Signetics

MC3303/3403/3503
Quad Low Power Operational Amplifiers

Product Specification

Linear Products

DESCRIPTION

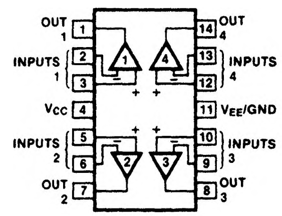
The MC3403 is a quad operational amplifier with true differential inputs. The device has electrical characteristics similar to the popular μA741. However, the MC3403 has several distinct advantages over standard operational amplifier types in single supply applications. The MC3403 can operate at supply voltages as low as 3.0V or as high as 32V. 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 to 32V**
- **Split supply operation: ± 1.5 to ± 16V**
- **Low input bias currents: 500nA max**
- **Four amplifiers per package**
- **Internally compensated**

PIN CONFIGURATION

D, F, N, Packages



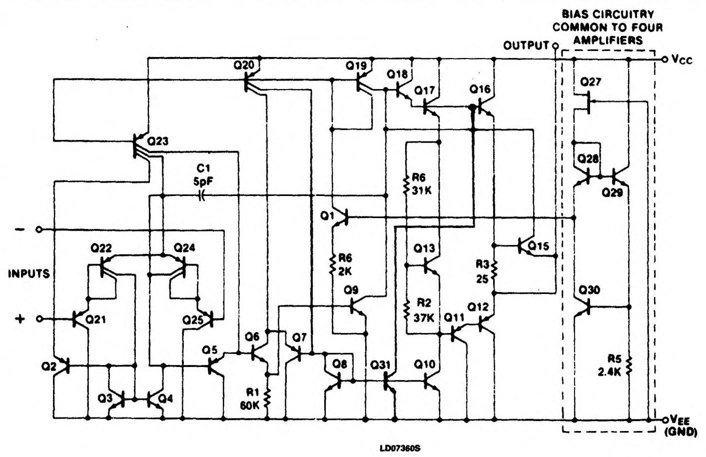
TOP VIEW

CD11580S

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE
14-Pin Plastic SO	-40°C to +85°C	MC3303D
14-Pin Ceramic DIP	-40°C to +85°C	MC3303F
14-Pin Plastic DIP	-40°C to +85°C	MC3303N
14-Pin Plastic SO	0 to +70°C	MC3403D
14-Pin Ceramic DIP	0 to +70°C	MC3403F
14-Pin Plastic DIP	0 to +70°C	MC3403N
14-Pin Ceramic DIP	-55°C to +125°C	MC3503F

CIRCUIT SCHEMATIC (¼ Shown)



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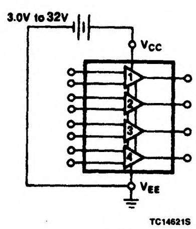

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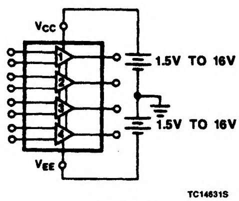
Single Supply



TC14631S

Split Supplies

Quad Low Power Operational Amplifiers MC3303/3403/3503

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNIT
	Power supply voltage[3]		
V_{CC}	Single supply	36	V_{DC}
V_{CC}	Split supplies	+18	V_{DC}
V_{EE}		-18	V_{DC}
V_{IDR}	Input differential voltage range[1]	±36	V_{DC}
V_{ICR}	Input common-mode voltage range[1, 2]	±18	V_{DC}
$P_{D\ MAX}$	Maximum power dissipation, T_A = 25°C (still-air)[4]		
	F package	1.20	W
	D package	1.04	W
	N package	1.45	W
T_{STG}	Storage temperature range		
	Ceramic	-65 to +150	°C
	Plastic	-55 to +125	
T_A	Operating ambient temperature range		
	MC3503	-55 to +125	°C
	MC3403	0 to +70	°C
	MC3303	-40 to +85	°C
T_J	Junction temperature	150	°C

NOTES:
1. Split power supplies.
2. For supply voltages less than ± 15V, the absolute maximum input voltage is equal to the supply voltage.
3. Device not functional for single supply > 32V or split supply > ± 16V.
4. Derate above 25°C at the following rates:
   F package at 9.5mW/°C
   D package at 8.7mW/°C
   N package at 11.6mW/°C

DC AND AC ELECTRICAL CHARACTERISTICS

V_{CC} = +15V, V_{EE} = −15V for MC3503, MC3403; V_{CC} = +14V, V_{EE} = GND for MC3303. T_A = 25°C, unless otherwise noted.

SYMBOL	PARAMETER	TEST CONDITIONS	MC3503			MC3403			MC3303			UNIT
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{IO}	Input offset voltage			2.0	5.0		2.0	10		2.0	8.0	mV
		$T_A = T_{HIGH}$ to T_{LOW}			6.0			12			10	
I_{IO}	Input offset current			10	50		10	50		30	75	nA
		$T_A = T_{HIGH}$ to T_{LOW}			200			200			250	
A_{VOL}	Large-signal open-loop voltage gain	V_O = ±10V,	50	200		20	200		20	200		V/mV
		V_O = ±10V R_L = 2.0kΩ	50	200		20	200		20	200		
		$T_A = T_{HIGH}$ to T_{LOW}	25	300		15			15			
I_{BIAS}	Input bias current			-30	-500		-30	-500		-30	-500	nA
		$T_A = T_{HIGH}$ to T_{LOW}		-40	-1200			-800			-1000	
Z_O	Output impedance	f = 20Hz		75			75			75		Ω
Z_I	Input impedance	f = 20Hz	0.3	1.0		0.3	1.0		0.3	1.0		MΩ
V_{OR}	Output voltage range	R_L = 10kΩ	±12	±13.5		±12	±13.5		+12	+12.5		V
		R_L = 2.0kΩ	±10	±13		±10	±13		+10	+12		
		R_L = 2.0kΩ $T_A = T_{HIGH}$ to T_{LOW}	±10			±10			+10			

DC AND AC ELECTRICAL CHARACTERISTICS (Continued) V_{CC} = +15V, V_{EE} = −15V for MC3503, MC3403; V_{CC} = +14V, V_{EE} = GND for MC3303. T_A = 25°C, unless otherwise noted.

SYMBOL	PARAMETER	TEST CONDITIONS	MC3503			MC3403			MC3303			UNIT
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{ICR}	Input common-mode voltage range		+13 $-V_{EE}$	+13.5 $-V_{EE}$		+13 $-V_{EE}$	+13.5 $-V_{EE}$		+12 $-V_{EE}$	+12.5 $-V_{EE}$		V
CMRR	Common-mode rejection ratio	$R_S \leq 10k\Omega$	70	90		70	90		70	90		dB
I_{CC}, I_{EE}	Power supply current (V_O = 0)	$R_L = \infty$ $T_A = T_{HIGH}$ to T_{LOW}		2.5 3.5	4.0 5.0		2.5 3.5	7.0 7.0		2.5 3.5	7.0 7.0	mA mA
$I_{OS}\pm$	Individual output short-circuit current[1]		±10	±30	±45	±10	±20	±45	±10	±30	±45	mA
PSSR+	Positive power supply rejection ratio			30	150		30	150		30	150	μV/V
PSSR−	Negative power supply rejection ratio			30	150		30	150				μV/V
$\Delta I_B/\Delta T$	Average temperature coefficient of input bias current	$T_A = T_{HIGH}$ to T_{LOW}		50			50			50		pA/°C
$\Delta I_{IO}/\Delta T$	Average temperature coefficient of input offset current	$T_A = T_{HIGH}$ to T_{LOW}		50			50			50		pA/°C
$\Delta V_{IO}/\Delta T$	Average temperature coefficient of input offset voltage	$T_A = T_{HIGH}$ to T_{LOW}		10			10			10		μV/°C
BW_P	Power bandwidth	A_V = 1, R_L = 2.0kΩ, V_O = 20V_{P-P} THD = 5%		9.0			9.0			9.0		kHz
BW	Small-signal bandwidth	A_V = 1, R_L = 10kΩ, V_O = 50mV		1.0			1.0			1.0		MHz
SR	Slew rate	A_V = 1, V_I = −10V to +10V		0.6			0.6			0.6		V/μs
t_{TLH}	Rise time	A_V = 1, R_L = 10kΩ, V_O = 50mV		0.35			0.35			0.35		μs
t_{THL}	Fall time	A_V = 1, R_L = 10kΩ, V_O = 50mV		0.35			0.35			0.35		μs
OS	Overshoot	A_V = 1, R_L = 10kΩ, V_O = 50mV		20			20			20		%
θm	Phase margin	A_V = 1, R_L = 2.0kΩ, C_L = 200pF		50			50			50		Deg
	Crossover distortion	V_{IN} = 30mV_{P-P}, V_{OUT} = 2.0V_{P-P}, f = 10kHz		1.0			1.0			1.0		%

DC AND AC ELECTRICAL CHARACTERISTICS V_{CC} = 5.0V, V_E = GND, T_A = 25°C, unless otherwise noted.

SYMBOL	PARAMETER	TEST CONDITIONS	MC3503			MC3403			MC3303			UNIT
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
V_{IO}	Input offset voltage			2.0	5.0		2.0	10.0			10.0	mV
I_{IO}	Input offset current			30	50		30	50			75	nA
I_{BIAS}	Input bias current			-200	-500		-200	-500			-500	nA
A_{VOL}	Large-signal open-loop voltage gain	R_L = 2.0kΩ	10	200		10	200		10	200		V/mV
PSRR	Power supply rejection ratio				150			150			150	μV/V
V_{OR}	Output voltage range[2]	R_L = 10kΩ, V_{CC} = 5.0V	3.3	3.5		3.3	3.5		3.3	3.5		V_P
		R_L = 10kΩ, 5.0V ≤ V_{CC} ≤ 30V	V_{CC} -1.7	V_{CC} -1.5		V_{CC} -1.7	V_{CC} -1.5		V_{CC} -1.7	V_{CC} -1.5		
I_{CC}	Power supply current			2.5	4.0		2.5	7.0		2.5	7.0	mA
	Channel separation	f = 1.0kHz to 20kHz (input referenced)		-120			-120			-120		dB

NOTES:
1. Not to exceed maximum package power dissipation.
2. Output will swing to ground.

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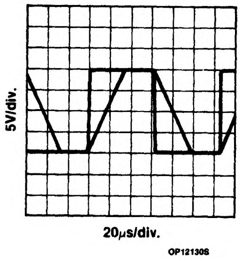
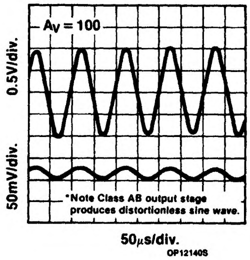
TYPICAL PERFORMANCE CHARACTERISTICS

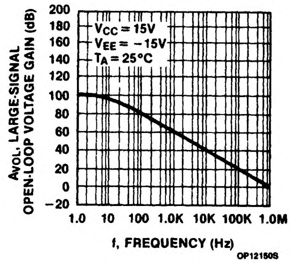
Inverter Pulse Response



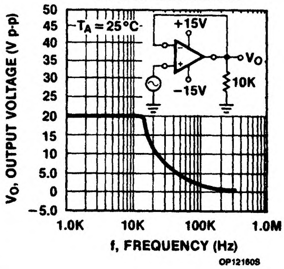
Sine Wave Response



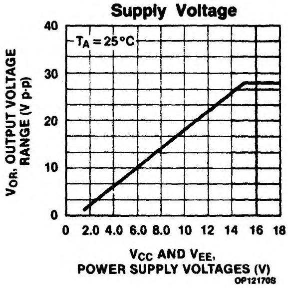
Open-Loop Frequency Response



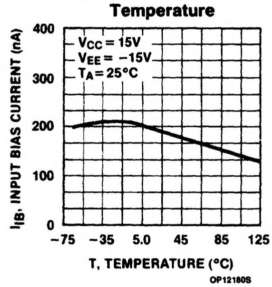
Power Bandwidth



Output Swing vs Supply Voltage



Input Bias Current vs Temperature



Input Bias Current vs Supply Voltage