



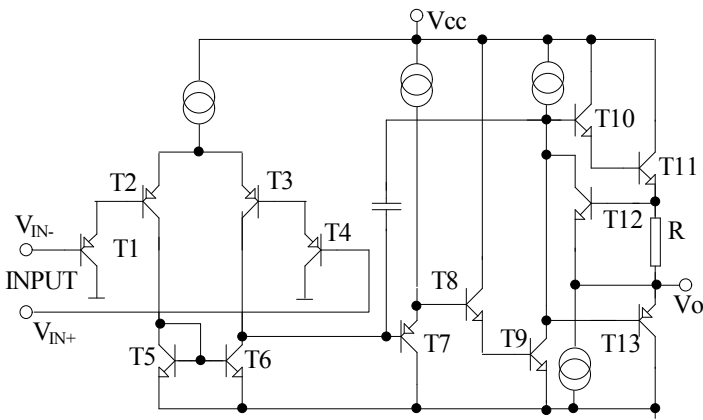
概述:

LM224 为高性能、具有四个独立的运算放大器，内含相位补偿电路，适用于收录机和音调系统作音调均衡网络，也用于其他场合。采用 SOP14/DIP14塑料封装。

主要特点:

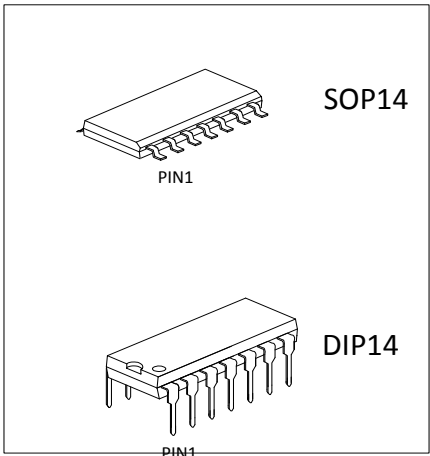
- 无需外接相位补偿电路
- 电源电压范围宽：单电源时， $V_{CC}=3\sim 20V$ ，双电源时， $V_{CC}=\pm 1.5V\sim 10V$
- 功耗电流小： $I_{CC}=0.6mA$ （典型）（ $R_L=\infty$ ）
- 输入电压范围可接近地电平

内部电路图



原理简介

LM224由四个完全相同的运算放大器组成，单元电路如图所示，其工作原理简要说明如下：输入信号加到 T_1 、 T_4 基极，经差分放大后； T_8 、 T_9 复合放大构成中间级；输出级由 $T_{10}\sim T_{13}$ 组成。其中 T_{12} 为保护管，当输出电流过大时， R 上压降增大使 T_{12} 饱和导通， T_{12} 集电极电位下降，接近 $1/2V_{CC}$ ，使得推挽管 T_{10} 、 T_{11} 和 T_{13} 截止，从而起到保护作用。电容 C 为相位补偿电容。



引出端功能符号

引出端序号	功 能	符 号	引出端序号	功 能	符 号
1	输出 1	OUT ₁	8	输出 3	OUT ₃
2	反向输入 1	IN- (1)	9	反向输入 3	IN- (3)
3	正向输入 2	IN+ (2)	10	正向输入 3	IN+ (3)
4	电源	V _{CC}	11	地	GND
5	正向输入 2	IN+ (2)	12	正向输入 4	IN+ (4)
6	反向输入 2	IN- (2)	13	反向输入 4	IN- (4)
7	输出 2	OUT ₂	14	输出 4	OUT ₄



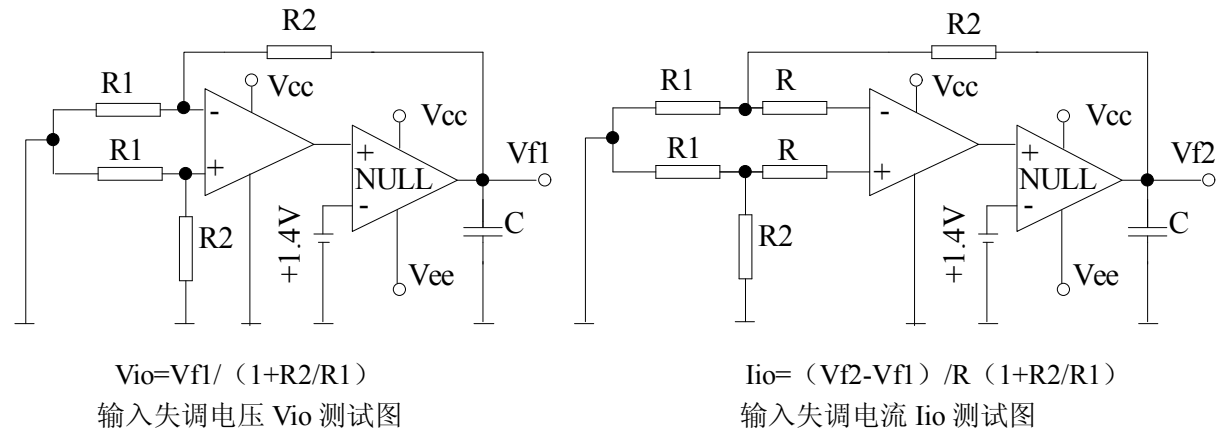
极限值（绝对最大额定值，若无其它规定，Tamb=25℃）

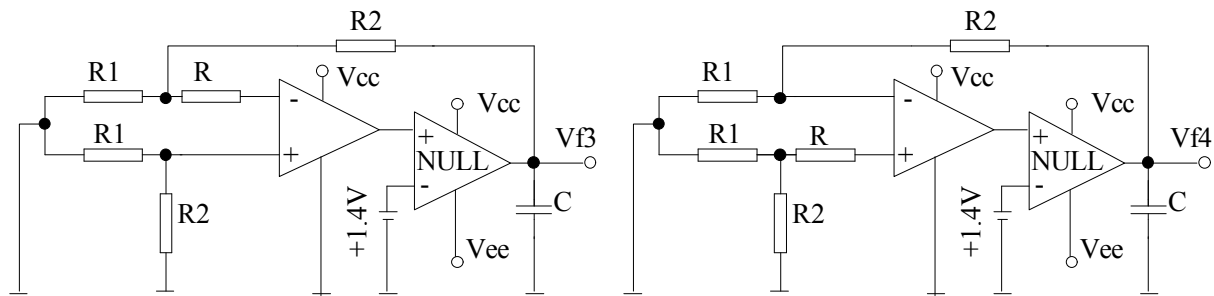
参 数	符 号	测 试 条 件	额 定 值	单 位
电源电压	Vcc		24	V
差动输入电压	V _{ID}		24	V
最大输入电压	V _{IN}		-0.3~24	V
允许功耗	P _D		600	mW
工作温度	Topr		0~+70	℃
贮存温度	Tstg		-55~+125	℃

电特性（若无其它规定，Vcc=5V，Tamb=25℃）

参数	符号	测试条件	最小植	典型值	最大值	单位
失调输入电压	V _{IO}			±2	±7	mV
输入失调电流	I _{IO}	I _{in(+)} /I _{in(-)}		±5	±50	nA
输入偏置电流	I _{BA}			45	250	nA
共模输入电压范围	V _{ICM}		0		Vcc-1.5	V
共模抑制比	K _{CMR}		65	80		dB
强信号电压增益	G _V	Vcc=15V, R _L ≥ 2 k Ω	25	100		V/mV
输出电压范围	V _O		0		Vcc-1.5	V
电源纹波抑制比	PSRR		65	100		dB
通 道 分 离	C _s	f=1kHz~20kHz		120		dB
消耗电流（1）	I _{cc}			0.6	2	mA
消耗电流（2）	I _{cc}	Vcc=20V		1.5	3	mA
输出电流（1）	I _O	V _{in} ⁺ =1V, V _{in} ⁻ =0V	20	40		mA
输出电流（2）	I _O	V _{in} ⁺ =0V, V _{in} ⁻ =1V	10	20		mA

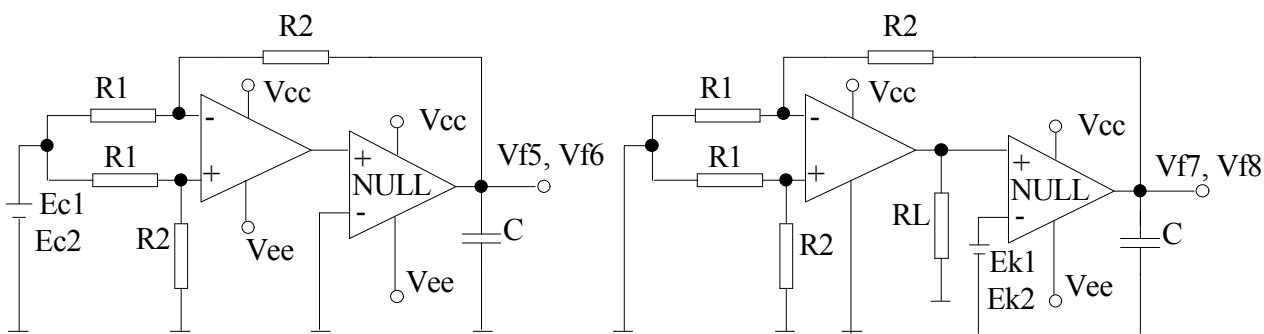
测试原理图（注：NULL 指零放大器）





$$I_{BA} = (V_{f4} - V_{f3}) / 2R (1 + R_2/R_1)$$

输入偏置电流 I_{BA} 测试图

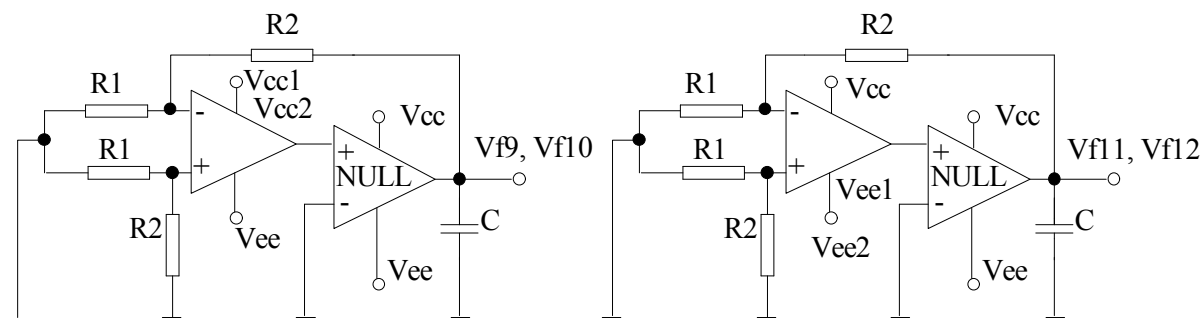


$$CMR = 20 \log \left| \frac{(E_{c1} - E_{c2}) (1 + R_2/R_1)}{(V_{f5} - V_{f6})} \right|$$

共模抑制比 CMR 及共模输入电压范围 V_{ICM} 测试图

$$G_v = (E_{k1} - E_{k2}) (1 + R_2/R_1) / (V_{f8} - V_{f7})$$

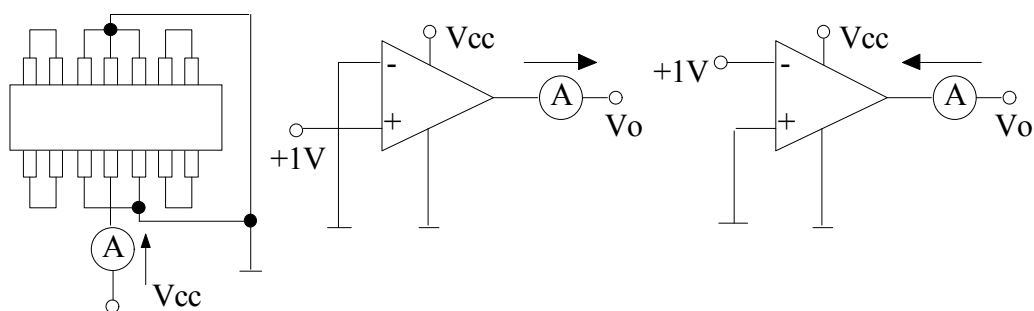
电压增益 G_v 测试图



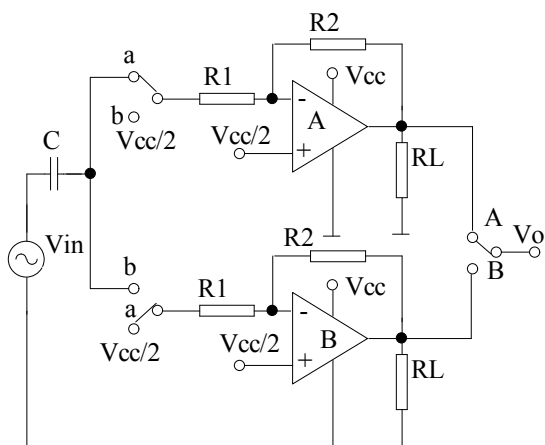
$$PSRR (+) = 20 \log \left| \frac{(V_{cc1} - V_{cc2}) (1 + R_2/R_1)}{(V_{f9} - V_{f10})} \right|$$

$$PSRR (-) = 20 \log \left| \frac{(V_{ee1} - V_{ee2}) (1 + R_2/R_1)}{(V_{f11} - V_{f12})} \right|$$

电源纹波抑制比 PSRR 测试图



消耗电流 I_{cc} 及输出电流 I_o 测试图



通道分离度 Cs 测试图

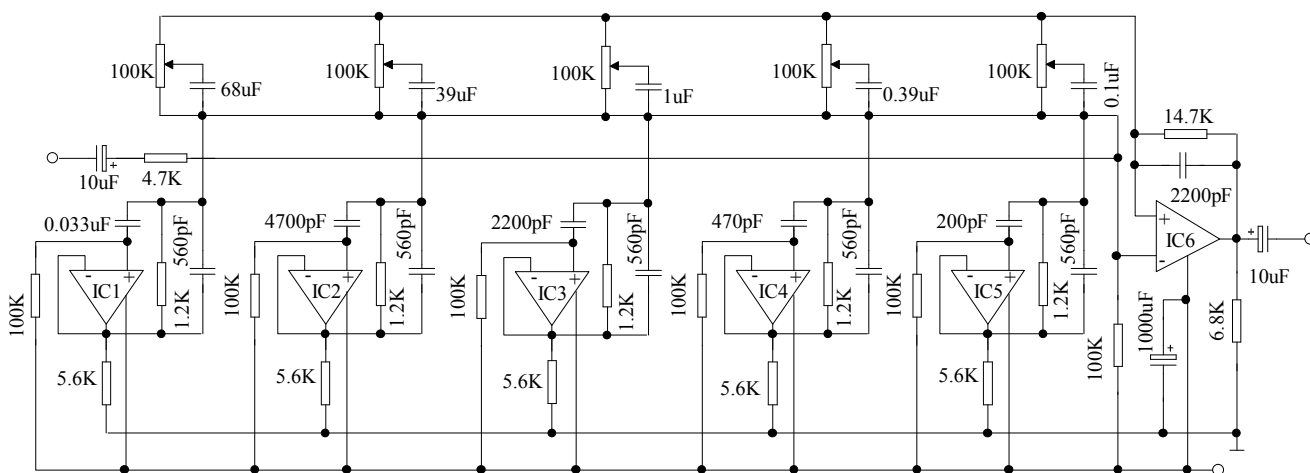
SW: A

$$Cs(A \rightarrow B) = 20 \log (R2 * V_{OA}) / (R1 * V_{OB})$$

SW: B

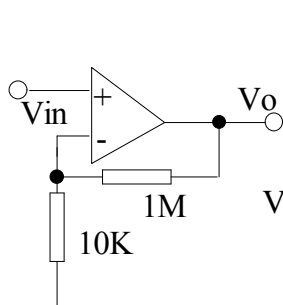
$$Cs(B \rightarrow A) = 20 \log (R2 * V_{OB}) / (R1 * V_{OA})$$

应用图

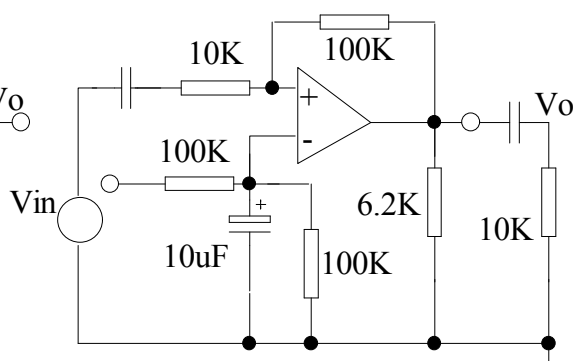


用于五频率音调控制电路

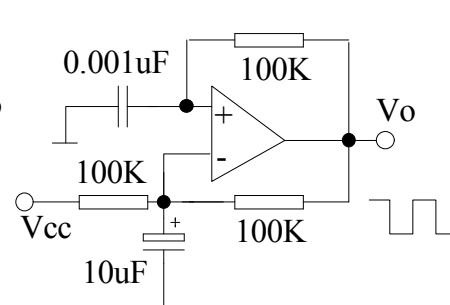
直流放大器



倒相放大器



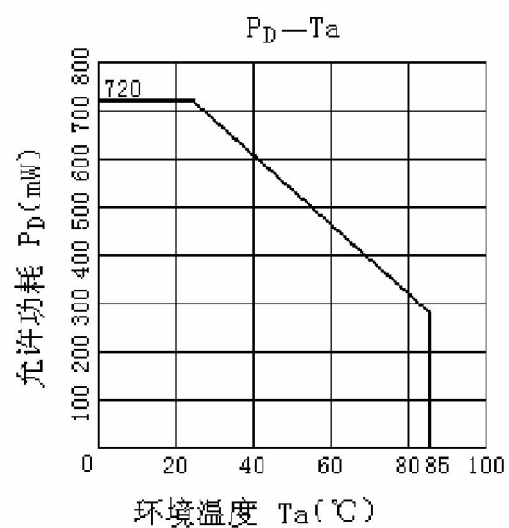
矩形波发生器



其它应用

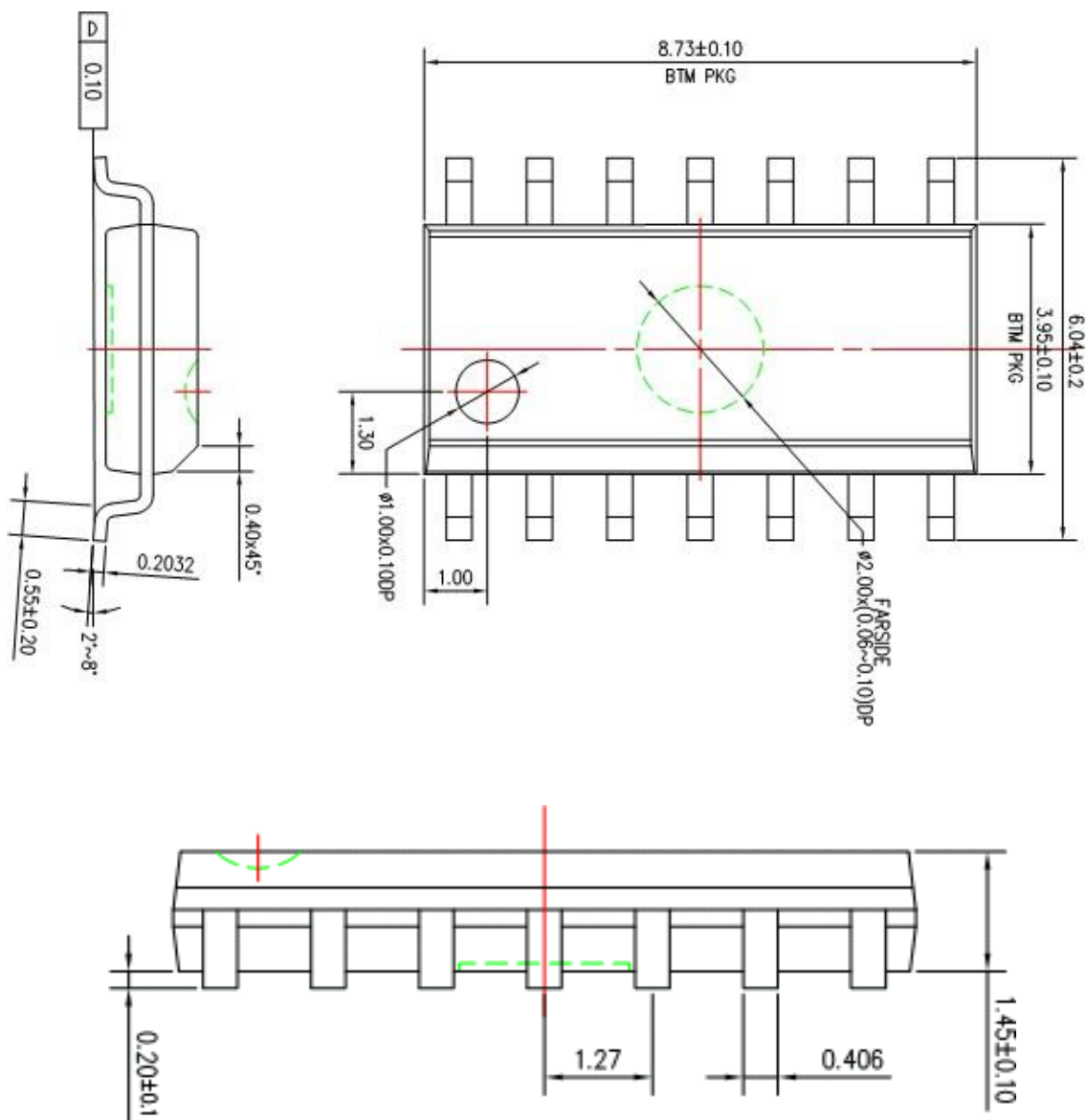


特性曲线



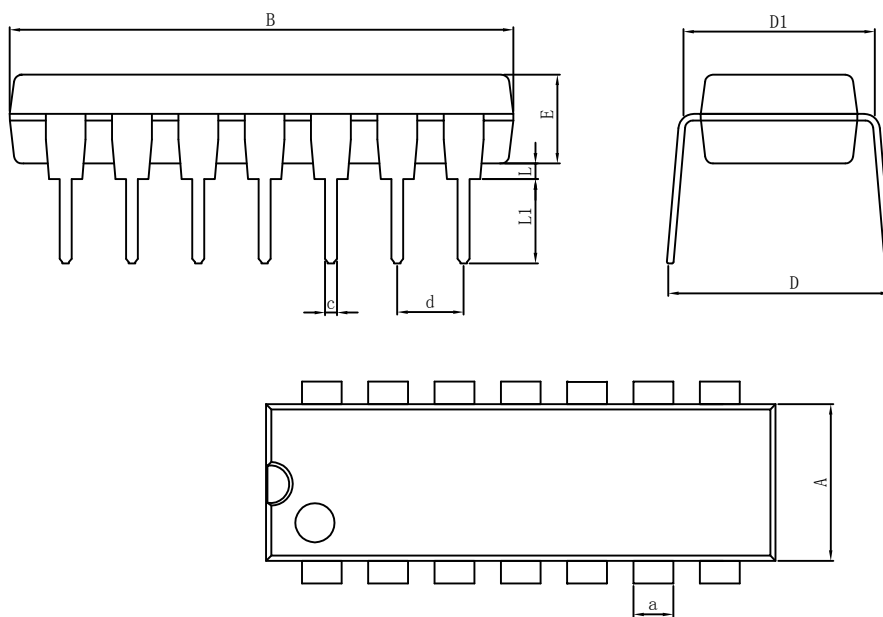


SOP-14(SOIC-14)





DIP-14



UNIT: mm							
DIM.	MIN	TYP	MAX	DIM.	MIN	TYP	MAX
A	6.100	6.300	6.680	a	1.504	1.524	1.544
B	18.940	19.200	19.560	c	0.437	0.457	0.477
D	8.200	8.700	9.200	d	2.530	2.540	2.550
D1	7.42	7.62	7.82	L	0.500	—	0.800
E	3.100	3.300	3.550	L1	3.000	3.200	3.600



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