RC3403A

Ground Sensing Quad Operational Amplifier

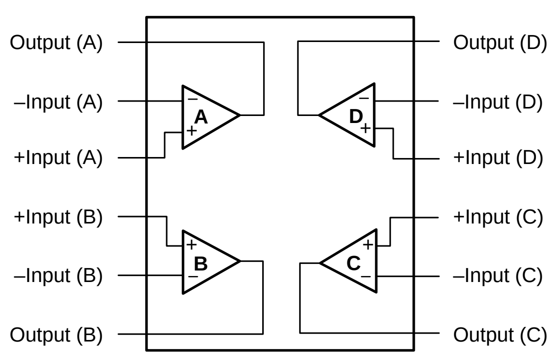
Features

- Class AB output stage – no crossover distortion
- Output voltage swings to ground in single supply operation
- High slew rate – 1.2 V/µS
- Single or split supply operation
- Wide supply operation – +2.5V to +36V or ±1.25V to ±18V
- Pin compatible with LM324 and MC3403
- Low power consumption – 0.8 mA/amplifier
- Common mode range includes ground

Description

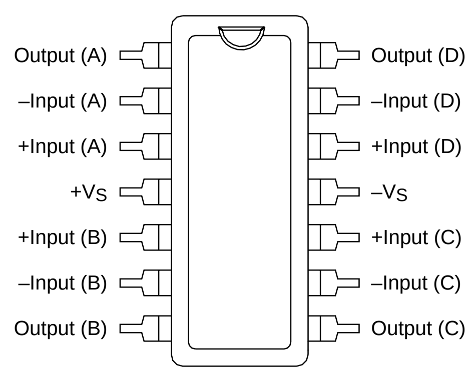
The RC3403A is a high performance ground sensing quad operational amplifier featuring improved dc specifications equal to or better than the standard 741 type general purpose op amp. The ground sensing differential input stage of this op amp provides increased slew rate compared to 741 types.

Block Diagram



65-3403A-01

Pin Assignments



65-3403A-02

Absolute Maximum Ratings

(beyond which the device may be damaged)[1]

Parameter	Min	Typ	Max	Units
Supply Voltage			+36 or ±18	V
Input Voltage	-0.3		36	V
Differential Voltage			36	V
$P_D T_A$ < 50°C			468	mW
Operating Temperature	0		70	°C
Storage Temperature	-65		150	°C
Junction Temperature			125	°C
Lead Soldering Temperature (60 seconds)			300	°C
For T_A > 50°C Derate at 6.25mW/°C				

Notes:

1. Functional operation under any of these conditions is NOT implied. Performance and reliability are guaranteed only if Operating Conditions are not exceeded.

Operating Conditions

Parameter		Min	Typ	Max	Units
θ_{JA}	Thermal resistance		160		°C/W

Low Voltage Electrical Characteristics

$+V_S$ = +5V, $-V_S$ = GND, and T_A = +25°C

Parameter	Conditions	Min	Typ	Max	Units
Input Offset Voltage			2.0	10	mV
Input Bias Current			-150	-500	nA
Input Offset Current			30	50	nA
Supply Current	$R_L = \infty$ All Amplifiers		2.5	5.0	mA
Large Signal Voltage Gain	$R_L \geq 2k\Omega$	20	200		V/mV
Output Voltage Swing[1]	$R_L \geq 10k\Omega$	3.5			V_{p-p}
Channel Separation	1kHz ≤ F ≤ 200kHz (Input referred)		120		dB
Power Supply Rejection Ratio		76			dB

Note:

1. Output will swing to ground.

Electrical Characteristics

$+V_S$ = ±15V, 0°C ≤ T_A ≤ +70°C

Parameter	Conditions	Min	Typ	Max	Units
Input Offset Voltage				10	mV
Input Bias Current				-800	nA
Input Offset Current				200	nA
Large Signal Voltage Gain	$R_L \geq 2k\Omega$	15			V/mV
Output Voltage Swing	$R_L \geq 2k\Omega$	±10			V

Electrical Characteristics +V_S = ±15V, T_A = +25°C

Parameter	Conditions	Min	Typ	Max	Units
Input Offset Voltage			2.0	6.0[1]	mV
Input Bias Current			-150	-500	nA
Input Offset Current			30	50	nA
Input Voltage Range		0		+V_S – 2	V
Supply Current	R_L = ∞ On All Op Amps		3.0	5.0[1]	mA
Large Signal Voltage Gain	R_L ≥ 2kΩ	25[1]	100		V/mV
Output Voltage Swing[1]	R_L ≥ 10kΩ	±13	±14		V
Common Mode Rejection Ratio	DC	70	90		dB
Channel Separation	±1 kHz to 20kHz		120		dB
Output Source Current	+V_{IN} = 1V, –V_{IN} = 0V	20	40		mA
Output Sink Current		10	20		mA
Unity Gain Bandwidth			1.0		MHz
Slew Rate	A_V = 1, -10 ≤ V_{IN} < +10		1.2[1]		V/µS
Distortion (Crossover)	F = 20kHz, V_{OUT} = 10V_{p-p}		1.0		%
Power Bandwidth	V_{OUT} = 10V_{p-p}		40		kHz
Power Supply Rejection Ratio		80	94		dB

Note:
1. Significantly improved performance.

Electrical Characteristics Comparison – RC3403A, MC3403, LM324

MAX Ratings	RC3403A			MC3403			LM324			Unit
Supply Voltage	+36 or ±18			+36 or ±18			+32 or ±16			V
Differential Input Voltage	36			36			32			V
Input Voltage	36			36			32			V
Electrical Characteristics	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**
Test Conditions		±15			±15			+5.0		V
Input Offset Voltage		2.0	6.0		2.0	8.0		2.0	7.0	mV
Input Offset Current		±30	±50		±30	±50		±5.0	±50	nA
Input Bias Current		150	500		200	500		45	500	nA
Input Voltage Range	0		+V_S – 2	0		+V_S – 2	0		+V_S – 1.5	V
Supply Current		3.0	5.0		2.8	7.0		0.8	2.0	mA
Large Signal Voltage Gain	25	100		20	200			100		V/mV
Output Voltage Swing	±13	±14		±10	±13		0		+V_S – 1.5	V
Common Mode Rejection Ratio	70	90		70	90			85		dB
Power Supply Rejection Ratio	80	94		76	90			85		dB
Unity Gain Bandwidth		1.0			1.0			1.0		MHz
Slew Rate		1.2			0.6			0.4		V/µS
Output Sink Current	10	20						20		mA
Output Source Current	20	40					20	40		mA
Channel Separation		120			120			120		dB
Distortion (Crossover)		1.0			1.0					%

Typical Performance Characteristics

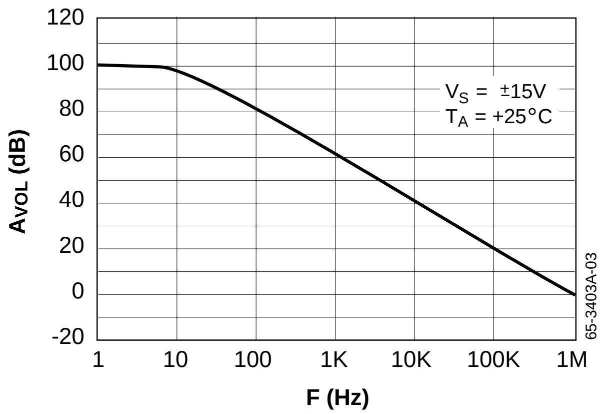


Figure 1. Open Loop Gain vs. Frequency

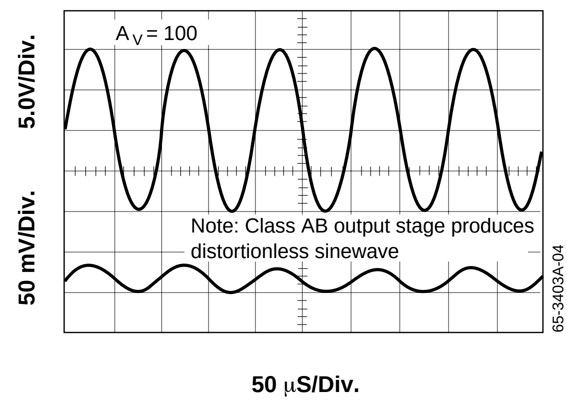


Figure 2. Sinewave Response

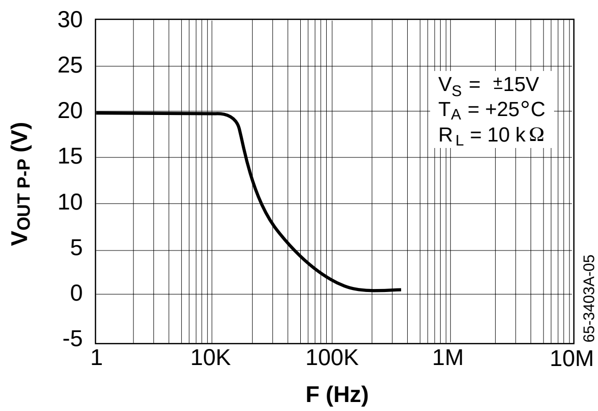


Figure 3. Output Voltage vs. Frequency

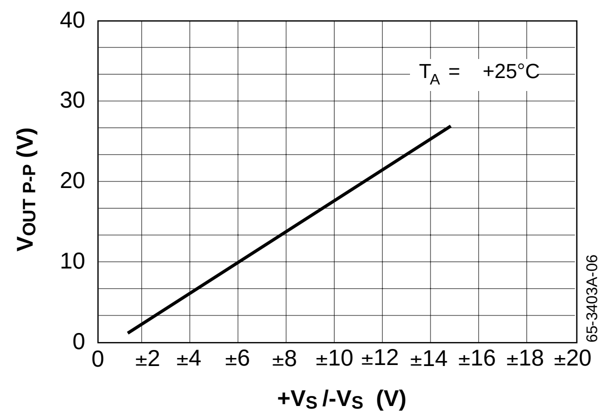


Figure 4. Output Swing vs Supply Voltage

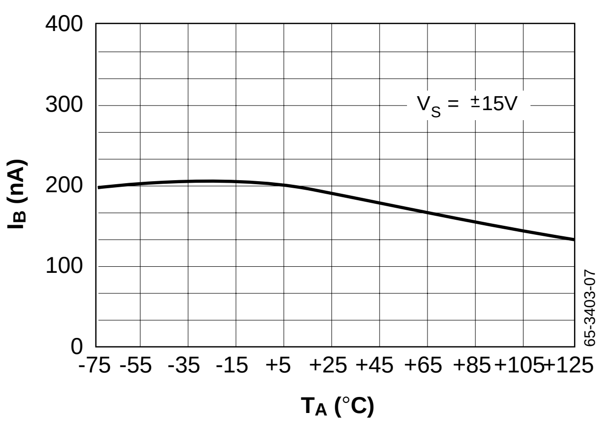


Figure 5. Input Bias Current vs. Temperature

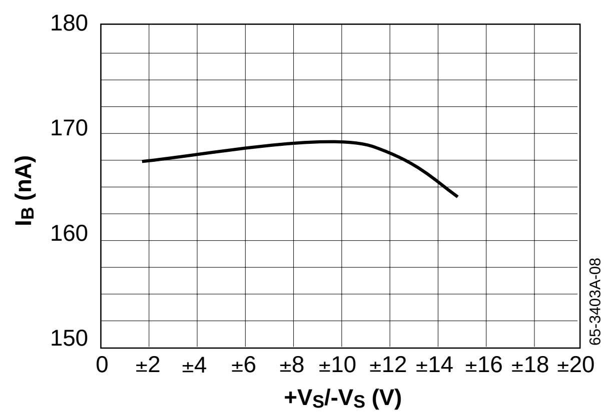


Figure 6. Input Bias Current vs. Supply Voltage

Typical Applications

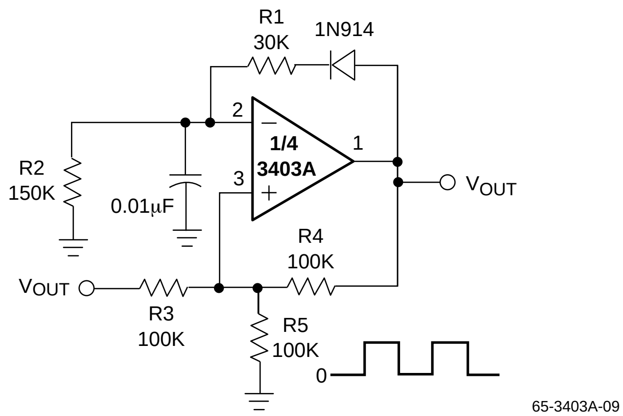


Figure 7. Pulse Generator

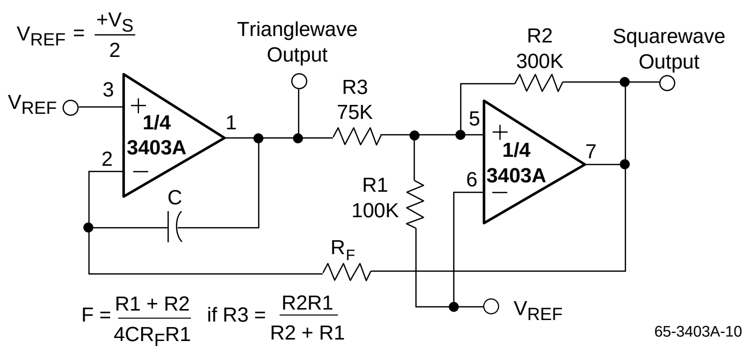


Figure 8. Function Generator

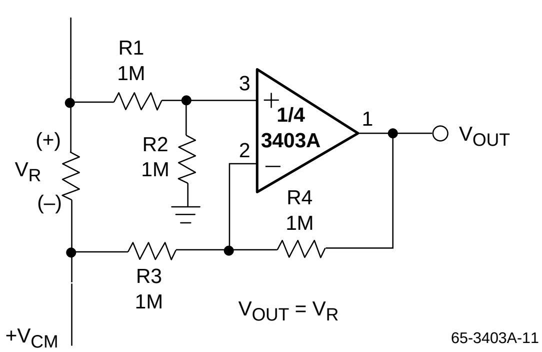


Figure 9. Ground Referencing a Differential Input Signal

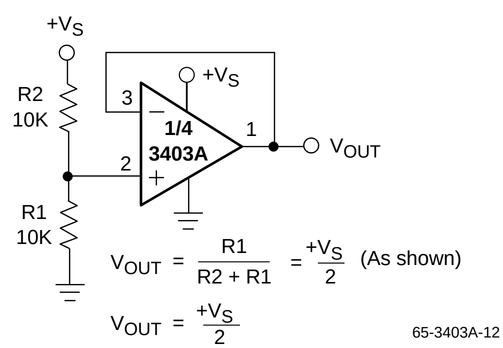


Figure 10. Voltage Reference

Typical Applications (continued)

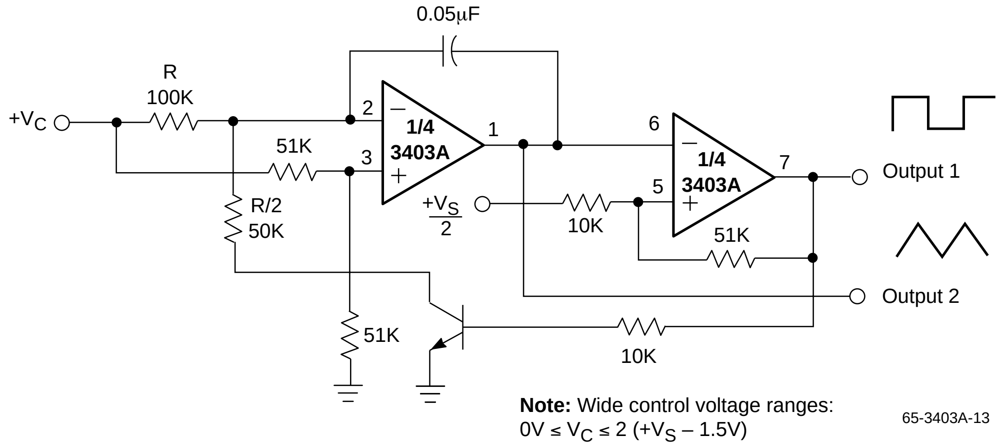


Figure 11. Voltage Controlled Oscillator

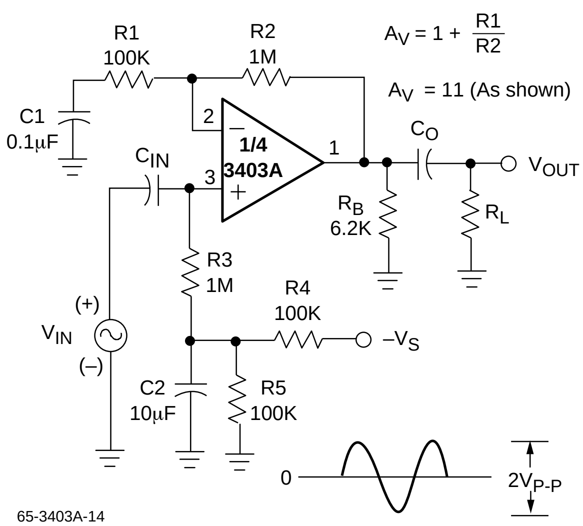


Figure 12. AC Coupled Non-Inverting Amplifier

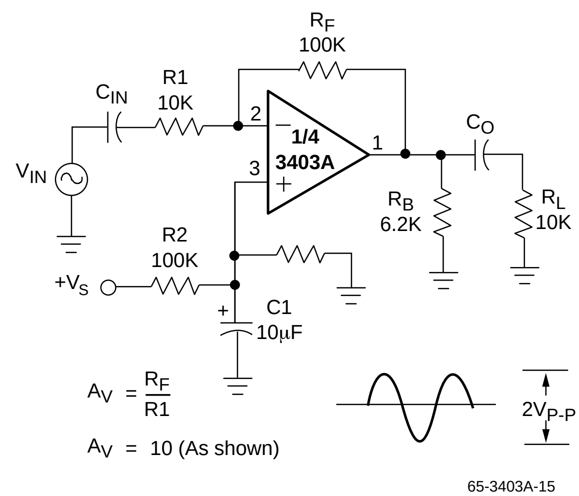
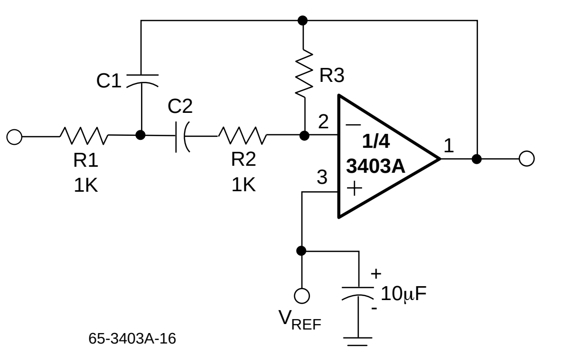


Figure 13. AC Coupled Inverting Amplifier



F_O Δ Center Frequency
BW Δ Bandwidth
R in kΩ
C in µF

$Q = \frac{F_O}{BW} < 10$

$C1 = C2 = \frac{Q}{3}$

R1 = R2 = 1
$R3 = 9Q^2 - 1$
} Use scaling factors in these expressions.

If source impedance is high or varies, filter may be preceeded with voltage follower buffer to stabilize filter parameters.

Design Example:

Given: Q = 5, F_O = 1 kHz
Let R1 = R2 = 10 kΩ
Then $R3 = 9 (5)^2 - 10$
R3 = 215 kΩ

$C = \frac{5}{3} = 1.6$ nF

Figure 14. Multiple Feedback Bandpass FIlter

Typical Applications (continued)

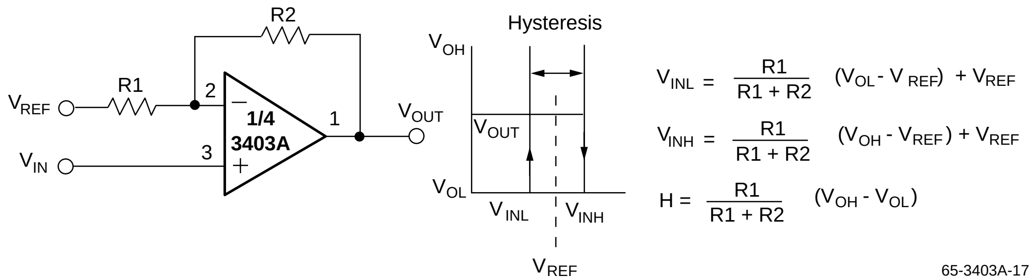


Figure 15. Comparator with Hysteresis

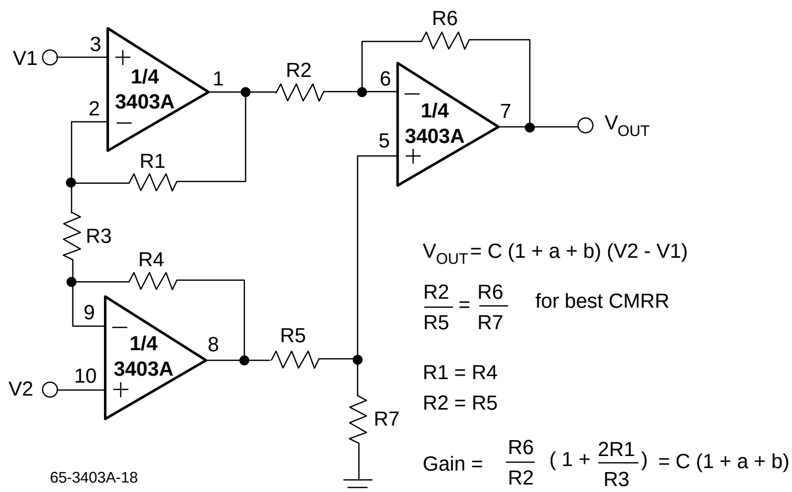


Figure 16. High Impedance Differential Amplifier

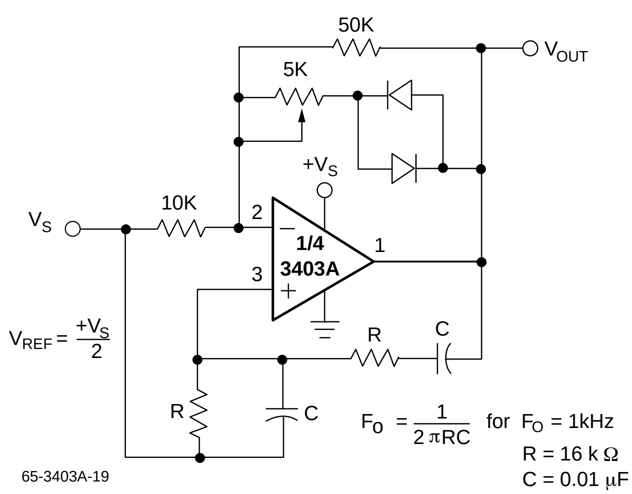
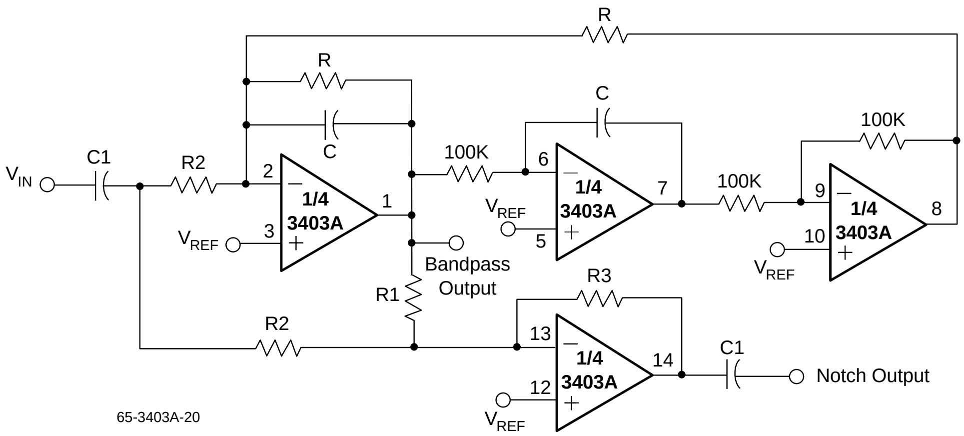


Figure 17. Wein Bridge Oscillator

Typical Applications (continued)



$Q = \frac{F_O}{BW}$

Where:

T_{BP} = Center Frequency Gain

T_N = Bandpass Notch Gain

$F_O = \frac{1}{2\pi RC}$

$R1 = QR$

$R2 = \frac{R1}{T_{BP}}$

$R3 = T_N R2$

$C1 = 10C$

Example:

F_O = 1000 Hz

BW = 100 Hz

T_{BP} = 1

T_N = 1

R = 160 kΩ

R1 = 1.6 MΩ

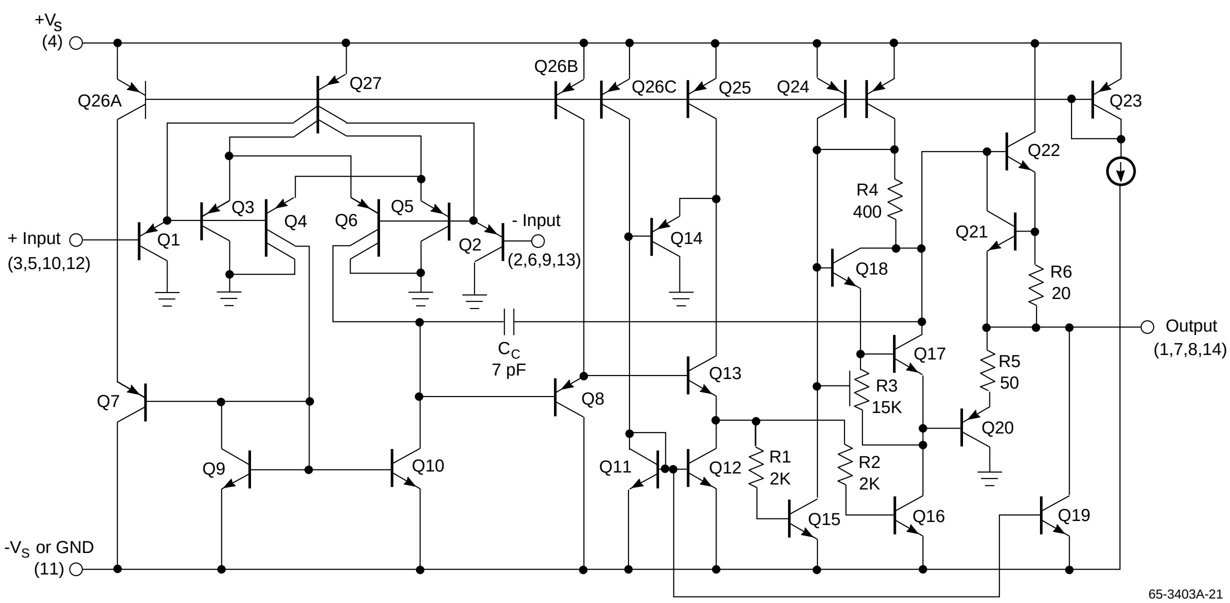
R2 = 1.6 MΩ

R3 = 1.6 MΩ

C = 0.001µF

Figure 18. Bi-Quad Filter

Simplified Schematic Diagram (1/4 Shown)

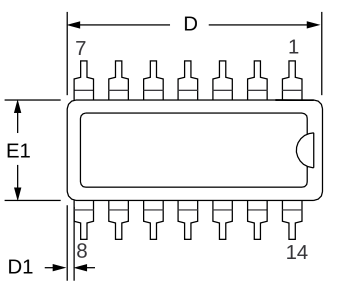


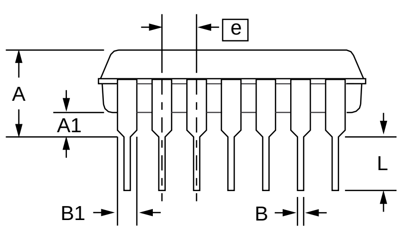
Mechanical Dimensions – 14-Lead Plastic DIP Package

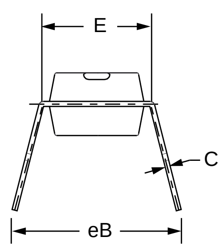
Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	—	.210	—	5.33	
A1	.015	—	.38	—	
A2	.115	.195	2.93	4.95	
B	.014	.022	.36	.56	
B1	.045	.070	1.14	1.78	
C	.008	.015	.20	.38	4
D	.725	.795	18.42	20.19	2
D1	.005	—	.13	—	
E	.300	.325	7.62	8.26	
E1	.240	.280	6.10	7.11	2
e	.100 BSC		2.54 BSC		
eB	—	.430	—	10.92	
L	.115	.200	2.92	5.08	
N	14		14		5

Notes:

1. Dimensioning and tolerancing per ANSI Y14.5M-1982.
2. "D" and "E1" do not include mold flashing. Mold flash or protrusions shall not exceed .010 inch (0.25mm).
3. Terminal numbers are shown for reference only.
4. "C" dimension does not include solder finish thickness.
5. Symbol "N" is the maximum number of terminals.







Ordering Information

Product Number	Temperature Range	Screening	Package	Package Marking
RC3403AN	0° to 70°C	Commercial	14 Pin Plastic DIP	RC3403AN

5/20/98 0.0m 001
Stock#DS30003403A