

**MCCF3503**  
**MCCF3403**  
**MCCF3303**

**QUAD LOW POWER OPERATIONAL AMPLIFIER  
 FLIP-CHIPS**

... low-cost, quad operational amplifiers, with true differential inputs. This amplifier can operate at supply voltages as low as 3.0 Volts or as high as 36 Volts with quiescent currents about one-third of those associated with the MCCF1741 (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.

- Short Circuit Protected Outputs
- Class AB Output Stage for Minimal Crossover Distortion
- Split Supply Operation:  $\pm 1.5$  to  $\pm 18$  Volts
- Low Input Bias Currents: 500 nA Max
- Internally Compensated

**MAXIMUM RATINGS**

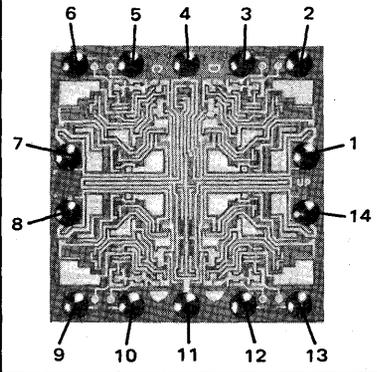
Rating	Symbol	Value	Unit
Power Supply Voltages			Vdc
Single Supply	$V_{CC}$	36	
Split Supplies	$V_{CC}$ $V_{EE}$	+18 -18	
Input Differential Voltage Range (1)	$V_{IDR}$	$\pm 30$	Vdc
Input Common Mode Voltage Range (1) (2)	$V_{ICR}$	$\pm 15$	Vdc
Storage Temperature Range	$T_{stg}$		$^{\circ}C$
Ceramic Package		-65 to +150	
Plastic Package		-55 to +125	
Operating Ambient Temperature Range	$T_A$		$^{\circ}C$
MCCF3503		-55 to +125	
MCCF3403		0 to +70	
MCCF3303		-40 to +85	

(1) Split Power Supplies.

(2) For Supply Voltages less than  $\pm 15$  V, the absolute maximum input voltage is equal to the supply voltage.

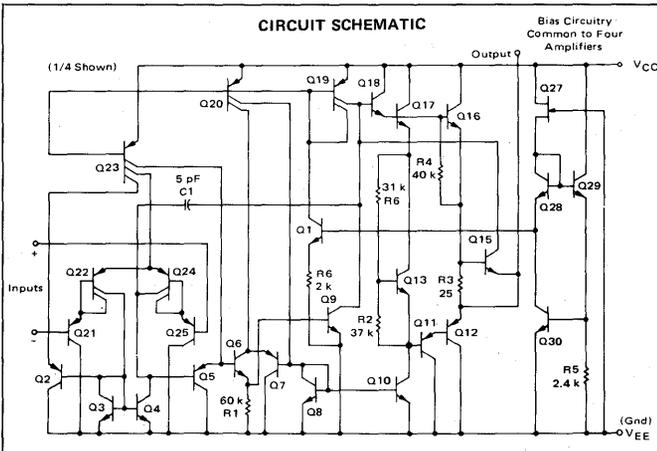
**QUAD DIFFERENTIAL  
 INPUT  
 OPERATIONAL AMPLIFIERS**

**SILICON MONOLITHIC  
 INTEGRATED CIRCUIT**

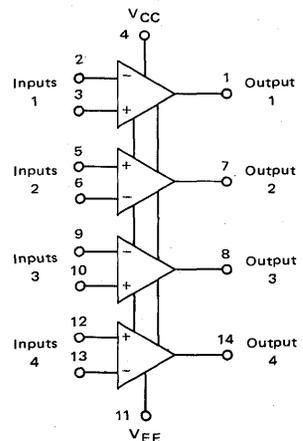


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**CIRCUIT SCHEMATIC**



**EQUIVALENT CIRCUIT**



# MCCF3503, MCCF3403, MCCF3303 (continued)

## ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = +15 V, V<sub>EE</sub> = -15 V, T<sub>A</sub> = 25°C unless otherwise noted.)

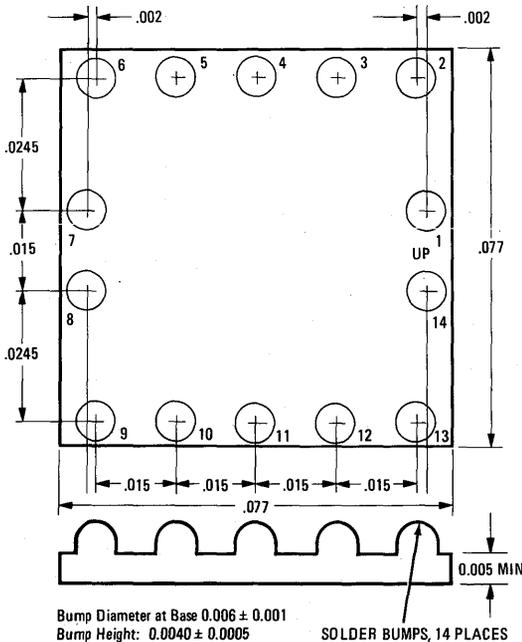
Characteristic	Symbol	MCCF3503			MCCF3403			MCCF3303			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	V <sub>IO</sub>	—	2.0	5.0	—	2.0	10	—	2.0	8.0	mV
Input Offset Current	I <sub>IO</sub>	—	30	50	—	30	50	—	30	75	nA
Large Signal Open-Loop Voltage Gain V <sub>O</sub> = ±10 V, R <sub>L</sub> = 2.0 kΩ, T <sub>A</sub> = High to T <sub>Low</sub>	A <sub>VOL</sub>	50 25	200 300	—	20 15	200 —	—	20 15	200 —	—	V/mV
Input Bias Current	I <sub>IB</sub>	—	-200	-500	—	-200	-500	—	-200	-500	nA
Output Voltage Range R <sub>L</sub> = 10 kΩ R <sub>L</sub> = 2.0 kΩ	V <sub>OR</sub>	±12 ±10	±13.5 ±13	—	±12 ±10	±13.5 ±13	—	±12 ±10	±12.5 ±12	—	V
Common-Mode Rejection Ratio R <sub>S</sub> ≤ 10 kΩ	CMRR	70	90	—	70	90	—	70	90	—	dB
Power Supply Current (V <sub>O</sub> = 0) R <sub>L</sub> = ∞	I <sub>CC</sub> , I <sub>EE</sub>	—	2.8	4.0	—	2.8	7.0	—	2.8	7.0	mA
Individual Output Short-Circuit Current (2)	I <sub>OS±</sub>	±10	±30	±45	±10	±20	±45	±10	±30	±45	mA
Positive Power Supply Rejection Ratio	PSRR+	—	30	150	—	30	150	—	30	150	μV/V
Negative Power Supply Rejection Ratio	PSRR-	—	30	150	—	30	150	—	30	150	μV/V
Average Temperature Coefficient of Input	∂I <sub>IO</sub> /∂T	—	50	—	—	50	—	—	50	—	pA/°C

## ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 5.0 V, V<sub>EE</sub> = Gnd, T<sub>A</sub> = 25°C unless otherwise noted.)

Characteristic	Symbol	MCCF3503			MCCF3403			MCCF3303			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	V <sub>IO</sub>	—	2.0	5.0	—	2.0	10	—	—	10	mV
Input Offset Current	I <sub>IO</sub>	—	30	50	—	30	50	—	—	75	nA
Input Bias Current	I <sub>IB</sub>	—	-200	-500	—	-200	-500	—	—	-500	nA
Large-Signal Open-Loop Voltage Gain R <sub>L</sub> = 2.0 kΩ	A <sub>VOL</sub>	20	200	—	20	200	—	20	200	—	V/mV
Power Supply Rejection Ratio	PSRR	—	—	150	—	—	150	—	—	150	μV/V
Output Voltage Range (3) R <sub>L</sub> = 10 kΩ, V <sub>CC</sub> = 5.0 V R <sub>L</sub> = 10 kΩ, 5.0 V < V <sub>CC</sub> < 30 V	V <sub>OR</sub>	3.3 V <sub>CC</sub> -1.7	3.5 V <sub>CC</sub> -1.5	—	3.3 V <sub>CC</sub> -1.7	3.5 V <sub>CC</sub> -1.5	—	3.3 V <sub>CC</sub> -1.7	3.5 V <sub>CC</sub> -1.5	—	V <sub>pp</sub>
Power Supply Current	I <sub>CC</sub>	—	2.5	4.0	—	2.5	7.0	—	2.5	7.0	mA
Channel Separation f = 1.0 kHz to 20 kHz (Input Referenced)	—	—	-120	—	—	-120	—	—	-120	—	dB

(1) Output will swing to ground

## MCCF3503/MCCF3403/MCCF3303 BONDING DIAGRAM AND DEVICE DIMENSIONS



## PACKAGING AND HANDLING

The popular 3503 type quad operational amplifier is now available in two chip forms: 1) conventional chips, and 2) flip-chips, as well as in a variety of plastic and hermetic packages. The flip-chip consists of a silicon chip with solder bumps (90-10 solder on a chrome-copper-gold base) on the geometry surface to provide easy mechanical mounting and electrical connection. These devices are protected by a thin layer of phosphosilicate passivation which covers the interconnect metallization and active areas of the die.

Care must be exercised when removing the dice from the shipping carrier to avoid scratching the solder bumps. A vacuum pickup is useful for the handling of dice. Tweezers are not recommended for this purpose.

The non-spill type shipping carrier consists of a compartmentalized tray and fitted cover. Die are placed in the carrier with geometry side up.