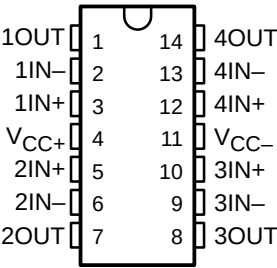


MC3303, MC3403
QUADRUPLE LOW-POWER OPERATIONAL AMPLIFIERS

SLOS101C – FEBRUARY 1979 – REVISED FEBRUARY 2002

- Wide Range of Supply Voltages, Single Supply . . . 3 V to 36 V or Dual Supplies
- Class AB Output Stage
- True Differential Input Stage
- Low Input Bias Current
- Internal Frequency Compensation
- Short-Circuit Protection
- Designed to Be Interchangeable With Motorola MC3303, MC3403

MC3303 . . . D, N, OR PW PACKAGE
MC3403 . . . D, DB, N, NS, OR PW PACKAGE
(TOP VIEW)



description

The MC3303 and the MC3403 are quadruple operational amplifiers similar in performance to the μ A741, but with several distinct advantages. They are designed to operate from a single supply over a range of voltages from 3 V to 36 V. Operation from split supplies also is possible, provided the difference between the two supplies is 3 V to 36 V. The common-mode input range includes the negative supply. Output range is from the negative supply to $V_{CC} - 1.5$ V. Quiescent supply currents are less than one-half those of the μ A741.

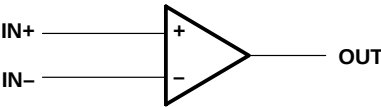
The MC3303 is characterized for operation from -40°C to 85°C , and the MC3403 is characterized for operation from 0°C to 70°C .

AVAILABLE OPTIONS

T_A	$V_{IO\text{MAX}}$ AT 25°C	PACKAGE			
		PLASTIC SMALL OUTLINE (D, NS)	PLASTIC SHRINK SMALL OUTLINE (DB)	PLASTIC DIP (N)	PLASTIC THIN SHRINK SMALL OUTLINE (PW)
0°C to 70°C	10 mV	MC3403D MC3403NS	MC3403DB	MC3403N	MC3403PW
-40°C to 85°C	8 mV	MC3303D	—	MC3303N	MC3303PW

The D package is available taped and reeled. Add R suffix to the device type (e.g., MC3403DR). The DB, NS, and PW packages are only available taped and reeled.

logic diagram (each amplifier)



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



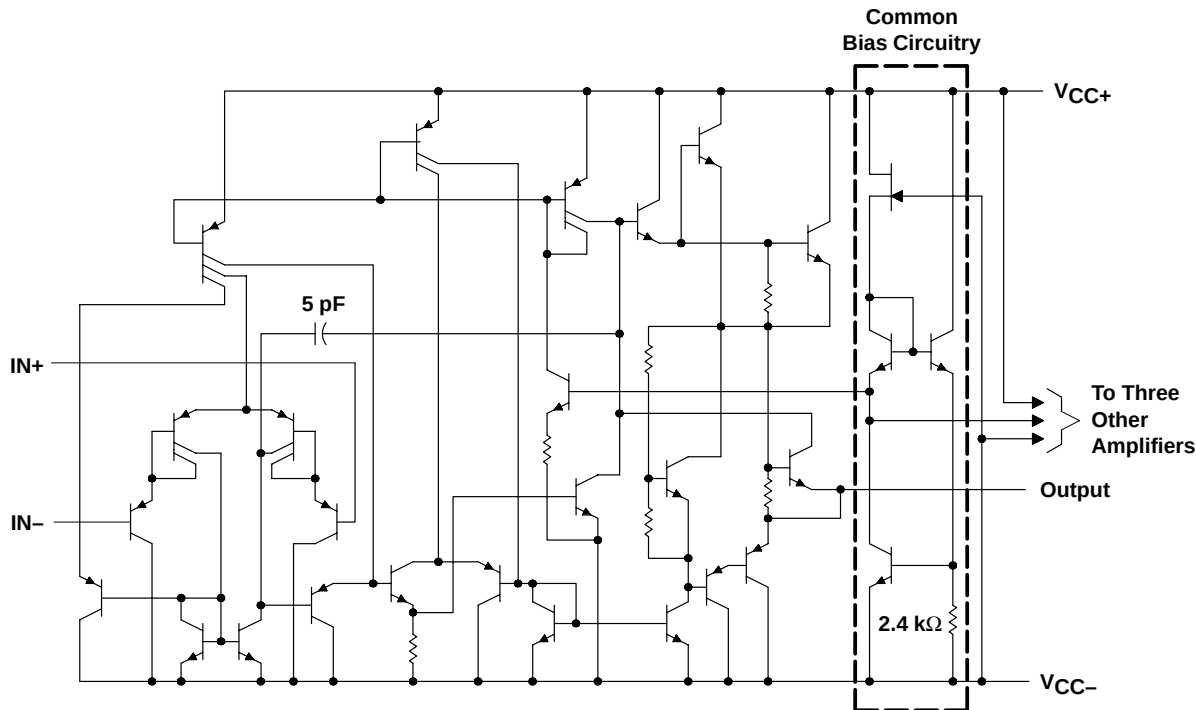
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2002, Texas Instruments Incorporated

MC3303, MC3403
QUADRUPLE LOW-POWER OPERATIONAL AMPLIFIERS

SLOS101C – FEBRUARY 1979 – REVISED FEBRUARY 2002

schematic (each amplifier)



Component values shown are nominal.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage (see Note 1): V_{CC+}	18 V
V_{CC-}	-18 V
Supply voltage, V_{CC+} with respect to V_{CC-}	36 V
Differential input voltage (see Note 2)	±36 V
Input voltage (see Notes 1 and 3)	±18 V
Package thermal impedance, θ_{JA} (see Note 4): D package	86°C/W
DB package	96°C/W
N package	80°C/W
NS package	76°C/W
PW package	113°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, T_{stg}	-65°C to 150°C

[†] Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. These voltage values are with respect to the midpoint between V_{CC+} and V_{CC-} .
 2. Differential voltages are at IN+ with respect to IN-.
 3. Neither input must ever be more positive than V_{CC+} or more negative than V_{CC-} .
 4. The package thermal impedance is calculated in accordance with JESD 51-7.

MC3303, MC3403

QUADRUPLE LOW-POWER OPERATIONAL AMPLIFIERS

SLOS101C – FEBRUARY 1979 – REVISED FEBRUARY 2002

recommended operating conditions

				MIN	MAX	UNIT
V _{CC}	Supply voltage			5	30	V
Dual-supply voltage		V _{CC+}		2.5	15	V
		V _{CC–}		–2.5	–15	V
T _A	Operating free-air temperature	MC3303		–40	85	°C
		MC3403		0	70	

electrical characteristics at specified free-air temperature, V_{CC+} = 14 V, V_{CC–} = 0 V for MC3303, V_{CC±} = ±15 V for MC3403 (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		MC3303			MC3403			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	See Note 5	25°C	2	8	2	10	mV		
			Full range	10			12			
α _{V_{IO}}	Temperature coefficient of input offset voltage	See Note 5	Full range	10		10		μV/°C		
I _{IO}	Input offset current	See Note 5	25°C	30	75	30	50	nA		
			Full range	250			200			
α _{I_{IO}}	Temperature coefficient of input offset current	See Note 5	Full range	50		50		pA/C		
I _{IB}	Input bias current	See Note 5	25°C	−0.2	−0.5	−0.2	−0.5	μA		
			Full range	−1			−0.8			
V _{ICR}	Common-mode input voltage range‡		25°C	V _{CC−} to 12	V _{CC−} to 12.5	V _{CC−} to 13	V _{CC−} to 13.5	V		
V _{OM}	Peak output voltage swing	R _L = 10 kΩ	25°C	12	12.5	±12	±13.5	V		
		R _L = 2 kΩ	25°C	10	12	±10	±13			
		R _L = 2 kΩ	Full range	10		±10				
A _{VD}	Large-signal differential voltage amplification	V _O = ±10 V, R _L = 2 kΩ	25°C	20	200	20	200	V/mV		
			Full range	15		15				
B _{OM}	Maximum-output-swing bandwidth	V _{OPP} = 20 V, A _{VD} = 1, THD ≤ 5%, R _L = 2 kΩ	25°C	9		9		kHz		
B ₁	Unity-gain bandwidth	V _O = 50 mV, R _L = 10 kΩ	25°C	1		1		MHz		
φ _m	Phase margin	C _L = 200 pF, R _L = 2 kΩ	25°C	60°		60°				
r _i	Input resistance	f = 20 Hz	25°C	0.3	1	0.3	1	MΩ		
r _o	Output resistance	f = 20 Hz	25°C	75		75		Ω		
CMRR	Common-mode rejection ratio	V _{IC} = V _{ICR} min	25°C	70	90	70	90	dB		
k _{SVS}	Supply voltage sensitivity (ΔV _{IO} /ΔV _{CC})	V _{CC±} = ±2.5 to ±15 V	25°C	30	150	30	150	μV/V		
I _{OS}	Short-circuit output current§		25°C	±10	±30	±45	±10	±30	±45	mA
I _{CC}	Total supply current	No load, See Note 5	25°C	2.8	7	2.8	7	mA		

† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified. Full range for T_A is –40°C to 85°C for MC3303, and 0°C to 70°C for MC3403.

‡ The V_{ICR} limits are linked directly, volt-for-volt, to supply voltage; the positive limit is 2 V less than V_{CC+}.

§ Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

NOTE 5: V_{IO}, I_{IO}, I_{IB}, and I_{CC} are defined at V_O = 0 for MC3403 and V_O = 7 V for MC3303.



MC3303, MC3403

QUADRUPLE LOW-POWER OPERATIONAL AMPLIFIERS

SLOS101C – FEBRUARY 1979 – REVISED FEBRUARY 2002

electrical characteristics, $V_{CC+} = 5\text{ V}$, $V_{CC-} = 0\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS†	MC3303			MC3403			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage	V _O = 2.5 V	10			2 10			mV
I _{IO}	Input offset current	V _O = 2.5 V	75			30 50			nA
I _{IB}	Input bias current	V _O = 2.5 V	−0.5			−0.2 −0.5			μA
V _{OM}	Peak output voltage swing‡	R _L = 10 kΩ	3.3	3.5		3.3	3.5		V
		R _L = 10 kΩ, V _{CC+} = 5 V to 30 V	V _{CC+} − 1.7			V _{CC+} − 1.7			
A _{VD}	Large-signal differential voltage amplification	V _O = 1.7 V to 3.3 V, R _L = 2 kΩ	20	200		20	200		V/mV
k _{SVS}	Supply-voltage sensitivity (ΔV _{IO} /ΔV _{CC±})	V _{CC±} = ±2.5 V to ±15 V	150			150			μV/V
I _{CC}	Supply current	V _O = 2.5 V, No load	2.5 7			2.5 7			mA
V _{O1} /V _{O2}	Crosstalk attenuation	f = 1 kHz to 20 kHz	120			120			dB

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified.

‡ Output will swing essentially to ground.

operating characteristics, $V_{CC+} = 14\text{ V}$, $V_{CC-} = 0\text{ V}$ for MC3303, $V_{CC\pm} = \pm 15\text{ V}$ for MC3403, $T_A = 25^\circ\text{C}$, $A_{VD} = 1$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS				TYP	UNIT
SR Slew rate at unity gain	$V_I = \pm 10\text{ V}$,	$C_L = 100\text{ pF}$,	$R_L = 2\text{ k}\Omega$,	See Figure 1	0.6	V/ μs
t_r Rise time	$\Delta V_O = 50\text{ mV}$,	$C_L = 100\text{ pF}$,	$R_L = 10\text{ k}\Omega$,	See Figure 1	0.35	μs
t_f Fall time	$\Delta V_O = 50\text{ mV}$,	$C_L = 100\text{ pF}$,	$R_L = 10\text{ k}\Omega$,	See Figure 1	0.35	μs
Overshoot factor	$\Delta V_O = 50\text{ mV}$,	$C_L = 100\text{ pF}$,	$R_L = 10\text{ k}\Omega$,	See Figure 1	20	%
Crossover distortion	$V_{I(PP)} = 30\text{ mV}$,	$V_{OPP} = 2\text{ V}$,	$f = 10\text{ kHz}$		1	%

PARAMETER MEASUREMENT INFORMATION

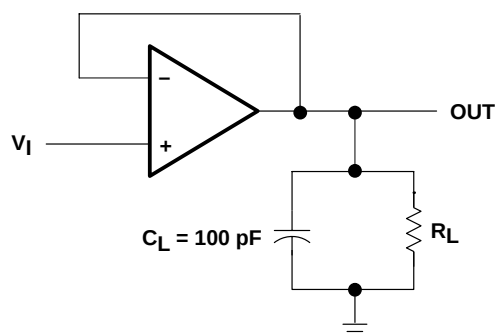


Figure 1. Unity-Gain Amplifier

MC3303, MC3403 QUADRUPLE LOW-POWER OPERATIONAL AMPLIFIERS

SLOS101C – FEBRUARY 1979 – REVISED FEBRUARY 2002

TYPICAL CHARACTERISTICS†

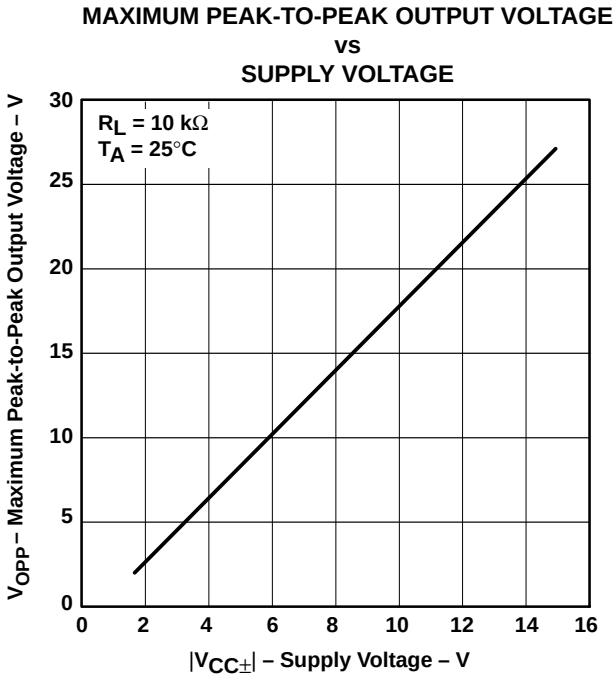


Figure 2

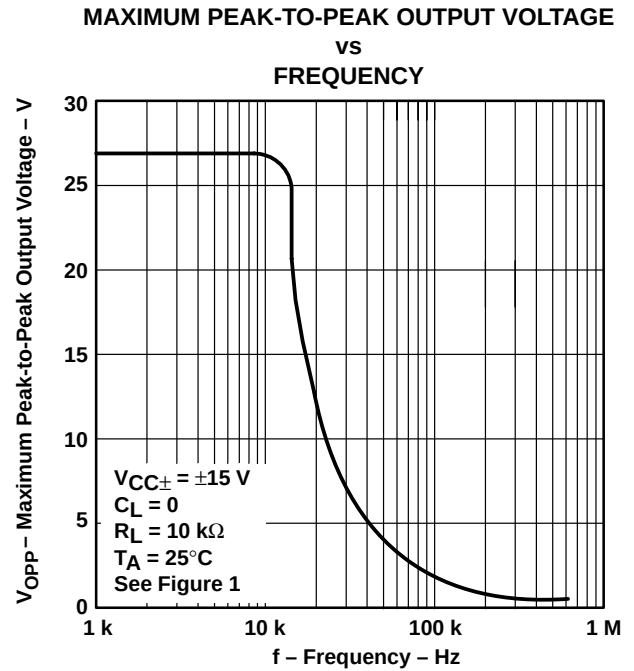


Figure 3

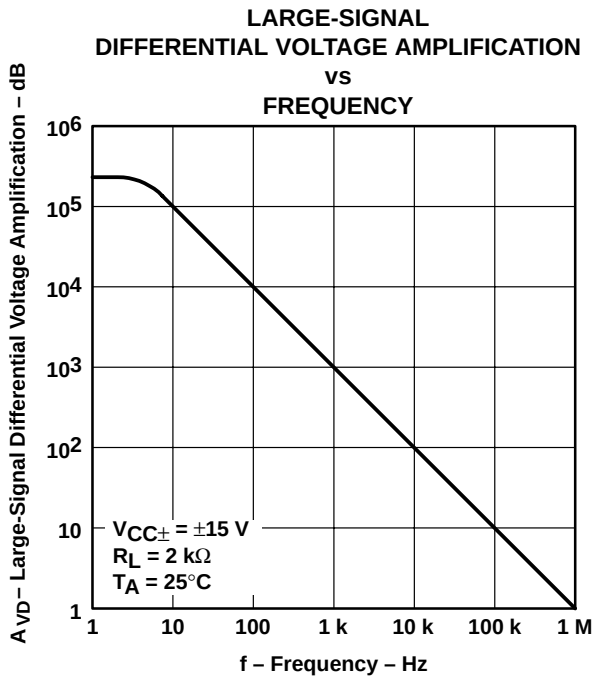


Figure 4

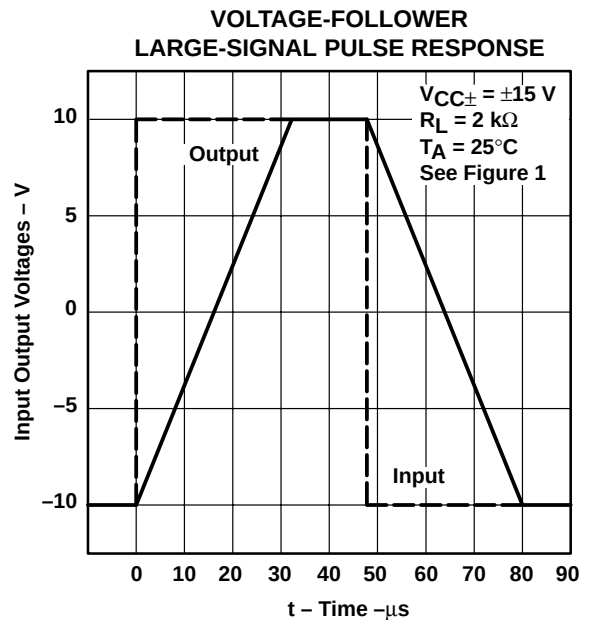


Figure 5

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

MC3303, MC3403
QUADRUPLE LOW-POWER OPERATIONAL AMPLIFIERS

SLOS101C – FEBRUARY 1979 – REVISED FEBRUARY 2002

TYPICAL CHARACTERISTICS†

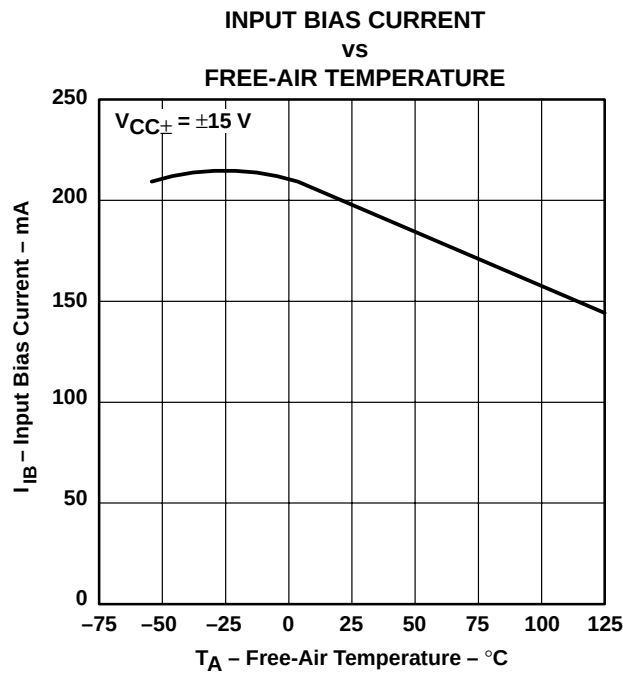


Figure 6

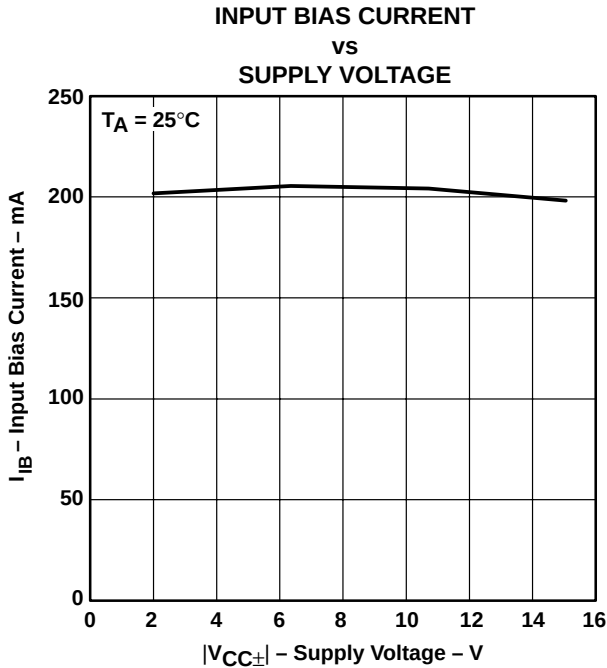


Figure 7

† Operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265