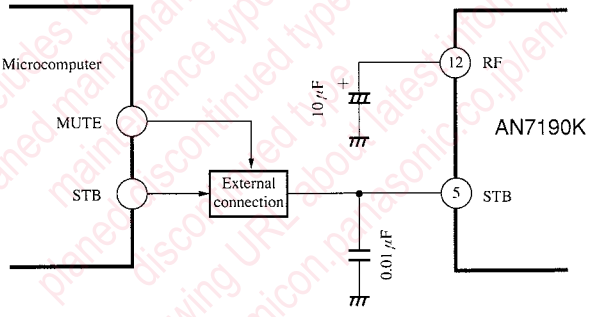
a) By the connection shown in the right figure, stand-by function can be used as audio mute. However, beep sound can not be outputted when audio mute function is ON.

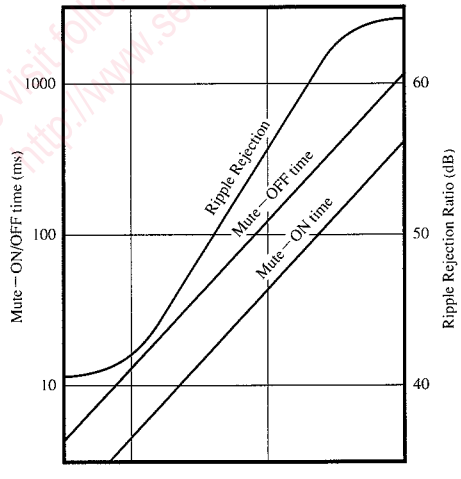
Also, design the external circuit so that interference of MUTE signal with STB signal could be prevented.

When the OR circuit of STB and MUTE is constructed inside the microcomputer, no external circuits are required.

b) Mute ON/OFF time and ripple rejection ratio depends on the capacitance value of capacitor C_{RF} of ripple filter, as the characteristics shown in the right figure. Determine C_{RF} value, taking into consideration the mute ON/OFF time and ripple rejection ratio.

c) No shock noise is released even when C_{RF} value is set to approx. 1 μF.





(8) Voltage Gain

The voltage gain is 40dB fixed and can not be changed by adding an external resistance.
The AN7191K with different voltage gain (34dB) is also available.

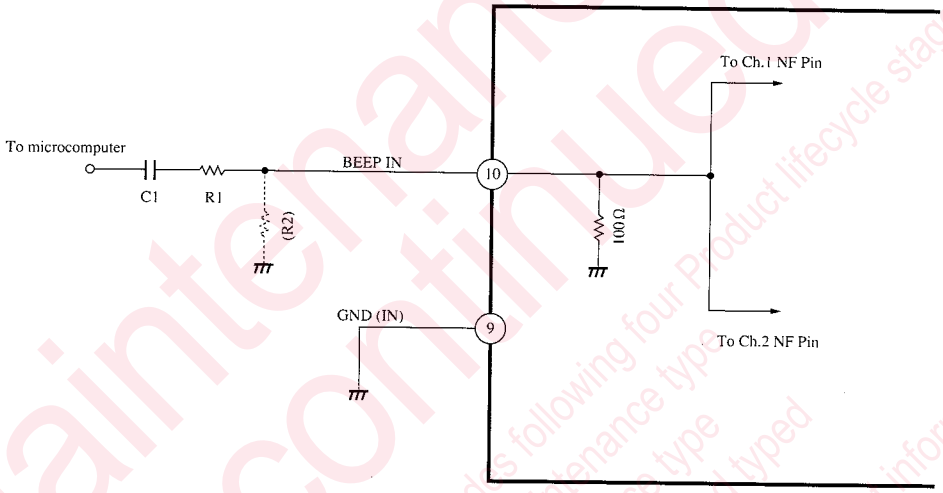
(9) Beep Sound Input Function

a) The figure below shows the application circuit using the beep sound input. The internal circuit of Beep Sound Input Pin⑩ is short-circuited to GND with 100 Ω, and connected to negative input pin of each amplifier.

b) Input the beep sound signal from the microcomputer to Pin⑩ through Capacitor C1 for DC cut and Resistor R1 for voltage gain adjustment. When R2 is also used to set the voltage gain, provide GND of R2 near Pin⑨.

c) The voltage gain of beep sound pin is 40 dB, the same as of signal input pins (Pin⑥ and Pin⑪).

d) When the beep sound is not used, short-circuit Pin⑩ directly to Pin⑨.



Request for your special attention and precautions in using the technical information and semiconductors described in this book

(1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.

(2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products. No license is granted in and to any intellectual property right or other right owned by Panasonic Corporation or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information described in this book.

(3) The products described in this book are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).
Consult our sales staff in advance for information on the following applications:
- Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
- Any applications other than the standard applications intended.

(4) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.

(5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
 Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.

(6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.

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