

概述

本电路为高性能、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 14 引线双列直插式塑料封装 DIP-14，功耗 720mW，以及贴片 SOP-14封装,功耗 400mW。

特点

- 无需外接相位补偿电路
- 电源电压范围宽：
单电源时， $V_{CC}=3\sim 32V$ ，
双电源时， $V_{CC}=\pm 1.5V\sim 16V$
- 输入失调电流低: $\pm 5nA$ (典型)
- 输入失调电压低: 130mV
- 可与 TTL 及 CMOS 兼容

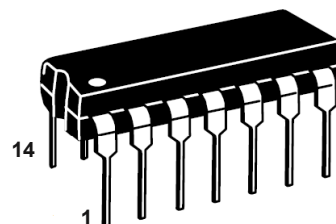
原理

LM324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T1、T4基极，经差分放大后；T8、T9于复合放大构成中间级；输出级由T10~T13组成。其中T12为保护管，当输出电流过大时，R上压降增大使T12饱和导通，T12集电极电位下降，接近 $1/2V_{CC}$ ，使得推挽管T10、T11和T13截止，从而起到保护作用。电容C为相位补偿电容。

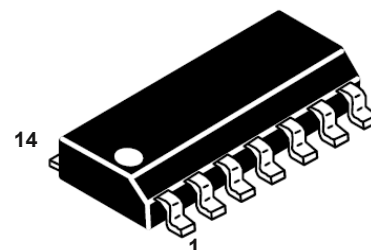
引脚功能

引脚序号	符号	功能	引脚序号	符号	功能
1	OUT1	输出 1	8	OUT3	输出 3
2	IN1-	反相输入 1	9	IN3-	反相输入 3
3	IN1+	正相输入 1	10	IN3+	正相输入 3
4	VCC	电源	11	GND	地
5	IN2+	正相输入 2	12	IN4+	正相输入 4
6	IN2-	反相输入 2	13	IN4-	反相输入 4
7	OUT2	输出 2	14	OUT4	输出 4

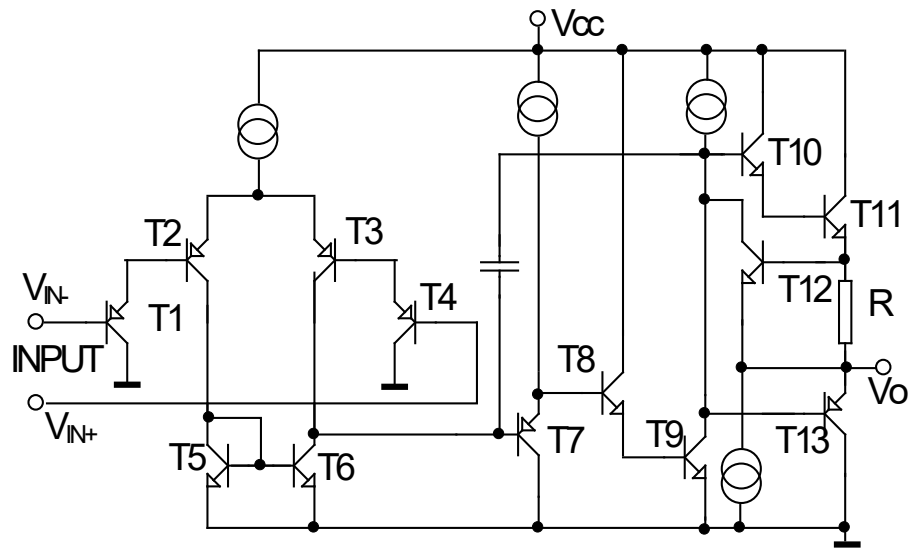
DIP-14



SOP-14



功能框图



极性参数 (绝对最大值, 若无其他规定, $T_A=25^{\circ}\text{C}$)

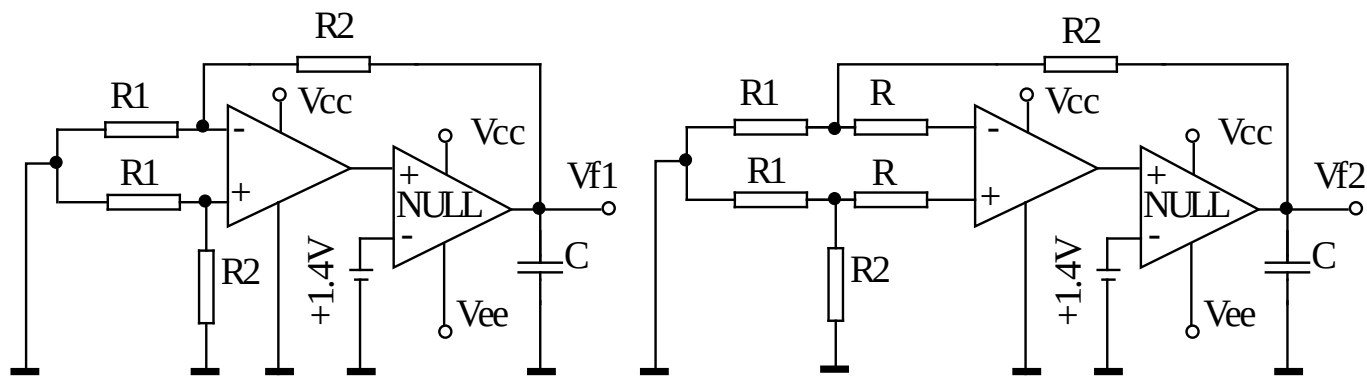
参数名称		符号	数值	单位
电源电压		V_{CC}	32	V
输入差分电压		$V_{I(DIFF)}$	32	V
最大输入电压		V_{IN}	-0.3~32	V
功耗	DIP-14	P_D	720	mW
	SOP-14		400	
工作环境温度		T_{amb}	0~70	$^{\circ}\text{C}$
贮存温度		T_{STG}	-55~125	$^{\circ}\text{C}$

电性参数

$V_{CC}=5V$, $T_A=25^{\circ}C$, 若无其他特殊规定。

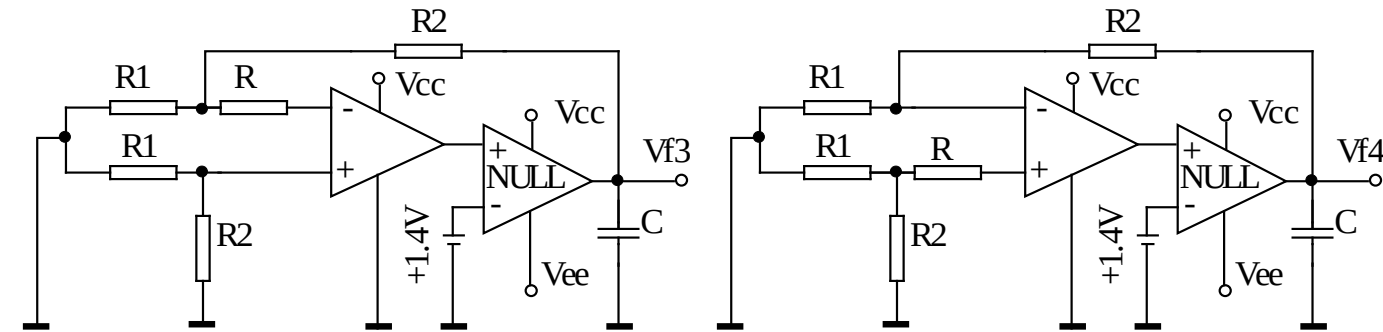
参数	符号	测试条件	规范值			单位
			最小	典型	最大	
输入失调电压	V_{IO}		--	± 2	± 5	mV
输入失调电流	I_{IO}	$I_{IN(+)} / I_{IN(-)}$	--	± 5	± 50	nA
输入偏置电流	I_{IB}	$I_{IN(+)} / I_{IN(-)}$	--	45	250	nA
输入共模电压范围	V_{ICR}		0	--	$V_{CC}-1.5$	V
共模抑制比	CMRR		65	80	--	dB
电压增益	A_{VD}	$R_L \geq 15K\Omega$, $V_{CC}=15V$	25	100	--	V/mV
输出电压范围	V_O		0	--	$V_{CC}-1.5$	V
电源纹波抑制比	PSRR		65	100	--	dB
通道分离	C_S	$f=1kHz \sim 20kHz$	--	120	--	dB
输出拉电流	I_O	$V_{IN(+)}=1V$, $V_{IN(-)}=0V$	20	35	--	mA
输出灌电流		$V_{IN(+)}=0V$, $V_{IN(-)}=1V$	10	13	--	
电源电流	I_{CC}	$R_L=\infty$, $V_{CC}=5V$	--	0.6	2	mA
		$R_L=\infty$, $V_{CC}=30V$	--	1.5	3	

典型测试原理图

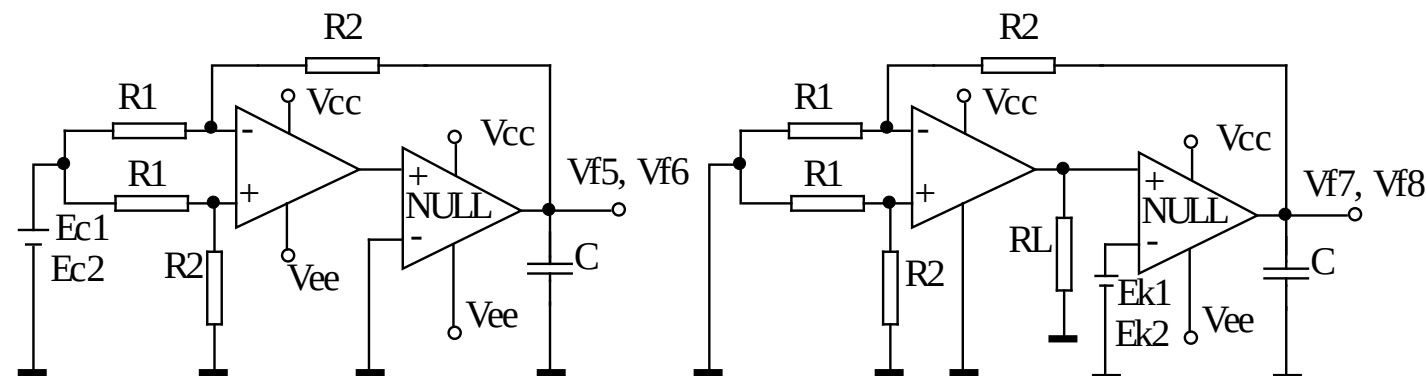


$V_{io}=V_{f1}/(1+R2/R1)$
输入失调电压 V_{io} 测试图

$l_{io}=(V_{f2}-V_{f1})/R(1+R2/R1)$
输入失调电流 l_{io} 测试图

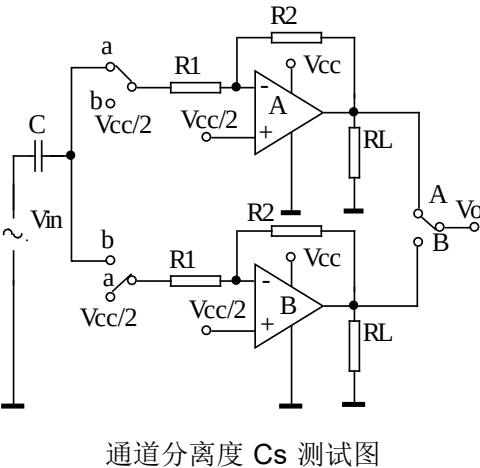
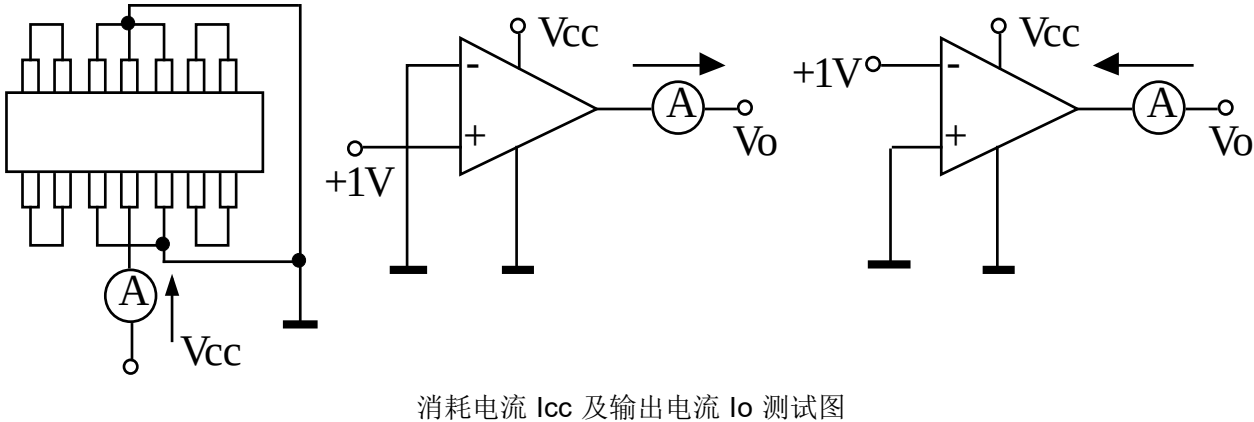
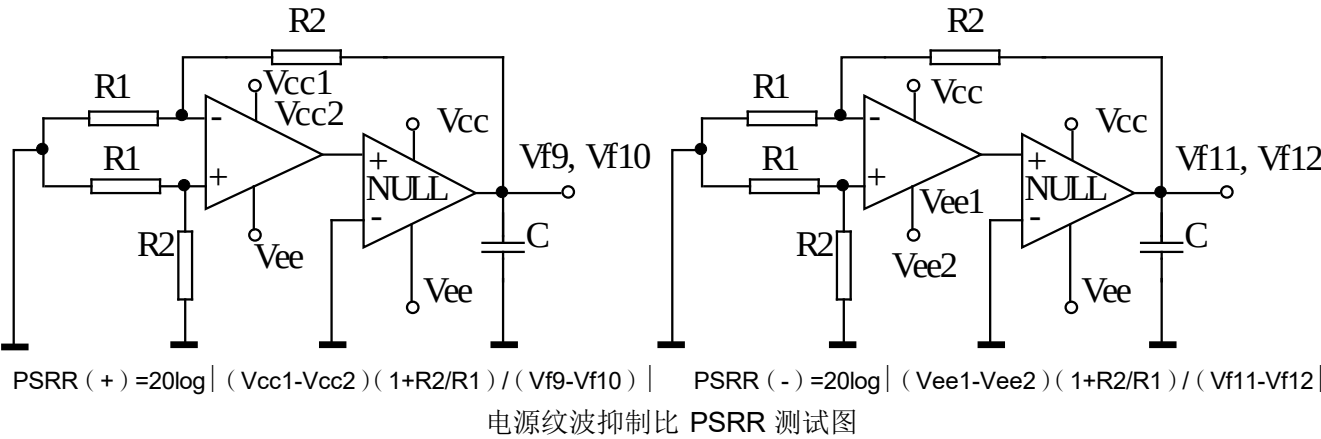


$I_{BA}=(V_{f4}-V_{f3})/2R(1+R2/R1)$
输入偏置电流 I_{BA} 测试图



$CMR=20\log |(Ec1-Ec2)(1+R2/R1)/(V_{f5}-V_{f6})|$
共模抑制比 CMR 及共模输入电压范围 V_{ICM} 测试图

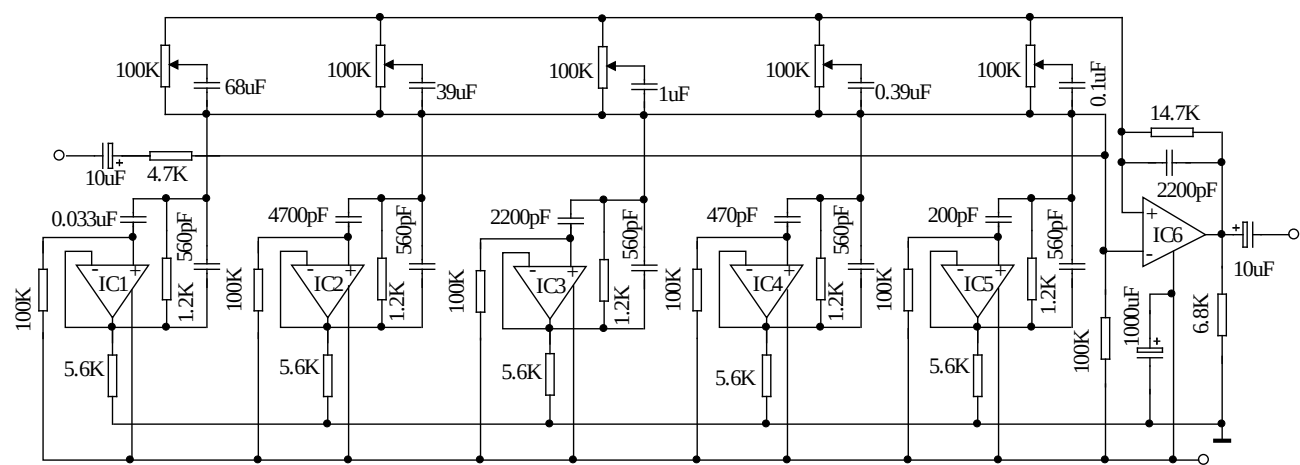
$G_v=(Ek1-Ek2)(1+R2/R1)/(V_{f8}-V_{f7})$
电压增益 G_v 测试图



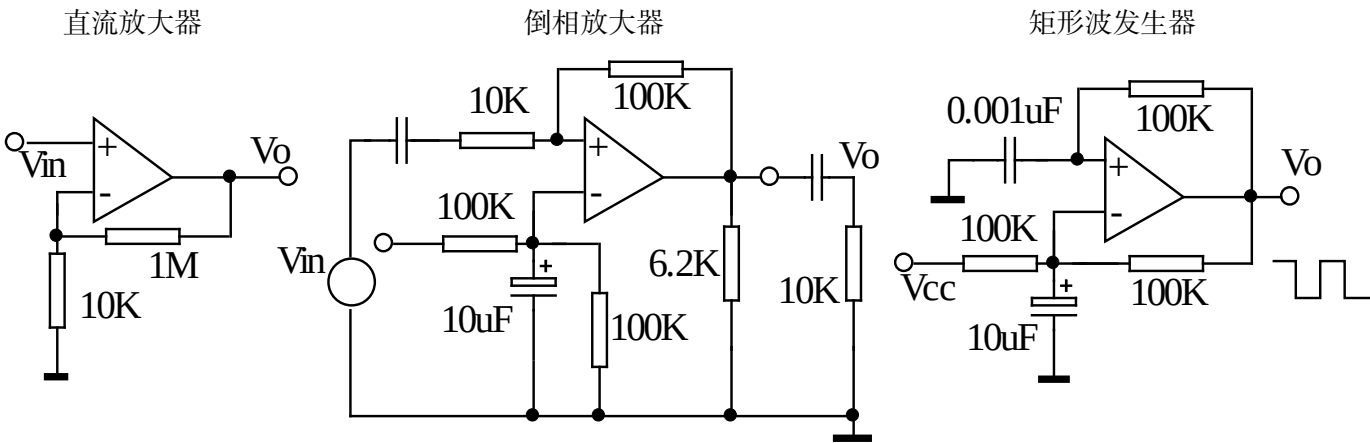
SW: A
 $C_s (A) = 20 \log \left(\frac{R2 \cdot V_{OA}}{R1 \cdot V_{OB}} \right)$

SW: B
 $C_s (B) = 20 \log \left(\frac{R2 \cdot V_{OB}}{R1 \cdot V_{OA}} \right)$

应用图

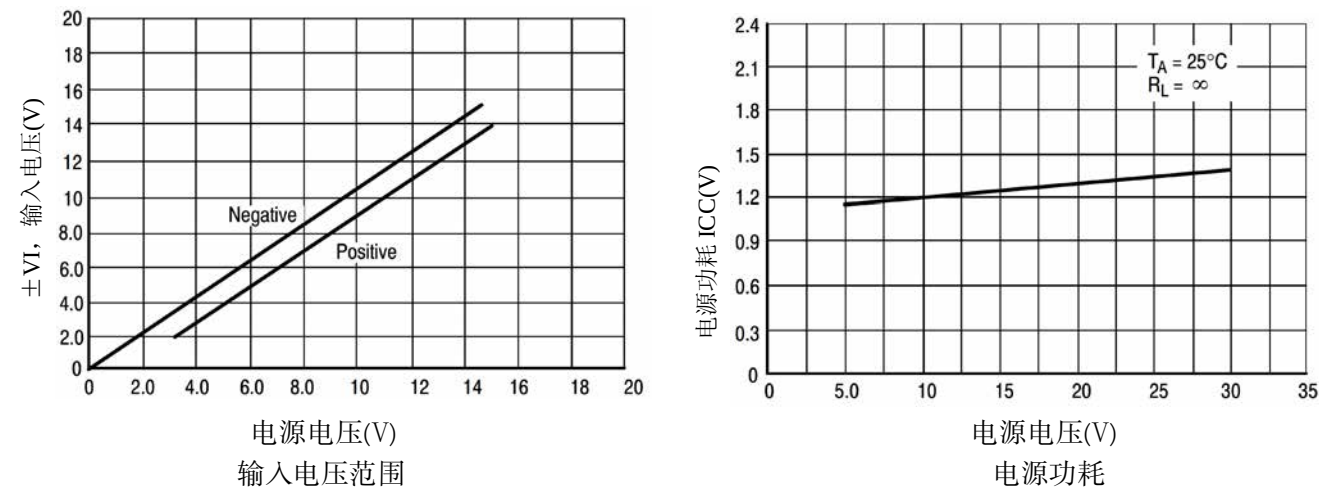


LM324 用于五频率音调控制电路



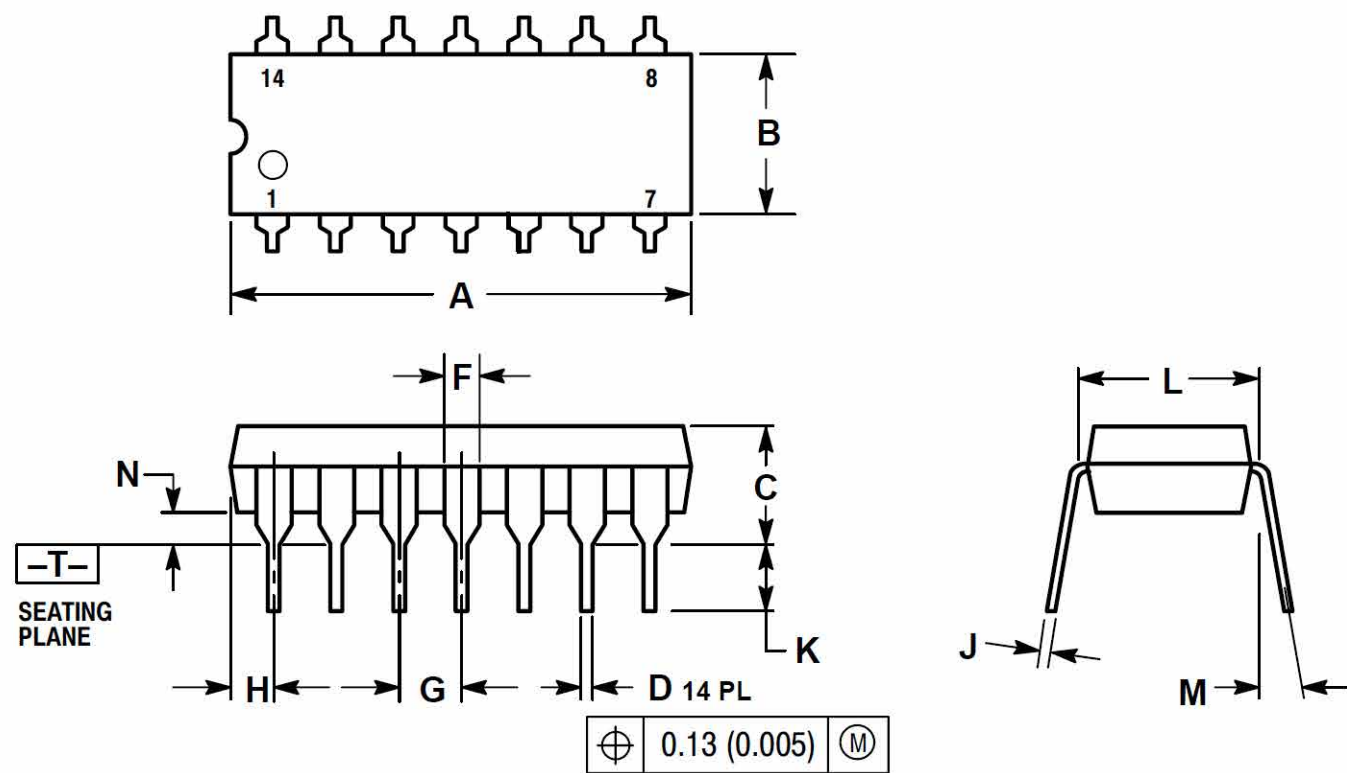
LM324 的其它应用

特性曲线



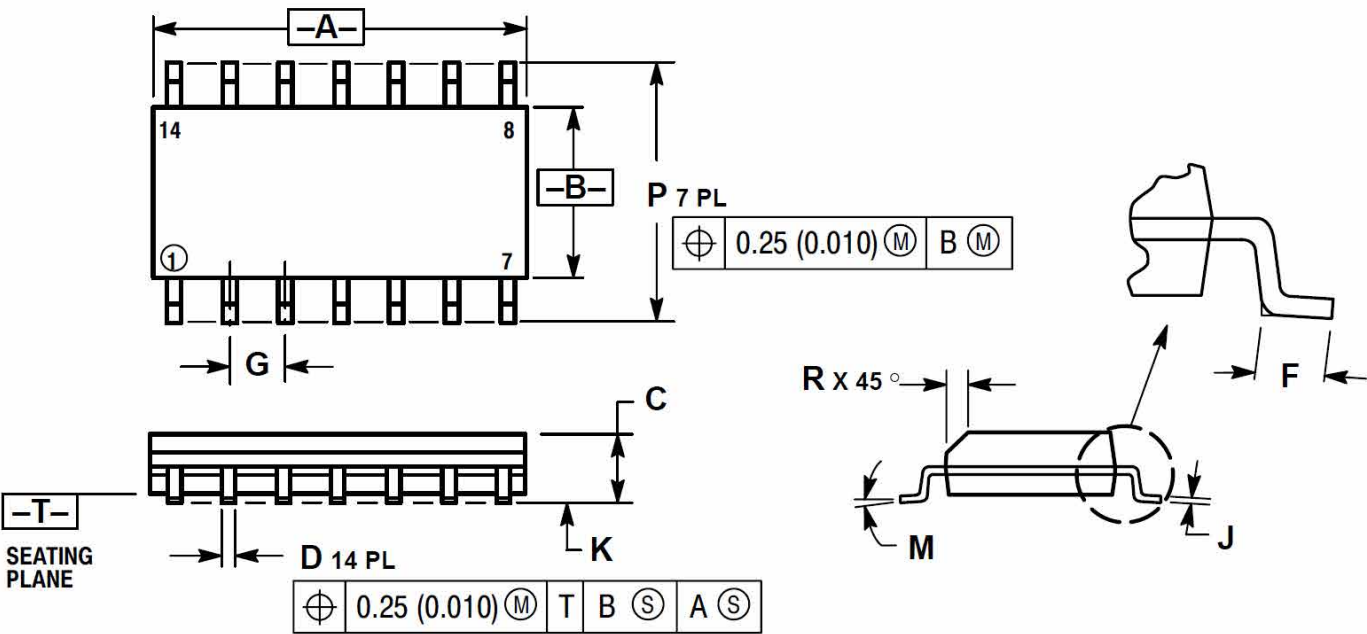
封装数据

DIP-14



封装数据

SOP-14



变量名	毫米		英寸	
	最小	最大	最小	最大
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

Contact Information

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For additional information, please contact your local Sales Representative.

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Product Specification Statement

The product specification aims to provide users with a reference regarding various product parameters, performance, and usage. It presents certain aspects of the product's performance in graphical form and is intended solely for users to select product and make product comparisons, enabling users to better understand and evaluate the characteristics and advantages of the product. It does not constitute any commitment, warranty, or guarantee.

The product parameters described in the product specification are numerical values, characteristics, and functions obtained through actual testing or theoretical calculations of the product in an independent or ideal state. Due to the complexity of product applications and variations in test conditions and equipment, there may be slight fluctuations in parameter test values. TANI shall not guarantee that the actual performance of the product when installed in the customer's system or equipment will be entirely consistent with the product specification, especially concerning dynamic parameters. It is recommended that users consult with professionals for product selection and system design. Users should also thoroughly validate and assess whether the actual parameters and performance when installed in their respective systems or equipment meet their requirements or expectations.

Additionally, users should exercise caution in verifying product compatibility issues, and TANI assumes no responsibility for the application of the product. TANI strives to provide accurate and up-to-date information to the best of our ability. However, due to technical, human, or other reasons, TANI cannot guarantee that the information provided in the product specification is entirely accurate and error-free. TANI shall not be held responsible for any losses or damages resulting from the use or reliance on any information in these product specifications.

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Users are advised to pay attention to the parameter limit values specified in the product specification and maintain a certain margin in design or application to ensure that the product does not exceed the parameter limit values defined in the product specification. This precaution should be taken to avoid exceeding one or more of the limit values, which may result in permanent irreversible damage to the product, ultimately affecting the quality and reliability of the system or equipment.

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