

# MC3303/MC3403

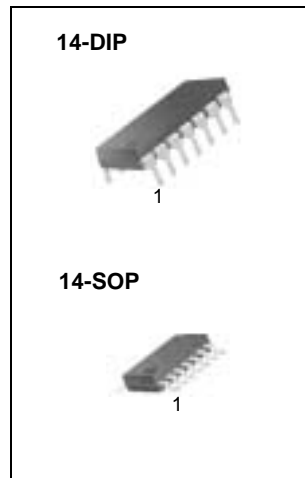
## Quad Operational Amplifier

### Features

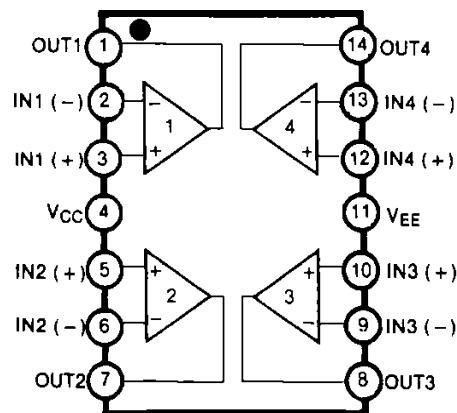
- Output voltage can swing to GND or negative supply
- Wide power supply range;
- Single supply of 3.0V to 36V
- Dual supply of  $\pm 1.5V$  to  $\pm 18V$
- Electrical characteristics similar to the KA741
- Class AB output stage for minimal crossover distortion
- Short circuit protected output.

### Description

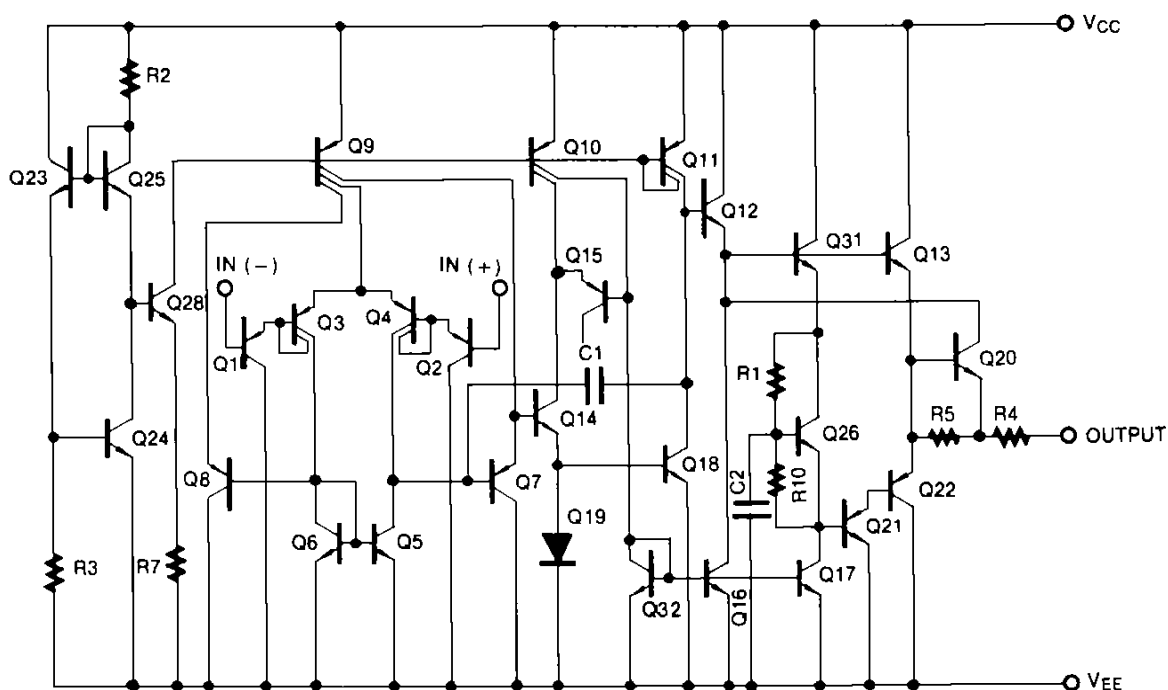
The MC3303/MC3403 series is a monolithic Quad operational amplifier consisting of four independent amplifiers. The device has high gain, internally frequency, compensated operational amplifiers designed to operate from a single power supply or dual power supplies over a wide range of voltages. The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications.



### Internal Block Diagram



## Schematic Diagram



## Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	VCC	±18 or +36	V
Differential Input Voltage	V <sub>I(DIFF)</sub>	36	V
Input Voltage	V <sub>I</sub>	±18	V
Output Short Circuit Duration	-	Continuous	-
Power Dissipation	P <sub>D</sub>	670	mW
Operating Temperature			
MC3303	T <sub>OPR</sub>	-40 ~ + 85	°C
MC3403		0 ~ + 70	°C
Storage Temperature	T <sub>STG</sub>	-65 ~ + 150	°C

## Electrical Characteristics

(VCC = +15V, VEE = -15V for MC3403, VCC = +14V, VEE = GND for MC3303, TA = 25 °C, unless otherwise specified)

Parameter	Symbol	Conditions	MC3303			MC3403			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage	V <sub>IO</sub>		-	1.5	8.0	-	1.5	10	mV
		NOTE 1	-	-	10	-	-	12	
Input Offset Current	I <sub>IO</sub>		-	5	75	-	5	50	nA
		NOTE 1	-	-	150	-	-	100	
Input Bias Current	I <sub>BIAS</sub>		-	30	200	-	30	200	nA
		NOTE 1	-	-	500	-	-	400	
Large Signal Voltage Gain	G <sub>V</sub>	V <sub>O(P-P)</sub> = ±10V R <sub>L</sub> = 2KΩ	20	200	-	20	200	-	V/mV
		NOTE 1	15	-	-	15	-	-	
Input Impedance	R <sub>I</sub>	-	0.3	1.0	-	0.3	1.0	-	MΩ
Output Voltage Swing	V <sub>O(P-P)</sub>	R <sub>L</sub> = 10KΩ	+12	+12.5	-	±12	±13.5	-	V
		R <sub>L</sub> = 2KΩ	+10	+12	-	±10	±13	-	
		R <sub>L</sub> = 2KΩ   NOTE 1	+10	-	-	±10	-	-	
Input Common Mode Voltage Range	V <sub>I(R)</sub>	-	12V - VEE	12.5V - VEE	-	13V - VEE	13.5V - VEE	-	V
Common Mode Rejection Ratio	CMRR	R <sub>S</sub> ≥ 10KΩ	70	90	-	70	90	-	dB
Power Supply Current	I <sub>CC</sub>	V <sub>O(P)</sub> = 0, R <sub>L</sub> = ∞	-	2.8	7.0	-	2.3	7.0	mA
Output Short Circuit Current	I <sub>SC</sub>	Each amplifier	±10	±30	±45	±10	±20	±45	mA
Positive Supply Rejection Ratio	PSRR(+)	-	-	30	150	-	30	150	μV/V
Negative Supply Rejection Ratio	PSRR(-)	-	-	-	-	-	30	150	μV/V

## Electrical Characteristics (Continued)

(VCC = +15V, VEE = -15V for MC3403, VCC = +14V, VEE = GND for MC3303, TA = 25 °C, unless otherwise specified)

Parameter	Symbol	Conditions	MC3303			MC3403			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Average Temperature Coefficient of Input Offset Current (Note2)	$\Delta I_{IO}/\Delta T$	-	-	50	-	-	50	-	pA/°C
Input Offset Voltage Drift (Note2)	$\Delta V_{IO}/\Delta T$	-	-	10	-	-	10	-	$\mu V/^\circ C$
Power Bandwidth (Note2)	GBW	GV=1,RL=2K $\Omega$ , VO(P-P)=20VP-P, THD=5%	-	9.0	-	-	9.0	-	KHz
Small Signal Bandwidth (Note2)	BW	GV=1,RL=10K $\Omega$ , VO(P-P)=50mV	-	1.0	-	-	1.0	-	MHz
Slew Rate (Note2)	SR	GV=1,VI= -10V to +10V	-	0.4	-	-	0.4	-	V/ $\mu s$
Rise Time (Note2)	TR	GV=1,RL=10K $\Omega$ , VO(P-P)=50mV	-	0.35	-	-	0.35	-	$\mu s$
Fall Time (Note2)	TF	GV=1,RL=10K $\Omega$ , VO(P-P)=50mV	-	0.35	-	-	0.35	-	$\mu s$
Over Shoot (Note2)	OS	GV=1,RL=10K $\Omega$ , VO(P-P)=50mV	-	20	-	-	20	-	%
Phase Margin (Note2)	MPH	GV=1,RL=2K $\Omega$ , CL =200pF	-	60	-	-	60	-	De- gree
Crossover Distortion (Note2)	CD	VI =30mVP-P, VO(P-P)=2.0VP-P, f =10KHz	-	1.0	-	-	1.0	-	%

### Note:

1. MC3403: 0 °C ≤ TA ≤ +70 °C , MC3303: -40 °C ≤ TA ≤ +85 °C
2. Guaranteed by design.

## Electrical Characteristics

( $V_{CC} = 5.0V$ ,  $V_{EE} = GND$ ,  $T_A = 25^\circ C$  unless otherwise specified)

Parameter	Symbol	Conditions	MC3303			MC3403			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage	$V_{IO}$	-	-	-	10	-	2.0	10	mV
Input Offset Current	$I_{IO}$	-	-	-	75	-	30	50	nA
Input Bias Current	$I_{BIAS}$	-	-	-	500	-	200	500	nA
Large Signal Open Loop Voltage Gain	$G_V$	$R_L = 2.0K\Omega$	10	200	-	10	200	-	V/mV
Power Supply Rejection Ratio	PSRR	-	-	-	150	-	-	150	$\mu V/V$
Output Voltage Range	$V_{O(P-P)}$	$R_L = 10K\Omega$ , $V_{CC} = 5.0V$	3.3	3.5	-	3.3	3.5	-	V
		$R_L = 10K\Omega$ , $5.0V \leq V_{CC} \leq 30V$	$V_{CC} - 2.0$	$V_{CC} - 1.7$	-	$V_{CC} - 2.0$	$V_{CC} - 1.7$	-	
Supply Current	$I_{CC}$	-	-	2.5	7.0	-	2.5	7.0	mA
Channel Separation	CS	$f = 1KHz$ to $20KHz$	-	120	-	-	120	-	dB

# Typical Performance Characteristics

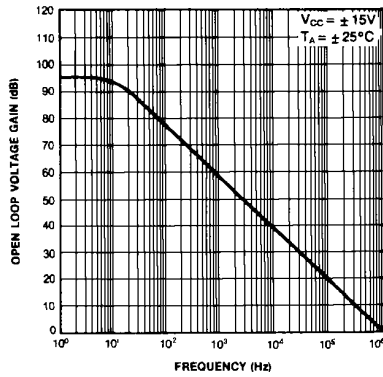


Figure 1. Open Loop Frequency Response

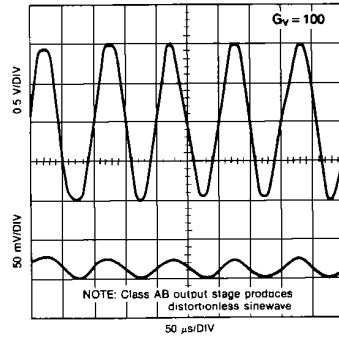


Figure 2. Wave Response

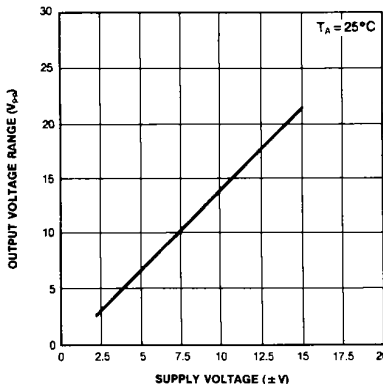


Figure 3. Output Swing

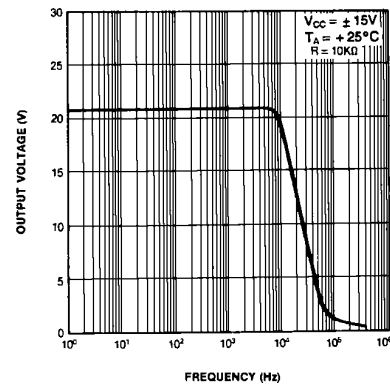


Figure 4. Output Voltage vs Frequency

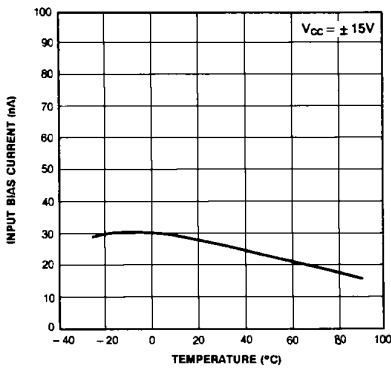


Figure 5. Input Bias Current vs Temperature

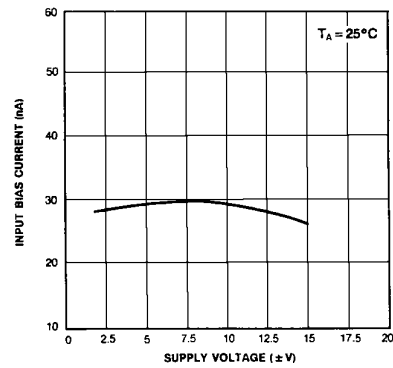


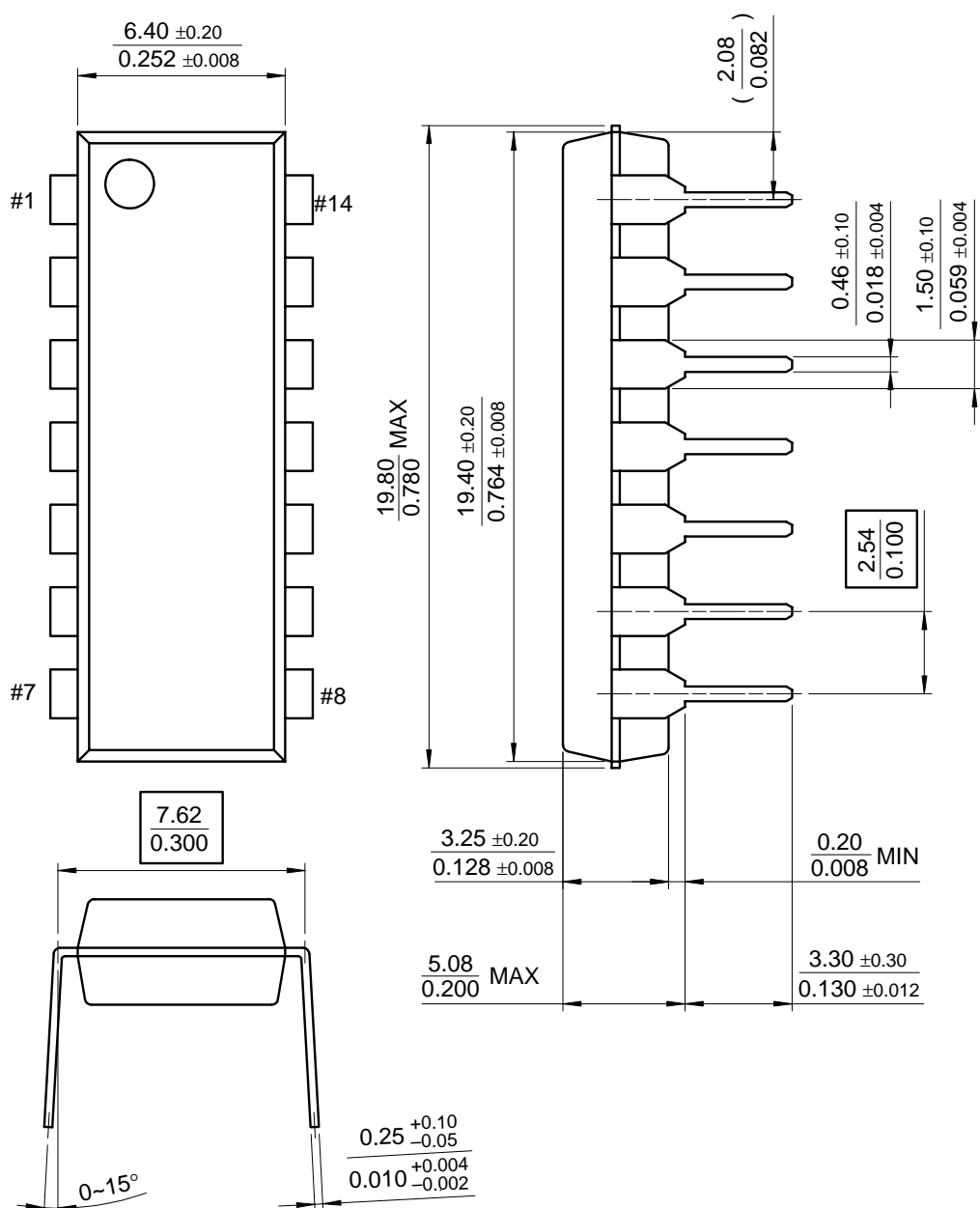
Figure 6. Input Bias Current vs Supply Voltage

# Mechanical Dimensions

## Package

Dimensions in millimeters

### 14-DIP

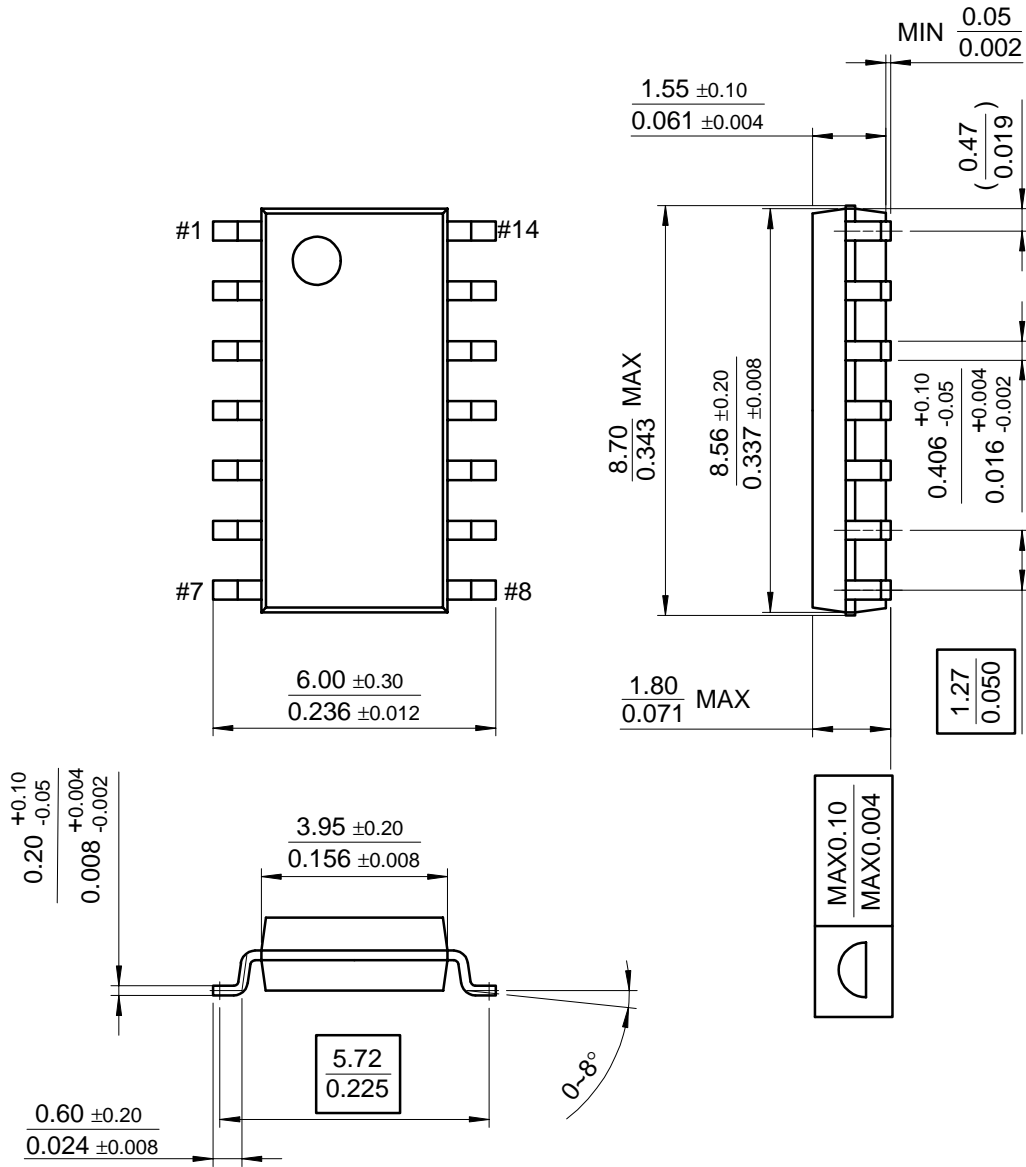


# Mechanical Dimensions (Continued)

Package

Dimensions in millimeters

## 14-SOP





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## Ordering Information

Product Number	Package	Operating Temperature
MC3403P	14-DIP	0 ~ + 70°C
MC3403D	14-SOP	
MC3303P	14-DIP	-40 ~ + 85°C
MC3303D	14-SOP	

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