MC3403, MC3303

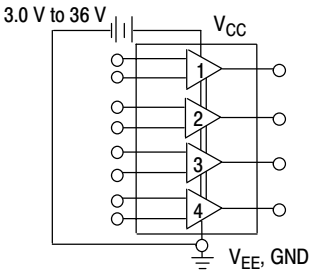
Single Supply Quad Operational Amplifiers

The MC3403 is a low cost, quad operational amplifier with true differential inputs. The device has electrical characteristics similar to the popular MC1741C. However, the MC3403 has several distinct advantages over standard operational amplifier types in single supply applications. The quad amplifier can operate at supply voltages as low as 3.0 V or as high as 36 V with quiescent currents about one third of those associated with the MC1741C (on a per amplifier basis). The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications. The output voltage range also includes the negative power supply voltage.

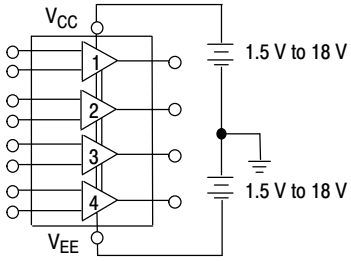
Features

- Short Circuit Protected Outputs
- Class AB Output Stage for Minimal Crossover Distortion
- True Differential Input Stage
- Single Supply Operation: 3.0 V to 36 V
- Split Supply Operation: ±1.5 V to ±18 V
- Low Input Bias Currents: 500 nA Max
- Four Amplifiers Per Package
- Internally Compensated
- Similar Performance to Popular MC1741C
- Industry Standard Pin−outs
- ESD Diodes Added for Increased Ruggedness
- Pb−Free Packages are Available

Single Supply



Split Supplies



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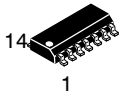
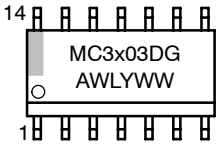
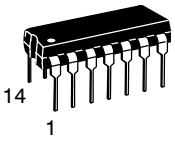
MARKING DIAGRAMS

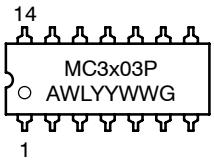


SOIC−14
D SUFFIX
CASE 751A



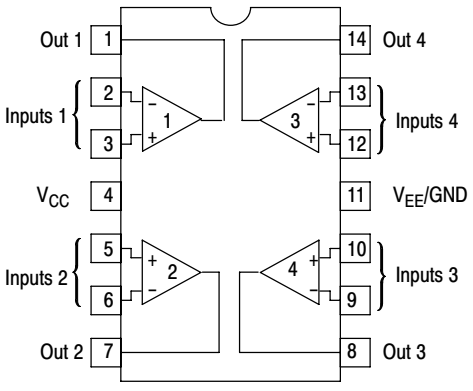


PDIP−14
P SUFFIX
CASE 646



x = 3 or 4
A = Assembly Location
WL = Wafer Lot
YY, Y = Year
WW = Work Week
G = Pb−Free Package

PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

Publication Order Number:
MC3403/D

ORDERING INFORMATION

Device	Package	Shipping†
MC3303D	SOIC−14	55 Units / Rail
MC3303DG	SOIC−14 (Pb−Free)	
MC3303DR2	SOIC−14	2500 Tape & Reel
MC3303DR2G	SOIC−14 (Pb−Free)	
MC3303P	PDIP−14	25 Units / Rail
MC3303PG	PDIP−14 (Pb−Free)	
MC3403D	SOIC−14	55 Units / Rail
MC3403DG	SOIC−14 (Pb−Free)	
MC3403DR2	SOIC−14	2500 Tape & Reel
MC3403DR2G	SOIC−14 (Pb−Free)	
MC3403P	PDIP−14	25 Units / Rail
MC3403PG	PDIP−14 (Pb−Free)	

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Voltages Single Supply Split Supplies	 V_{CC} V_{CC}, V_{EE}	 36 ±18	Vdc
Input Differential Voltage Range (Note 1)	V_{IDR}	±36	Vdc
Input Common Mode Voltage Range (Notes 1 and 2)	V_{ICR}	±18	Vdc
Storage Temperature Range	T_{stg}	−55 to +125	°C
Operating Ambient Temperature Range MC3303 MC3403	T_A	 −40 to +85 0 to +70	°C
Junction Temperature	T_J	150	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Split power supplies.
2. For supply voltages less than ±18 V, the absolute maximum input voltage is equal to the supply voltage.

ELECTRICAL CHARACTERISTICS

(V_{CC} = +15 V, V_{EE} = −15 V for MC3403; V_{CC} = +14 V, V_{EE} = GND for MC3303 T_A = 25°C, unless otherwise noted.)

Characteristic	Symbol	MC3403			MC3303			Unit
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage $T_A = T_{high}$ to T_{low} (Note 3)	V_{IO}	– –	2.0 –	10 12	– –	2.0 –	8.0 10	mV
Input Offset Current $T_A = T_{high}$ to T_{low}	I_{IO}	– –	30 –	50 200	– –	30 –	75 250	nA
Large Signal Open Loop Voltage Gain V_O = ±10 V, R_L = 2.0 kΩ $T_A = T_{high}$ to T_{low}	A_{VOL}	 20 15	 200 –	 – –	 20 15	 200 –	 – –	V/mV
Input Bias Current $T_A = T_{high}$ to T_{low}	I_{IB}	– –	−200 –	−500 −800	– –	−200 –	−500 −1000	nA
Output Impedance f = 20 Hz	z_o	–	75	–	–	75	–	Ω
Input Impedance f = 20 Hz	z_i	0.3	1.0	–	0.3	1.0	–	MΩ
Output Voltage Range R_L = 10 kΩ R_L = 2.0 kΩ R_L = 2.0 kΩ, T_A = T_{high} to T_{low}	V_O	 ±12 ±10 ±10	 ±13.5 ±13 –	 – – –	 12 10 10	 12.5 12 –	 – – –	V
Input Common Mode Voltage Range	V_{ICR}	+13 V $-V_{EE}$	+13 V $-V_{EE}$	–	+12 V $-V_{EE}$	+12.5 V $-V_{EE}$	–	V
Common Mode Rejection $R_S \leq$ 10 kΩ	CMR	70	90	–	70	90	–	dB
Power Supply Current (V_O = 0) R_L = ∞	I_{CC}, I_{EE}	–	2.8	7.0	–	2.8	7.0	mA
Individual Output Short−Circuit Current (Note 4)	I_{SC}	±10	±20	±45	±10	±30	±45	mA
Positive Power Supply Rejection Ratio	PSRR+	–	30	150	–	30	150	μV/V
Negative Power Supply Rejection Ratio	PSRR−	–	30	150	–	30	150	μV/V
Average Temperature Coefficient of Input Offset Current T_A = T_{high} to T_{low}	$\Delta I_{IO}/\Delta T$	–	50	–	–	50	–	pA/°C
Average Temperature Coefficient of Input Offset Voltage T_A = T_{high} to T_{low}	$\Delta V_{IO}/\Delta T$	–	10	–	–	10	–	μV/°C
Power Bandwidth A_V = 1, R_L = 10 kΩ, V_O = 20 V(p−p), THD = 5%	BWp	–	9.0	–	–	9.0	–	kHz
Small−Signal Bandwidth A_V = 1, R_L = 10 kΩ, V_O = 50 mV	BW	–	1.0	–	–	1.0	–	MHz
Slew Rate A_V = 1, V_i = −10 V to +10 V	SR	–	0.6	–	–	0.6	–	V/μs
Rise Time A_V = 1, R_L = 10 kΩ, V_O = 50 mV	t_{TLH}	–	0.35	–	–	0.35	–	μs
Fall Time A_V = 1, R_L = 10 kΩ, V_O = 50 mV	t_{TLH}	–	0.35	–	–	0.35	–	μs
Overshoot A_V = 1, R_L = 10 kΩ, V_O = 50 mV	os	–	20	–	–	20	–	%
Phase Margin A_V = 1, R_L = 2.0 kΩ, V_O = 200 pF	ϕm	–	60	–	–	60	–	°
Crossover Distortion (V_{in} = 30 mVpp, V_{out} = 2.0 Vpp, f = 10 kHz)	–	–	1.0	–	–	1.0	–	%

3. MC3303: T_{low} = −40°C, T_{high} = +85°C, MC3403: T_{low} = 0°C, T_{high} = +70°C
4. Not to exceed maximum package power dissipation.

ELECTRICAL CHARACTERISTICS (V_{CC} = 5.0 V, V_{EE} = GND, T_A = 25°C, unless otherwise noted.)

Characteristic	Symbol	MC3403			MC3303			Unit
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	V_{IO}	–	2.0	10	–	–	10	mV
Input Offset Current	I_{IO}	–	30	50	–	–	75	nA
Input Bias Current	I_{IB}	–	−200	−500	–	–	−500	nA
Large Signal Open Loop Voltage Gain R_L = 2.0 kΩ	A_{VOL}	10	200	–	10	200	–	V/mV
Power Supply Rejection Ratio	PSRR	–	–	150	–	–	150	μV/V
Output Voltage Range (Note 5) R_L = 10 kΩ, V_{CC} = 5.0 V R_L = 10 kΩ, 5.0 ≤ V_{CC} ≤ 30 V	V_{OR}	 3.3 V_{CC}–2.0	 3.5 V_{CC}–1.7	 – –	 3.3 V_{CC}–2.0	 3.5 V_{CC}–1.7	 – –	V_{pp}
Power Supply Current	I_{CC}	–	2.5	7.0	–	2.5	7.0	mA
Channel Separation f = 1.0 kHz to 20 kHz (Input Referenced)	CS	–	−120	–	–	−120	–	dB

5. Output will swing to ground with a 10 kΩ pull down resistor.

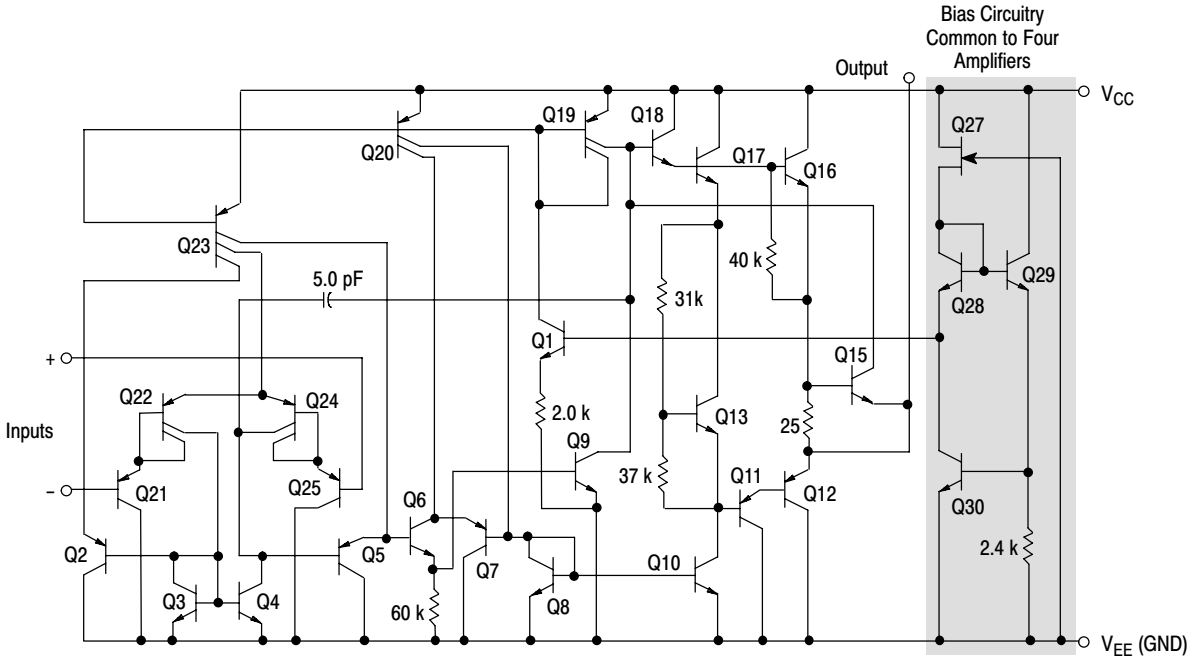
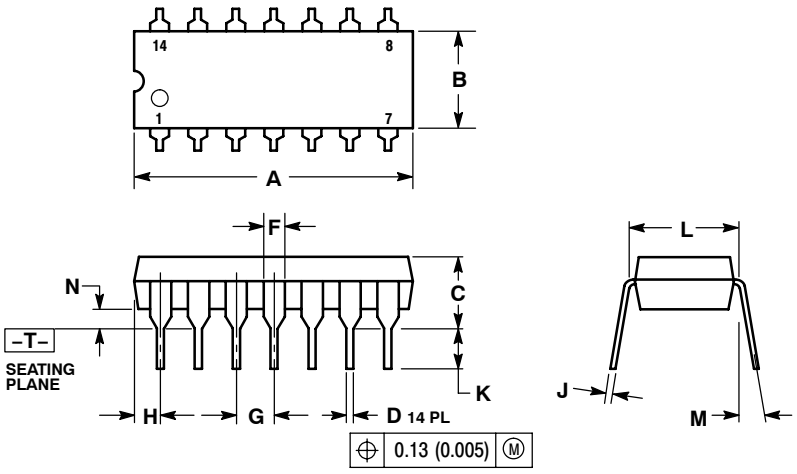


Figure 1. Representative Schematic Diagram
(1/4 of Circuit Shown)

PACKAGE DIMENSIONS

PDIP−14
CASE 646−06
ISSUE P



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	19.56
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