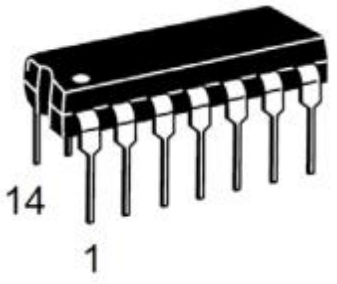
OTOMO

LM324

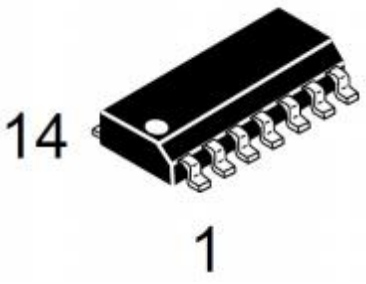
Quad op amp IC

Overview

This circuit is a high-performance, with four independent operational amplifiers, including a phase compensation circuit, suitable for tape recorders and tone systems as tone equalization network, and also used in other occasions. Adopt 14-lead dual in-line plastic package DIP14, power consumption 720mW, and SMD SOP14 package, power consumption 400mW.



DIP14



SOP14

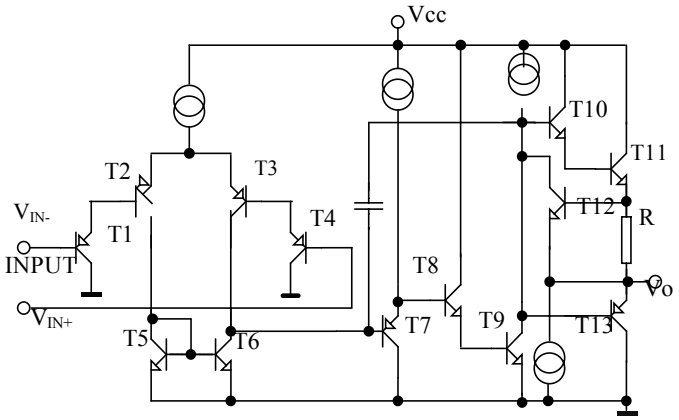
Main feature

- No external phase compensation circuit required
- Wide supply voltage range: when single supply, Vcc=3~32V， when dual power supply, Vcc=± 1.5V~16VWide supply voltage range: when single supply, Vcc=3~32V, when dual power supply, Vcc=± 1.5V~16V
- Low power consumption:Icc=0.6mA(typical) (RL= ∞)
- Input voltage range close to ground

Introduction

LM324 is composed of four identical operational amplifiers. The unit circuit is shown in the figure, and its working principle is briefly described as follows: The input signal is applied to the bases of T1 and T4, and then differentially amplified; T8 and T9 are compositely amplified to form an intermediate stage; The output stage consists of T10~T13. Among them, T12 is a protection tube. When the output current is too large, the voltage drop on R increases to make T12 saturate and conduct, and the collector potential of T12 drops, which is close to 1/2Vcc, so that the push-pull tubes T10, T11 and T13 are cut off, thus protecting effect. Capacitor C is a phase compensation capacitor.

Internal circuit diagram



Pin end function symbol

Terminal serial number	Function	Symbol	Terminal serial number	Function	Symbol
1	output 1	OUT1	8	output 3	OUT3
2	reverse input 1	IN- (1)	9	reverse input 3	IN- (3)
3	Positive input 1	IN+(1)	10	Positive input 3	IN+(3)
4	power supply	Vcc	11	land	GND
5	Positive input 2	IN+(2)	12	Positive input 4	IN+(4)
6	reverse input 2	IN- (2)	13	reverse input 4	IN- (4)
7	output 2	OUT2	14	output 4	OUT4

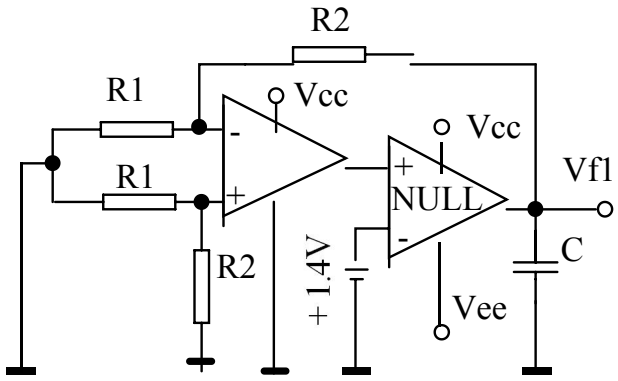
Limiting Parameters (Absolute Maximum Ratings, if not otherwise specified, Tamb=25℃)

Parameter	Symbol	Test Conditions	Rated value	Unit
voltage	Vcc		32	V
Differential input voltage	V_{ID}		32	V
Maximum input voltage	V_{IN}		-0.3~32	V
allowable power consumption	P_D	DIP SOP	720 400	mW
Operating temperature	Topr		0~+70	℃
Storage temperature	Tstg		-55~+125	℃

Electrical Characteristics (Vcc=5V, Tamb=25℃ unless otherwise specified)

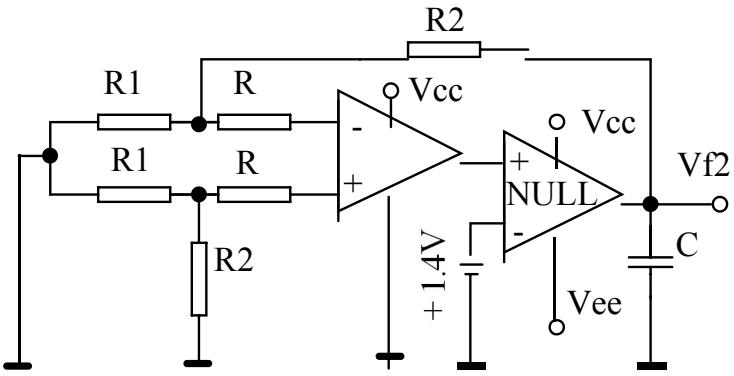
Parameter	Symbol	Test Conditions	Min Value	Typ Value	Max value	Unit
Offset input voltage	V_{IO}			±2	±5	mV
Input offset current	I_{IO}	Iin(+)/Iin(-)		±5	±50	nA
Input bias current	I_{BA}			45	250	nA
Common Mode Input Voltage Range	V_{ICM}		0		Vcc-1.5	V
Common Mode Rejection Ratio	K_{CMR}		65	80		dB
Strong signal voltage gain	G_V	Vcc=15V,R_L≥2 kΩ	25	100		V/mV
Output voltage range	Vo		0		Vcc-1.5	V
Power Ripple Rejection Ratio	PSRR		65	100		dB
channel separation	C_S	f=1kHz~20kHz		120		dB
Static current consumption(1)	Icc	Vcc=5V		0.6	2	mA
Static current consumption(2)	Icc	Vcc=30V		1.5	3	mA
output current	Io	Vin+=1V,Vin-=0V	20	35		mA
Output sink current	Io	Vin+=0V,Vin-=1V	10	13		mA

Test schematic diagram (Note: NULL refers to zero amplifier)



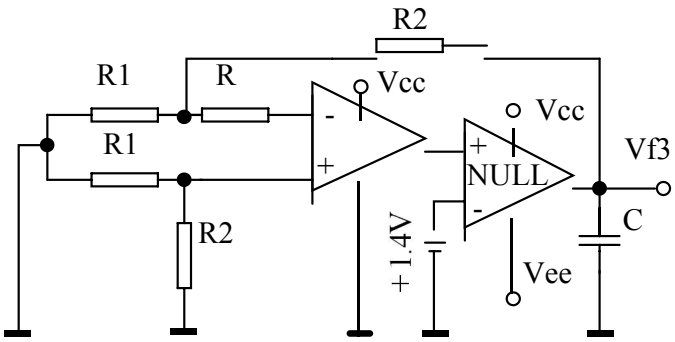
Vio=Vf1/(1+R2/R1)

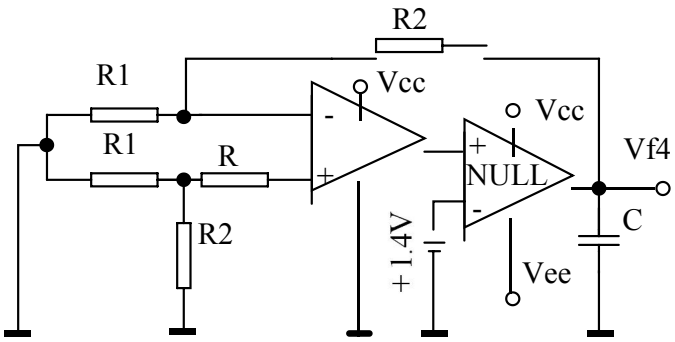
Input Offset Voltage Vio Test Chart



Iio=(Vf2-Vf1)/R(1+R2/R1)

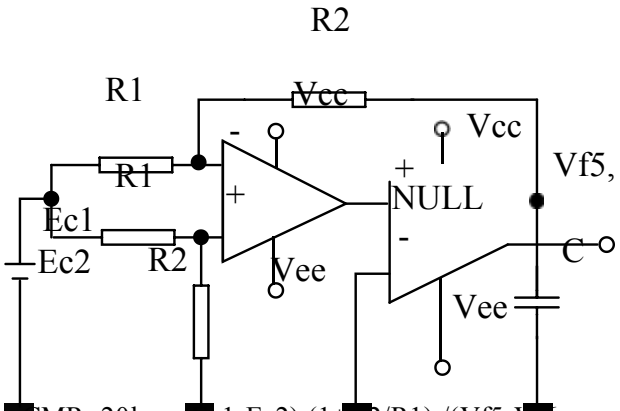
Input Offset Current Iio Test Chart





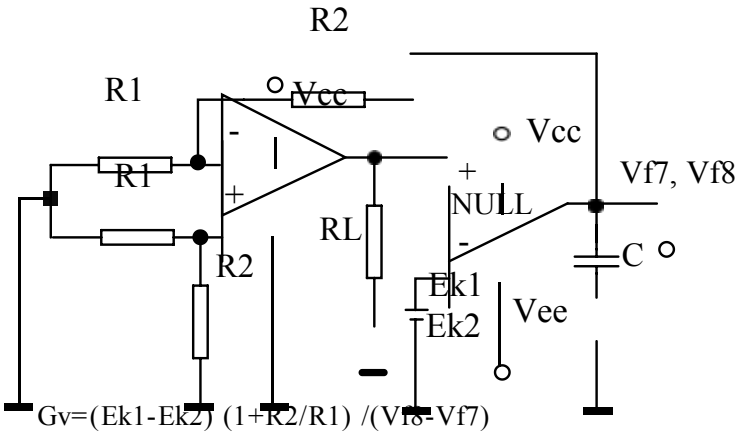
IBA=(Vf4-Vf3) /2R(1+R2/R1)

Input Bias Current IBA Test Chart



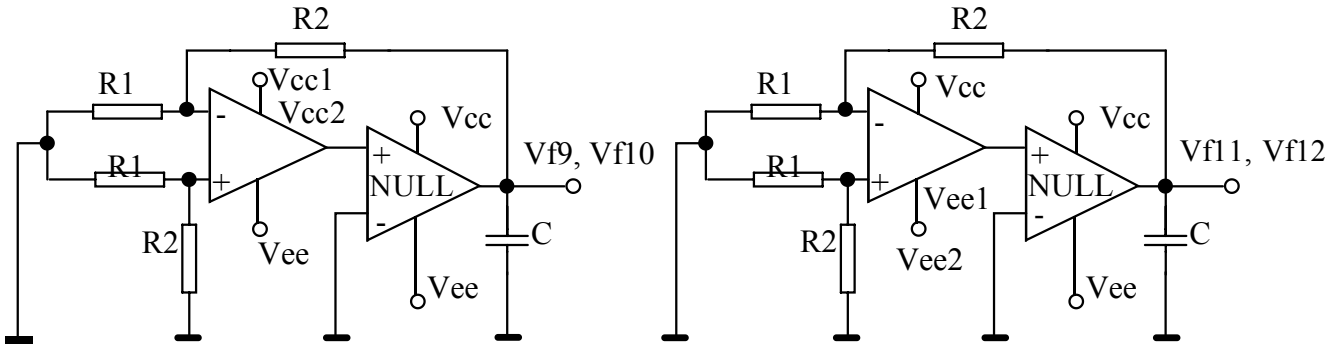
CMR=20log (Ec1-Ec2) (1+R2/R1) /(Vf5-Vf6

Common Mode Rejection Ratio CMR and Common Mode Input Voltage Range VICM Test Chart



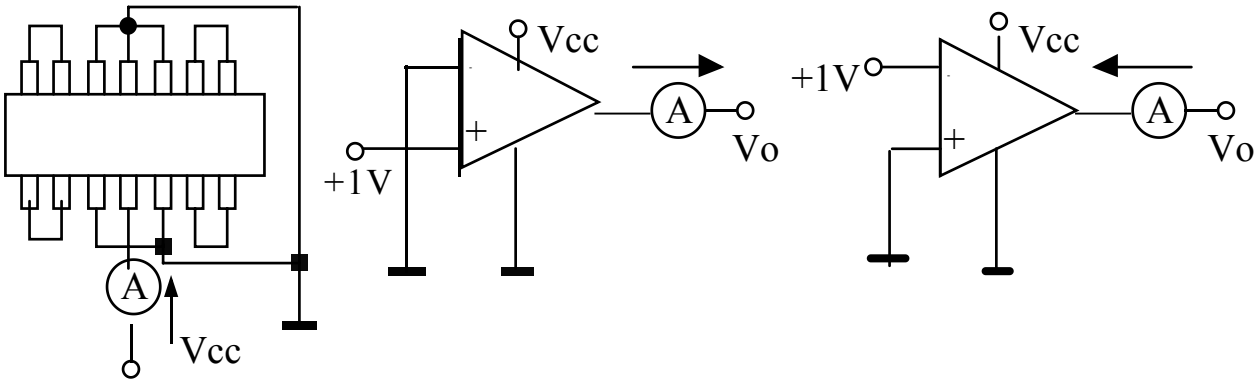
Gv=(Ek1-Ek2) (1+R2/R1) /(Vf8-Vf7)

Voltage Gain Gv Test Chart

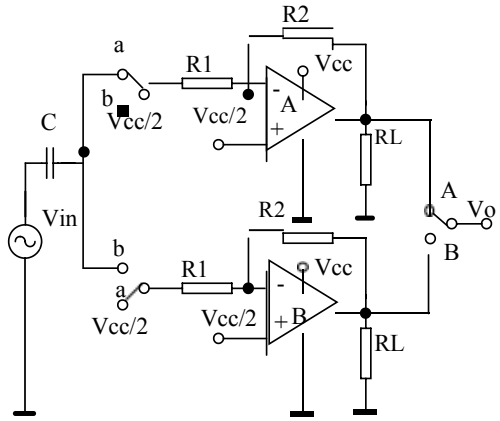


PSRR(+) =20log (Vcc1-Vcc2) (1+R2/R1) /(Vf9-Vf10) PSRR(-) =20log (Vee1-Vee2) (1+R2/R1) /(Vf11-Vf12

Power Supply Ripple Rejection Ratio PSRR Test Chart



Consumption current Icc and output current Io test chart



Channel Separation Cs Test Chart

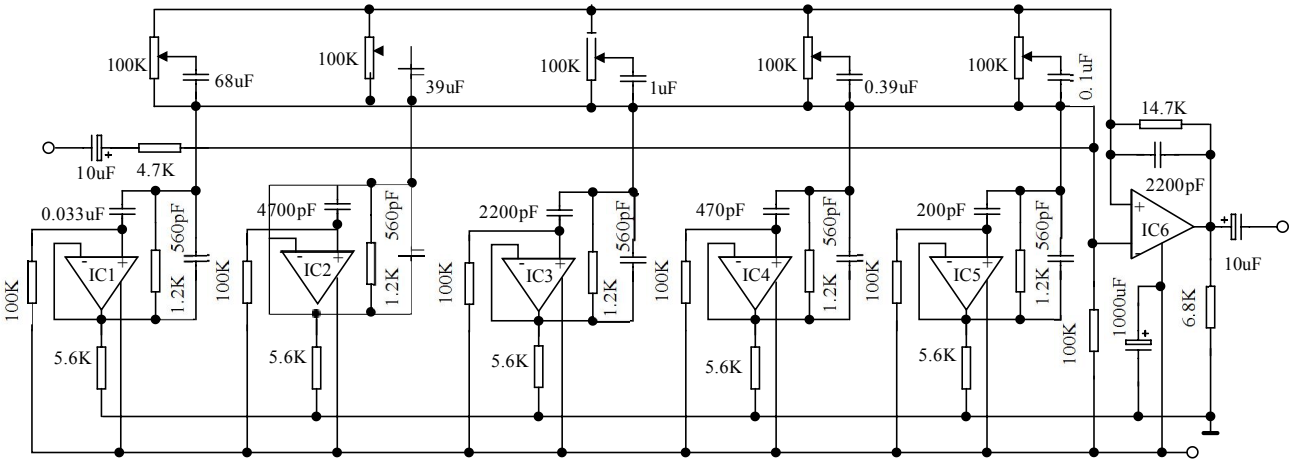
SW：A

Cs(A B)=20log(R2*VOA)/(R1*VOB)

SW：B

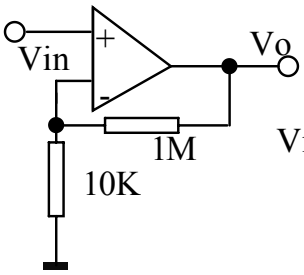
Cs(B A)=20log(R2*VOB)/(R1*VOA)

Application diagram

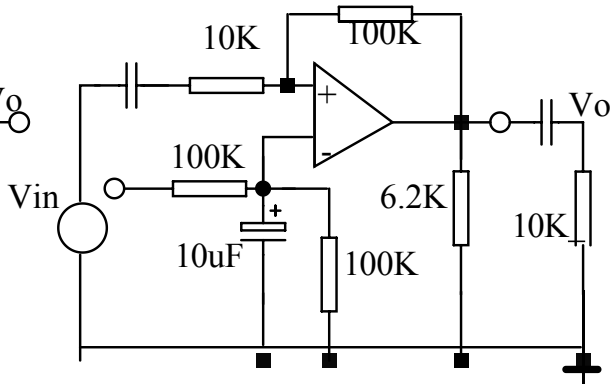


LM324 for five frequency tone control circuit

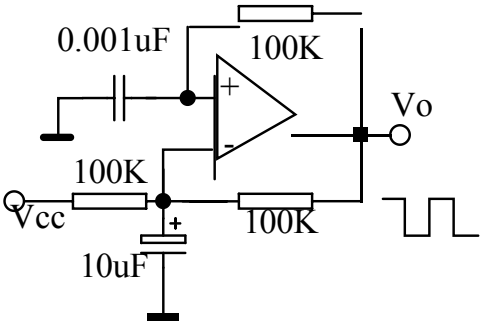
DC amplifier



Inverting amplifier

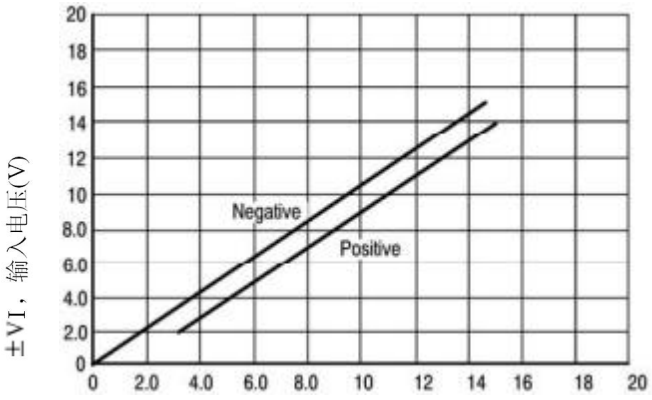


Rectangular Wave Generator



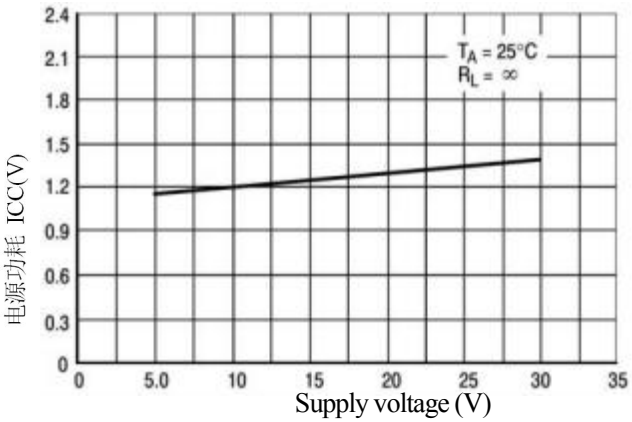
Other Applications of LM324

Characteristic curve



Supply voltage (V)

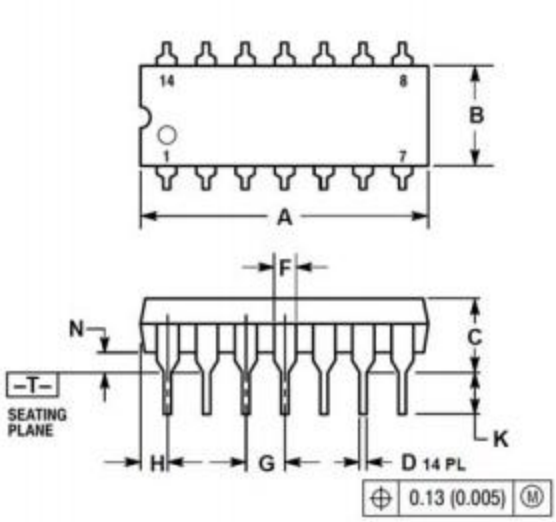
Input voltage range



Supply voltage (V)

Power consumption

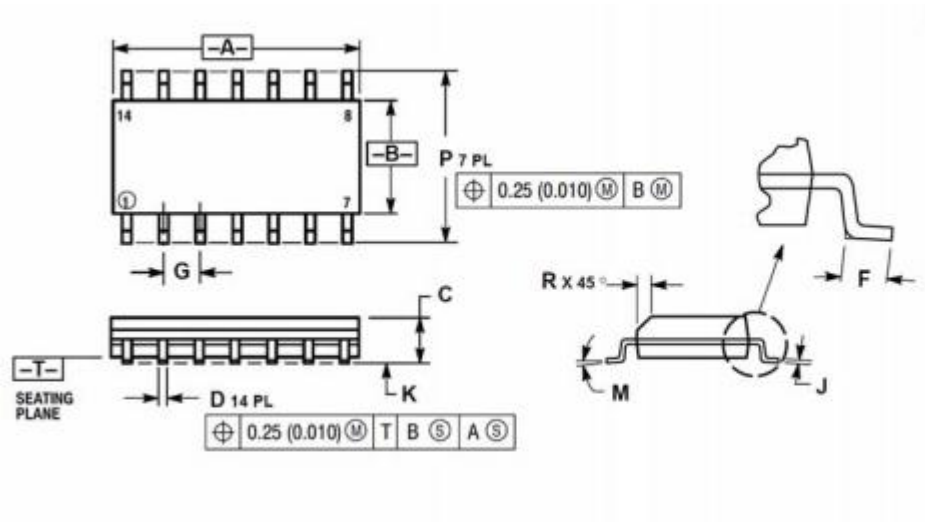
Package information:



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	18.80
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.290	0.310	7.37	7.87
M	---	10°	---	10°
N	0.015	0.039	0.38	1.01

DIP14



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
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		0.050 BSC	
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

SOP14