BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1310V

7 W DUAL AF POWER AMPLIFIER

SILICON BIPOLAR MONOLITHIC INTEGRATED CIRCUIT

DESCRIPTION

The μPC1310V is an audio power amplifier in a 14-lead vertical dual in-line package, specifically designed for car stereo applications.

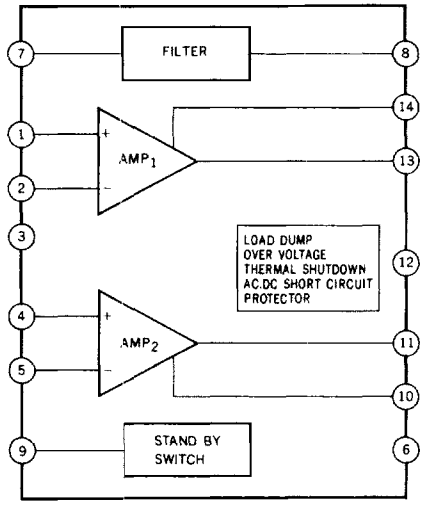
Typically it provides output power of 7 W/CH at 14.4 V or 5.8 W/CH at 13.2 V to a 4 Ω load.

The μPC1310V includes an original short circuit protection function which protects internal output power transistors when an output terminal is shorted to ground or V_{CC}.

FEATURES

- Internal stand-by switch circuit; CMOS drive possible.
- High output power: P_O = 7 W/CH (TYP.) @ R_L = 4 Ω, V_{CC} = 14.4 V, THD = 10 %
  P_O = 5.8 W/CH (TYP.) @ R_L = 4 Ω, V_{CC} = 13.2 V, THD = 10 %
- Very low distortion: THD = 0.1 % (TYP.)
- Following protection circuits are included.
  (1) Load dump voltage surge protection circuit.
  (2) Thermal shut down protection circuit.
  (3) Output terminal short circuit protection circuit. (V_{CC} to OUT, OUT to GND)

BLOCK DIAGRAM

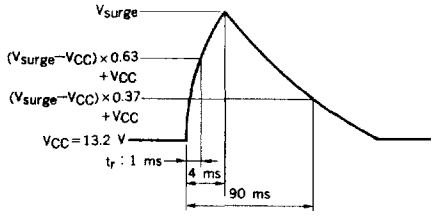


CONNECTION DIAGRAM

PIN No.	CONNECTION
1	Input 1
2	NFB_1
3	GND (Input)
4	Input 2
5	NFB_2
6	GND (Fin)
7	Filter
8	V_{CC}
9	Stand-by switch
10	Bootstrap 2
11	Output 2
12	GND (Output)
13	Output 1
14	Bootstrap 1

ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

Supply Voltage (Note)	$V_{CC\ surge}$	60*	V
Supply Voltage (Operational)	V_{CC}	18	V
Circuit Current (Peak)	$I_{CC\ peak}$	4.5	A
Power Dissipation	P_D	20	W
Operating Temperature	T_{opt}	−30 to +85	°C
Storage Temperature	T_{stg}	−55 to +150	°C



* Surge Pulse Waveform

RECOMMENDED OPERATING CONDITIONS (T_a = 25 °C)

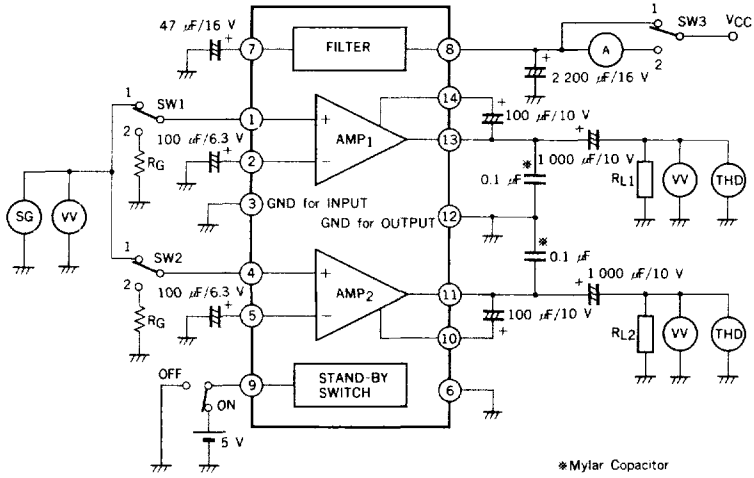
Supply Voltage Range	9 to 16	V
Load Impedance	2 to 8	Ω

ELECTRICAL CHARACTERISTICS (T_a = 25°C, V_{CC} = 13.2 V, R_L = 4 Ω, f = 1 kHz, Using 4°C/W heat sink)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Quiescent Current	I_{CC}		100	160	mA	V_{in} = 0
Output Power	P_O		7		W	V_{CC} = 14.4 V, THD = 10 %**
		5	5.8		W	V_{CC} = 13.2 V, THD = 10 %**
Voltage Gain	A_V	50	52	54	dB	
Total Harmonic Distortion	THD		0.1	0.5	%	P_O = 1 W, R_G = 600 Ω
Output Noise Level	V_n		0.8	2.0	$mV_{r.m.s.}$	R_G = 10 kΩ, BW = 20 Hz to 20 kHz
Supply Voltage Rejection Ratio	SVR	35	45		dB	R_G=0, f_{rip}=100 Hz, V_{rip}=1.0 $V_{r.m.s.}$
Input Resistance	R_{in}	45	60		kΩ	
Cross Talk	CT	50	60		dB	P_O = 1 W, R_G (other CH) = 0
Roll-off Frequency	f_H		40		kHz	A_V = −3 dB from 1 kHz Ref High
	f_L		60		Hz	A_V = −3 dB from 1 kHz Ref Low
Pin 9 Voltage	V_9	0		1.5	V	Stand-by
Pin 9 Voltage	V_9	3.5		V_{CC}	V	Operating
Stand-by Current	$I_{CC(SB)}$		0.3	0.5	mA	$0 \leq V9 \leq 1.5$ V

(**Using a Voltmeter: HP-400FL)

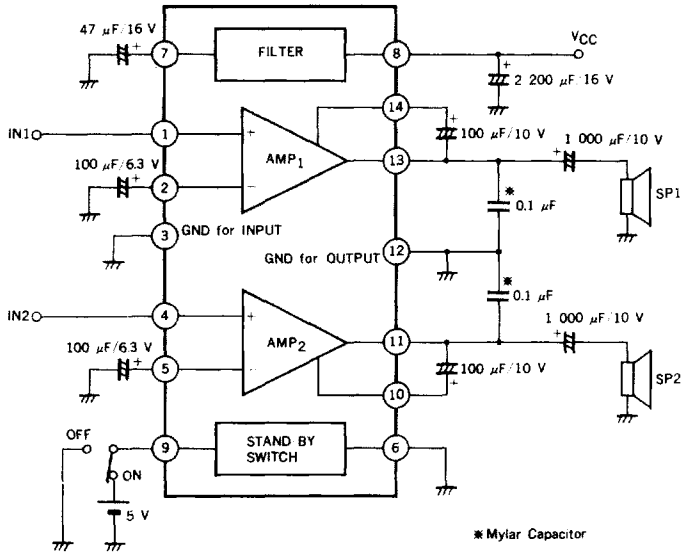
TEST CIRCUIT



SWITCH POSITION

ITEM	SYMBOL	SW1	SW2	SW3
Circuit Current	I_{CC}	2	2	2
Voltage Gain	A_V	1	1	1
Output Power	P_O	1	1	1
Total Harmonic Distortion	THD	1	1	1
Cross Talk	CT	1/2	2/1	1
Output Noise Level	V_n	2	2	1
Supply Voltage Rejection Ratio	SVR	2	2	1

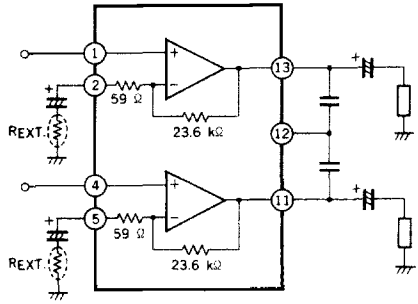
TYPICAL APPLICATION



INSTRUMENT FOR USE

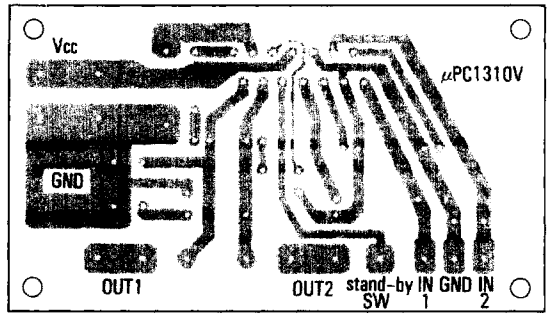
1. How to attach to the heat sink.
   - Surely use the silicon grease.
   - Keep fastening torque for the screw in the range of 5 to 8 kg-cm.
2. When this IC is unstable due to the high impedance of signal source, connect the capacitances (around 1 000 pF) between input terminals (pin #1 and pin #4) and GND for input (pin #3).
3. In pattern layout, connect pin #6 to pin #3 (GND for input), and separate its earth point from that of GND for output (pin #12).
4. The μPC1310V is not recommended for bridge and power booster amplifiers without capacitors because it doesn't include speaker protection circuit. The μPC1318AV is suitable for bridge and power booster amplifiers.
5. How to decrease voltage gain A_V.
   This IC is designed to use A_V of 52 dB so that the external components are most reduced. But A_V can be set down to 40 dB according to the following application. The modified points are shown by dotted circule and they are additional components.

How to decrease voltage gain.

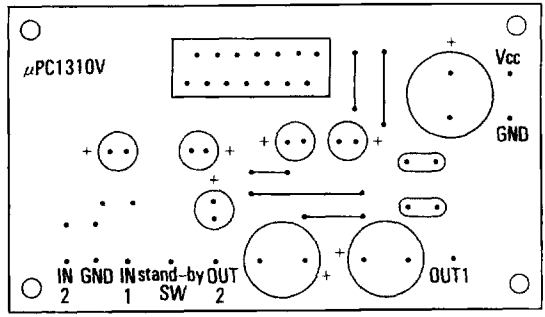


$$A_V \fallingdotseq 20 \text{ Log } [23.6 \times 10^3/(59 + R_{EXT.})]$$

EXAMPLE FOR PRINTED CIRCUIT BOARD (Copper foil side)

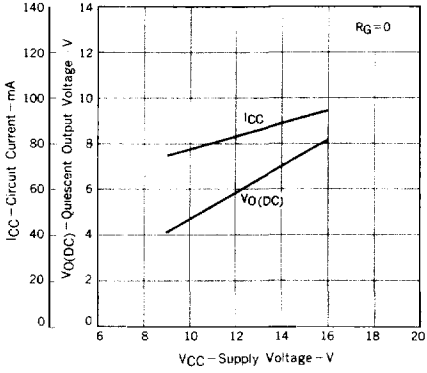


COMPONENT LAYOUT

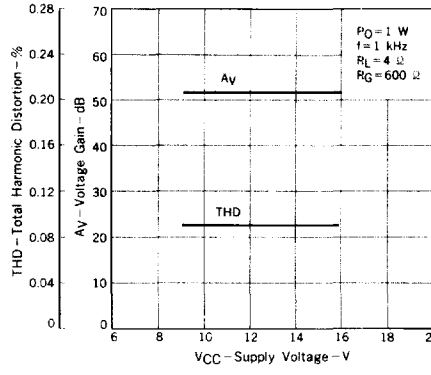


TYPICAL CHARACTERISTICS (T_a = 25 °C)

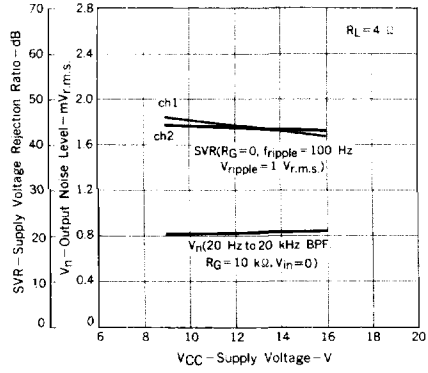
QUIESCENT OUTPUT VOLTAGE, CIRCUIT CURRENT vs. SUPPLY VOLTAGE



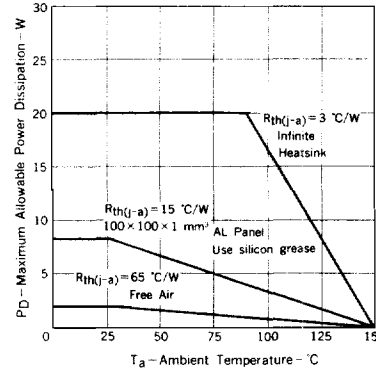
VOLTAGE GAIN, TOTAL HARMONIC DISTORTION vs. SUPPLY VOLTAGE



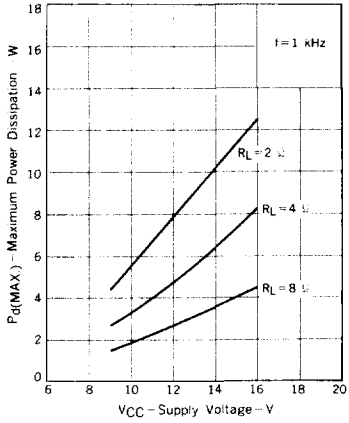
OUTPUT NOISE LEVEL, SUPPLY VOLTAGE REJECTION RATIO vs. SUPPLY VOLTAGE



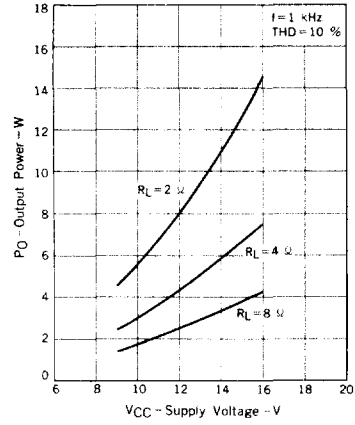
MAXIMUM ALLOWABLE POWER DISSIPATION vs. AMBIENT TEMPERATURE



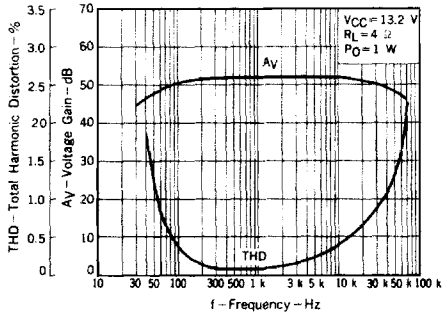
MAXIMUM POWER DISSIPATION vs. SUPPLY VOLTAGE



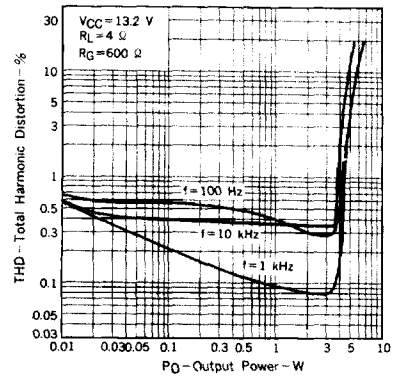
OUTPUT POWER vs. SUPPLY VOLTAGE



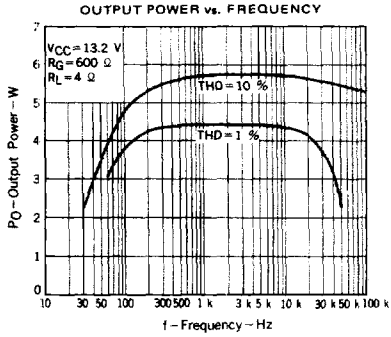
VOLTAGE GAIN, TOTAL HARMONIC DISTORTION vs. FREQUENCY



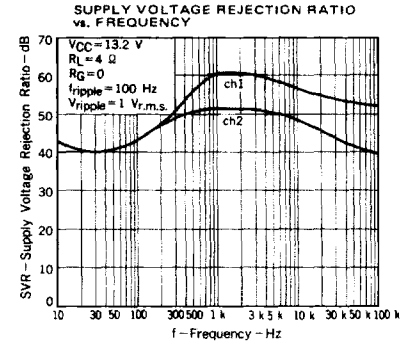
TOTAL HARMONIC DISTORTION vs. OUTPUT POWER



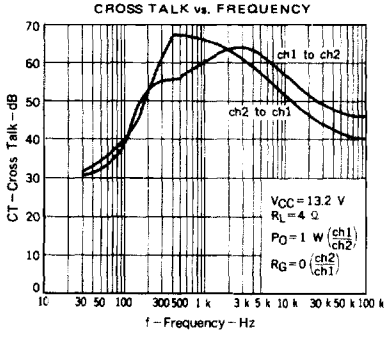
OUTPUT POWER vs. FREQUENCY



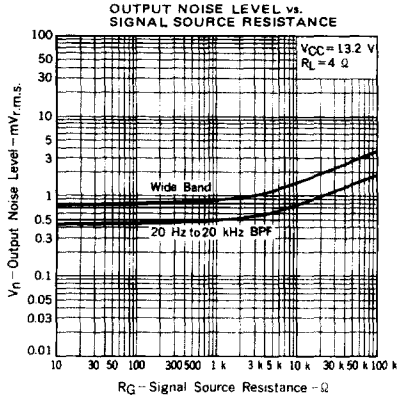
SUPPLY VOLTAGE REJECTION RATIO vs. FREQUENCY



CROSS TALK vs. FREQUENCY



OUTPUT NOISE LEVEL vs. SIGNAL SOURCE RESISTANCE



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14 PIN V-DIP PACKAGE DIMENSIONS (Unit : mm)