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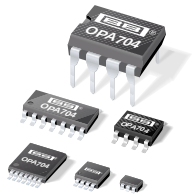


OPA703
OPA2703
OPA4703
OPA704
OPA2704
OPA4704

CMOS, Rail-to-Rail, I/O OPERATIONAL AMPLIFIERS

FEATURES

- **RAIL-TO-RAIL INPUT AND OUTPUT**
- **WIDE SUPPLY RANGE:**
  Single Supply: 4V to 12V
  Dual Supplies: ±2 to ±6
- **LOW QUIESCENT CURRENT: 160μA**
- **FULL SCALE CMRR: 90dB**
- **LOW OFFSET: 160μV**
- **HIGH SPEED:**
  OPA703: 1MHz, 0.6V/μs
  OPA704: 5MHz, 3V/μs
- **MICROSIZE PACKAGES:**
  SOT23-5, MSOP-8, TSSOP-14
- **LOW INPUT BIAS CURRENT: 1pA**

APPLICATIONS

- **AUTOMOTIVE APPLICATIONS:**
  Audio, Sensor Applications, Security Systems
- **PORTABLE EQUIPMENT**
- **ACTIVE FILTERS**
- **TRANSDUCER AMPLIFIER**
- **TEST EQUIPMENT**
- **DATA ACQUISITION**

DESCRIPTION

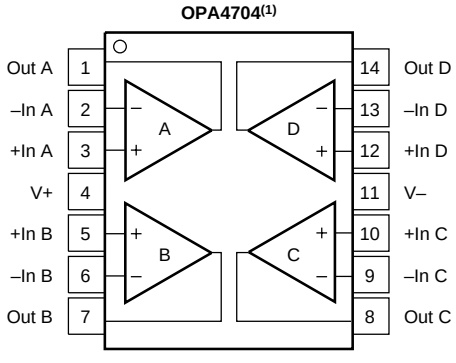
The OPA703 and OPA704 series op amps are optimized for applications requiring rail-to-rail input and output swing. Single, dual, and quad versions are offered in a variety of packages. While the quiescent current is less than 200μA per amplifier, the OPA703 still offers excellent dynamic performance (1MHz GBW and 0.6V/μs SR) and unity gain stability. The OPA704 is optimized for gains of 5 or greater and provides 5MHz GBW and 3V/μs slew rate.

The OPA703 and OPA704 series are fully specified and guaranteed over the supply range of ±2V to ±6V. Input swing extends 300mV beyond the rail and the output swings to within 40mV of the rail.

The single versions (OPA703 and OPA704[1]) are available in the microsize SOT23-5 and in the standard SO-8 surface-mount as well as the DIP-8 packages. Dual versions (OPA2703[1] and OPA2704[1]) are available in the MSOP-8, SO-8 and DIP-8 packages. The quad OPA4703[1] and OPA4704[1] are available in the TSSOP-14 and SO-14 packages. All are specified for operation from –55°C to +125°C.

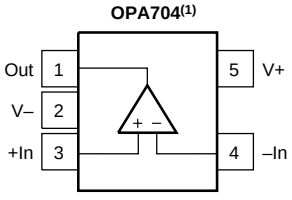
NOTE: (1) OPA2703, OPA4703, OPA704, OPA2704, and OPA4704 available Q1 2001.

OPA4703[1]
OPA4704[1]



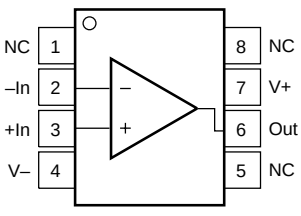
TSSOP-14, SO-14

OPA703
OPA704[1]



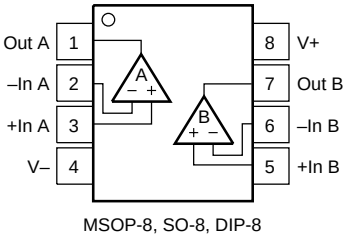
SOT23-5

OPA703
OPA704[1]



SO-8, DIP-8

OPA2703[1]
OPA2704[1]



MSOP-8, SO-8, DIP-8

TEXAS INSTRUMENTS

SBOS180

Printed in U.S.A. December, 2000

OPA703 SPECIFICATIONS: V_S = 10V

Boldface limits apply over the specified temperature range, **T_A = –55°C to +125°C**

At T_A = +25°C, R_L = 20kΩ connected to V_S/2 and V_{OUT} = V_S/2, unless otherwise noted.

PARAMETER		CONDITION	OPA703NA, UA, PA OPA2703EA, UA, PA[1] OPA4703EA, UA[1] MIN	TYP	MAX	UNITS
OFFSET VOLTAGE						
Input Offset Voltage	V_{OS}	V_S = ±5V, V_{CM} = 0V		±160	±750	µV
Drift	**dV_{OS}/dT**	**T_A = –55°C to +125°C**		**±4**		**µV/°C**
vs Power Supply	PSRR	V_S = ±2V to ±6V, V_{CM} = 0V		5	100	µV/V
Over Temperature		**V_S = ±2V to ±6V, V_{CM} = 0V**			**125**	**µV/V**
Channel Separation, dc		R_L = 20kΩ		1		µV/V
f = 1kHz				98		dB
INPUT VOLTAGE RANGE						
Common-Mode Voltage Range	V_{CM}		(V–) – 0.3		(V+) + 0.3	V
Common-Mode Rejection Ratio	CMRR	V_S = ±5V, (V–) – 0.3V < V_{CM} < (V+) + 0.3V	70	90		dB
over Temperature		**V_S = ±5V, (V–) < V_{CM} < (V+)**	**60**			**dB**
		V_S = ±5V, (V–) – 0.3V < V_{CM} < (V+) – 2V	80	96		dB
over Temperature		**V_S = ±5V, (V–) < V_{CM} < (V+) – 2V**	**66**			**dB**
INPUT BIAS CURRENT						
Input Bias Current	I_B	V_S = ±5V, V_{CM} = 0V		±1	±10	pA
Input Offset Current	I_{OS}	V_S = ±5V, V_{CM} = 0V		±0.5	±10	pA
INPUT IMPEDANCE						
Differential				$4 \cdot 10^9$ || 4		Ω || pF
Common-Mode				$5 \cdot 10^{12}$ || 4		Ω || pF
NOISE						
Input Voltage Noise, f = 0.1Hz to 10Hz		V_S = ±5V, V_{CM} = 0V		6		µVp-p
Input Voltage Noise Density, f = 1kHz	e_n	V_S = ±5V, V_{CM} = 0V		45		nV/√Hz
Current Noise Density, f = 1kHz	i_n	V_S = ±5V, V_{CM} = 0V		2.5		fA/√Hz
OPEN-LOOP GAIN						
Open-Loop Voltage Gain	A_{OL}	R_L = 100kΩ, (V–)+0.1V < V_O < (V+)–0.1V		120		dB
		R_L = 20kΩ, (V–)+0.075V < V_O < (V+)–0.075V	106	110		dB
over Temperature		**R_L = 20kΩ, (V–)+0.075V < V_O < (V+)–0.075V**	**100**			**dB**
		R_L = 5kΩ, (V–)+0.15V < V_O < (V+)–0.15V	106	110		dB
over Temperature		**R_L = 5kΩ, (V–)+0.15V < V_O < (V+)–0.15V**	**100**			**dB**
OUTPUT						
Voltage Output Swing from Rail		R_L = 100kΩ, A_{OL} > 80dB		40		mV
		R_L = 20kΩ, A_{OL} > 106dB			75	mV
over Temperature		**R_L = 20kΩ, A_{OL} > 100dB**			**75**	**mV**
		R_L = 5kΩ, A_{OL} > 106dB			150	mV
over Temperature		**R_L = 5kΩ, A_{OL} > 100dB**			**150**	**mV**
Output Current	I_{OUT}	|V_S – V_{OUT}| < 1V		±10		mA
Short-Circuit Current	I_{SC}			±40		mA
Capacitive Load Drive	C_{LOAD}			See Typical Performance Curve		
FREQUENCY RESPONSE		C_L = 100pF				
Gain-Bandwidth Product	GBW	G = +1		1		MHz
Slew Rate	SR	V_S = ±5V, G = +1		0.6		V/µs
Settling Time, 0.1%	t_S	V_S = ±5V, 5V Step, G = +1		15		µs
0.01%		V_S = ±5V, 5V Step, G = +1		20		µs
Overload Recovery Time		V_{IN} • Gain = V_S		3		µs
Total Harmonic Distortion + Noise	THD+N	V_S = ±5V, V_O = 3Vp-p, G = +1, f = 1kHz		0.02		%
POWER SUPPLY						
Specified Voltage Range, Single Supply	V_S		4		12	V
Specified Voltage Range, Dual Supplies	V_S		±2		±6	V
Operating Voltage Range				3.6 to 12		V
Quiescent Current (per amplifier)	I_Q	I_O = 0		160	200	µA
over Temperature					**300**	**µA**
TEMPERATURE RANGE						
Specified Range			–55		125	°C
Operating Range			–55		125	°C
Storage Range			–65		150	°C
Thermal Resistance	θ_{JA}					
SOT23-5 Surface-Mount				200		°C/W
MSOP-8 Surface-Mount				150		°C/W
TSSOP-14 Surface-Mount				100		°C/W
SO-8 Surface Mount				150		°C/W
SO-14 Surface Mount				100		°C/W
DIP-8				100		°C/W

NOTE: (1) OPA2703 and OPA4703 available Q1 2001.

OPA704 SPECIFICATIONS: V_S = 10V

Boldface limits apply over the specified temperature range, **T_A = –55°C to +125°C**

At T_A = +25°C, R_L = 20kΩ connected to V_S/2 and V_{OUT} = V_S/2, unless otherwise noted.

PARAMETER		CONDITION	OPA704NA, UA, PA(1) OPA2704EA, UA, PA(1) OPA4704EA, UA(1) MIN	TYP	MAX	UNITS
OFFSET VOLTAGE						
Input Offset Voltage	V_{OS}	V_S = ±5V, V_{CM} = 0V		±160	±750	µV
Drift	**dV_{OS}/dT**	**T_A = –55°C to +125°C**		**±4**		**µV/°C**
vs Power Supply	PSRR	V_S = ±2V to ±6V, V_{CM} = 0V		5	100	µV/V
Over Temperature		**V_S = ±2V to ±6V, V_{CM} = 0V**			**125**	**µV/V**
Channel Separation, dc		R_L = 20kΩ		1		µV/V
f = 1kHz				98		dB
INPUT VOLTAGE RANGE						
Common-Mode Voltage Range	V_{CM}		(V–) – 0.3		(V+) + 0.3	V
Common-Mode Rejection Ratio	CMRR	V_S = ±5V, (V–) – 0.3V < V_{CM} < (V+) + 0.3V	70	90		dB
over Temperature		**V_S = ±5V, (V–) < V_{CM} < (V+)**	**60**			**dB**
		V_S = ±5V, (V–) – 0.3V < V_{CM} < (V+) – 2V	80	96		dB
over Temperature		**V_S = ±5V, (V–) < V_{CM} < (V+) – 2V**	**66**			**dB**
INPUT BIAS CURRENT						
Input Bias Current	I_B	V_S = ±5V, V_{CM} = 0V		±1	±10	pA
Input Offset Current	I_{OS}	V_S = ±5V, V_{CM} = 0V		±0.5	±10	pA
INPUT IMPEDANCE						
Differential				$4 \cdot 10^9$ || 4		Ω || pF
Common-Mode				$5 \cdot 10^{12}$ || 4		Ω || pF
NOISE						
Input Voltage Noise, f = 0.1Hz to 10Hz		V_S = ±5V, V_{CM} = 0V		6		μV_{p-p}
Input Voltage Noise Density, f = 1kHz	e_n	V_S = ±5V, V_{CM} = 0V		45		$nV/\sqrt{Hz}$
Current Noise Density, f = 1kHz	i_n	V_S = ±5V, V_{CM} = 0V		4		$fA/\sqrt{Hz}$
OPEN-LOOP GAIN						
Open-Loop Voltage Gain	A_{OL}	R_L = 100kΩ, (V–)+0.1V < V_O < (V+)–0.1V		120		dB
		R_L = 20kΩ, (V–)+0.075V < V_O < (V+)–0.075V	106	110		dB
over Temperature		**R_L = 20kΩ, (V–)+0.075V < V_O < (V+)–0.075V**	**100**			**dB**
		R_L = 5kΩ, (V–)+0.15V < V_O < (V+)–0.15V	106	110		dB
over Temperature		**R_L = 5kΩ, (V–)+0.15V < V_O < (V+)–0.15V**	**100**			**dB**
OUTPUT						
Voltage Output Swing from Rail		R_L = 100kΩ, A_{OL} > 80dB		40		mV
		R_L = 20kΩ, A_{OL} > 106dB			75	mV
over Temperature		**R_L = 20kΩ, A_{OL} > 100dB**			**75**	**mV**
		R_L = 5kΩ, A_{OL} > 106dB			150	mV
over Temperature		**R_L = 5kΩ, A_{OL} > 100dB**			**150**	**mV**
Output Current	I_{OUT}	|V_S – V_{OUT}| < 1V		±10		mA
Short-Circuit Current	I_{SC}			±40		mA
Capacitive Load Drive	C_{LOAD}	See Typical Performance Curve				
FREQUENCY RESPONSE		C_L = 100pF				
Gain-Bandwidth Product	GBW	G = +5		5		MHz
Slew Rate	SR	V_S = ±5V, G = +5		3		V/µs
Settling Time, 0.1%	t_S	V_S = ±5V, 5V Step, G = +5		18		µs
0.01%		V_S = ±5V, 5V Step, G = +5		21		µs
Overload Recovery Time		V_{IN} • Gain = V_S		0.6		µs
Total Harmonic Distortion + Noise	THD+N	V_S = ±5V, V_O = 3Vp-p, G = +5, f = 1kHz		0.025		%
POWER SUPPLY						
Specified Voltage Range, Single Supply	V_S		4		12	V
Specified Voltage Range, Dual Supplies	V_S		±2		±6	V
Operating Voltage Range				3.6 to 12		V
Quiescent Current (per amplifier)	I_Q	I_O = 0		160	200	µA
over Temperature					**300**	**µA**
TEMPERATURE RANGE						
Specified Range			–55		125	°C
Operating Range			–55		125	°C
Storage Range			–65		150	°C
Thermal Resistance	θ_{JA}					
SOT23-5 Surface-Mount				200		°C/W
MSOP-8 Surface-Mount				150		°C/W
TSSOP-14 Surface-Mount				100		°C/W
SO-8 Surface Mount				150		°C/W
SO-14 Surface Mount				100		°C/W
DIP-8				100		°C/W

NOTE: (1) OPA704, OPA2704, and OPA4704 available Q1 2001.

ABSOLUTE MAXIMUM RATINGS[1]

Supply Voltage, V+ to V–	13.2V
Signal Input Terminals, Voltage[2]	(V–) –0.3V to (V+) +0.3V
Current[2]	10mA
Output Short-Circuit[3]	Continuous
Operating Temperature	–55°C to +125°C
Storage Temperature	–65°C to +150°C
Junction Temperature	+150°C
Lead Temperature (soldering, 10s)	+300°C

NOTES: (1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. (2) Input terminals are diode-clamped to the power supply rails. Input signals that can swing more than 0.3V beyond the supply rails should be current-limited to 10mA or less. (3) Short-circuit to ground, one amplifier per package.

ELECTROSTATIC DISCHARGE SENSITIVITY

This integrated circuit can be damaged by ESD. Burr-Brown recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PACKAGE/ORDERING INFORMATION

PRODUCT	DESCRIPTION	MINIMUM RECOMMENDED GAIN	PACKAGE	PACKAGE DRAWING NUMBER	PACKAGE MARKING	ORDERING NUMBER[1]	TRANSPORT MEDIA
OPA703NA	Single, GBW = 1MHz	1	SOT23-5	331	A03	OPA703NA/250	Tape and Reel
"	"	"	"	"	"	OPA703NA/3K	Tape and Reel
OPA703UA	Single, GBW = 1MHz	1	SO-8	182	OPA703UA	OPA703UA	Rails
"	"	"	"	"	"	OPA703UA/2K5	Tape and Reel
OPA703PA	Single, GBW = 1MHz	1	DIP-8	006	OPA703PA	OPA703PA	Rails
OPA2703EA[2]	Dual, GBW = 1MHz	1	MSOP-8	337	B03	OPA2703EA/250	Tape and Reel
"	"	"	"	"	"	OPA2703EA/2K5	Tape and Reel
OPA2703UA[2]	Dual, GBW = 1MHz	1	SO-8	182	OPA2703UA	OPA2703UA	Rails
"	"	"	"	"	"	OPA2703UA/2K5	Tape and Reel
OPA2703PA[2]	Dual, GBW = 1MHz	1	DIP-8	006	OPA2703PA	OPA2703PA	Rails
OPA4703EA[2]	Quad, GBW = 1MHz	1	TSSOP-14	357	OPA4703EA	OPA4703EA/250	Tape and Reel
"	"	"	"	"	"	OPA4703EA/2K5	Tape and Reel
OPA4703UA[2]	Quad, GBW = 1MHz	1	SO-14	235	OPA4703UA	OPA4703UA	Rails
"	"	"	"	"	"	OPA4703UA/2K5	Tape and Reel
OPA704NA[2]	Single, GBW = 5MHz	5	SOT23-5	331	A04	OPA704NA/250	Tape and Reel
"	"	"	"	"	"	OPA704NA/3K	Tape and Reel
OPA704UA[2]	Single, GBW = 5MHz	5	SO-8	182	OPA704UA	OPA704UA	Tape and Reel
"	"	"	"	"	"	OPA704UA/2K5	Tape and Reel
OPA704PA[2]	Single, GBW = 5MHz	5	DIP-8	006	OPA704PA	OPA704PA	Rails
OPA2704EA[2]	Dual, GBW = 5MHz	5	MSOP-8	337	B04	OPA2703EA/250	Tape and Reel
"	"	"	"	"	"	OPA2703EA/2K5	Tape and Reel
OPA2704UA[2]	Dual, GBW = 5MHz	5	SO-8	182	OPA2704UA	OPA2704UA	Rails
"	"	"	"	"	"	OPA2704UA/2K5	Tape and Reel
OPA2704PA[2]	Dual, GBW = 5MHz	5	DIP-8	006	OPA2704PA	OPA2704PA	Rails
OPA4704EA[2]	Quad, GBW = 5MHz	5	TSSOP-14	357	OPA4704EA	OPA4704EA/250	Tape and Reel
"	"	"	"	"	"	OPA4704EA/2K5	Tape and Reel
OPA4704UA[2]	Quad, GBW = 5MHz	5	SO-14	235	OPA4704UA	OPA4704UA	Rails
"	"	"	"	"	"	OPA4704UA/2K5	Tape and Reel

NOTE: (1) Models with a slash (/) are available only in Tape and Reel in the quantities indicated (e.g., /3K indicates 3000 devices per reel). Ordering 3000 pieces of “OPA703NA/3K” will get a single 3000-piece Tape and Reel. (2) OPA2703, OPA4703, OPA704, OPA2704, and OPA4704 available Q1 2001.

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