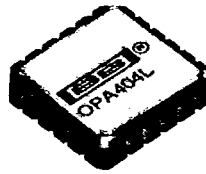




OPA404L



LCC Quad High-Speed Precision *Difet*® OPERATIONAL AMPLIFIER

FEATURES

- WIDE BANDWIDTH: 6.4MHz
- HIGH SLEW RATE: 35V/μs
- LOW OFFSET: ±750μV max
- LOW BIAS CURRENT: ±4pA max
- FAST SETTLING TIME: 1.5μs to 0.01%
- HERMETIC SURFACE MOUNT PACKAGE

APPLICATIONS

- PRECISION INSTRUMENTATION
- OPTOELECTRONICS
- SONAR, ULTRASOUND
- PROFESSIONAL AUDIO EQUIPMENT
- MEDICAL EQUIPMENT
- DETECTOR ARRAYS

DESCRIPTION

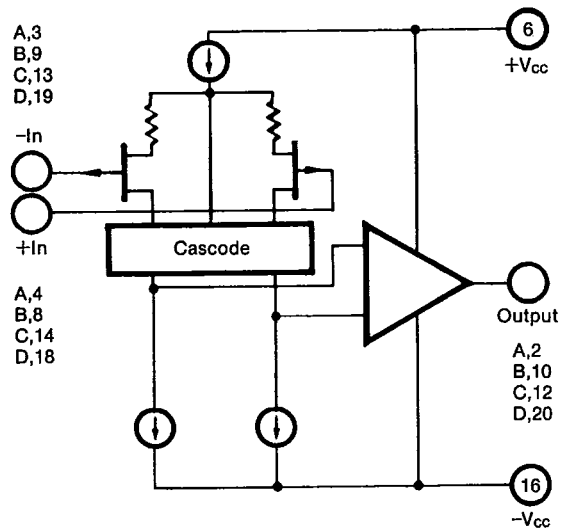
The OPA404L is a high performance monolithic *Difet*® (dielectrically isolated FET) quad operational amplifier. It offers an unusual combination of very low bias current together with wide bandwidth and fast slew rate.

Noise, bias current, voltage offset, drift, and speed are superior to BIFET® amplifiers.

Laser trimming of thin-film resistors gives very-low offset and drift—the best available in a quad FET op amp.

The OPA404L's input cascode design allows high precision input specifications and uncompromised high-speed performance.

Difet® Burr-Brown Corp., BIFET® National Semiconductor Corp.



OPA404L SIMPLIFIED CIRCUIT
(EACH AMPLIFIER)

SPECIFICATIONS

ELECTRICAL

At $V_{CC} = \pm 15VDC$ and $T_A = +25^\circ C$ unless otherwise noted.

PARAMETER	CONDITIONS	OPA404AL			OPA404BL			OPA404SL			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
INPUT											
NOISE⁽¹⁾											
Voltage: $f_o = 10Hz$			32			*			*		nV/\sqrt{Hz}
$f_o = 100Hz$			19			*			*		nV/\sqrt{Hz}
$f_o = 1kHz$			15			*			*		nV/\sqrt{Hz}
$f_o = 10kHz$			12			*			*		nV/\sqrt{Hz}
$f_b = 10Hz$ to $10kHz$			1.4			*			*		$\mu V, rms$
$f_b = 0.1Hz$ to $10Hz$			0.95			*			*		$\mu V, p-p$
Current: $f_b = 0.1Hz$ to $10Hz$			12			*			*		fA, p-p
$f_o = 0.1Hz$ to $20kHz$			0.6			*			*		fA/ \sqrt{Hz}
OFFSET VOLTAGE											
Input Offset Voltage	$V_{CM} = 0VDC$		± 260	$\pm 1mV$		*	± 750		*	*	μV
Average Drift	$T_A = T_{MIN}$ to T_{MAX}		± 3			*			*	*	$\mu V/^\circ C$
Supply Rejection	$\pm V_{CC} = 12V$ to $18V$	80	100	100	86	*		*	*	*	dB
Channel Separation	100Hz, $R_L = 2k\Omega$		10	100		*	50		*	*	$\mu V/V$
			125			*			*	*	dB
BIAS CURRENT											
Input Bias Current	$V_{CM} = 0VDC$		± 1	± 8		*	± 4		*	*	pA
OFFSET CURRENT											
Input Offset Current	$V_{CM} = 0VDC$		0.5	8		*	4		*	*	pA
IMPEDANCE											
Differential			$10^{13} \parallel 1$			*			*	*	$\Omega \parallel pF$
Common-Mode			$10^{14} \parallel 3$			*			*	*	$\Omega \parallel pF$
VOLTAGE RANGE											
Common-Mode Input Range	$V_{IN} = \pm 10VDC$	± 10.5	$+13, -11$		*	*		*	*	*	V
Common-Mode Rejection		88	100		92	*		*	*	*	dB
OPEN-LOOP GAIN, DC											
Open-Loop Voltage Gain	$R_L \geq 2k\Omega$	88	100		92	*		*	*	*	dB
FREQUENCY RESPONSE											
Gain Bandwidth	Gain = 100	4	6.4		5	*		*	*	*	MHz
Full Power Response	20V p-p, $R_L = 2k\Omega$		570			*		*	*	*	kHz
Slew Rate	$V_o = \pm 10V, R_L = 2k\Omega$	24	35		28	*		*	*	*	V/ μs
Settling Time: 0.1%	Gain = -1, $R_L = 2k\Omega$		0.6			*		*	*	*	μs
0.01%	$C_L = 100pF, 10V$ step		1.5			*		*	*	*	μs
RATED OUTPUT											
Voltage Output	$R_L = 2k\Omega$	± 11.5	$+13.2, -13.8$		*	*		*	*	*	V
Current Output	$V_o = \pm 10VDC$	± 5	± 10		*	*		*	*	*	mA
Output Resistance	1MHz, open loop		80			*		*	*	*	Ω
Load Capacitance Stability	Gain = +1		1000			*		*	*	*	pF
Short Circuit Current		± 10	± 18		± 20	*	*	*	*	*	mA
POWER SUPPLY											
Rated Voltage			± 15			*		*	*	*	VDC
Voltage Range, Derated Performance		± 5		± 18	*	*	*	*	*	*	VDC
Current, Quiescent	$I_o = 0mADC$		9	10		*	*	*	*	*	mA
TEMPERATURE RANGE											
Specification	Ambient temp.	-25		+85	*	*	*	-55	*	+125	$^\circ C$
Operating	Ambient temp.	-55		+125	*	*	*	*	*	*	$^\circ C$
Storage	Ambient temp.	-65		+150	*	*	*	*	*	*	$^\circ C$
θ Junction-Case			40			*	*	*	*	*	$^\circ C/W$

*Specification same as OPA404AL.

NOTES: (1) Noise testing available—inquire.

The information provided herein is believed to be reliable; however, BURR-BROWN assumes no responsibility for inaccuracies or omissions. BURR-BROWN assumes no responsibility for the use of this information, and all use of such information shall be entirely at the user's own risk. Prices and specifications are subject to change without notice. No patent rights or licenses to any of the circuits described herein are implied or granted to any third party. BURR-BROWN does not authorize or warrant any BURR-BROWN product for use in life support devices and/or systems.

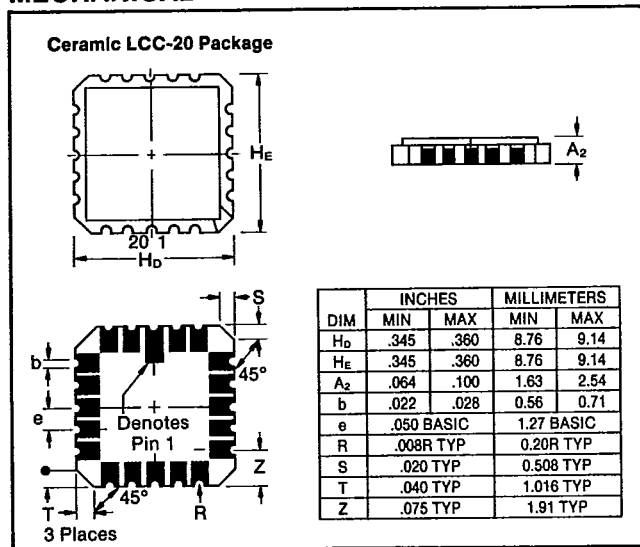
ELECTRICAL (FULL TEMPERATURE RANGE SPECIFICATIONS)

At $V_{CC} = \pm 15VDC$ and $T_A = T_{MIN}$ to T_{MAX} unless otherwise noted.

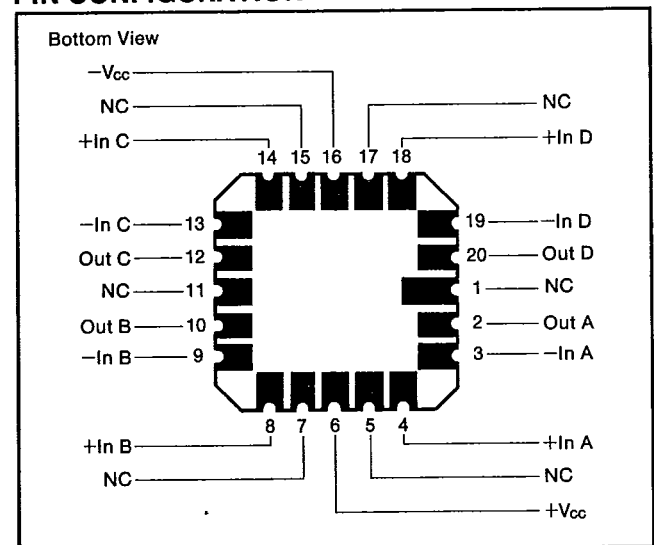
PARAMETER	CONDITIONS	OPA404AL			OPA404BL			OPA404SL			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
TEMPERATURE RANGE											
Specification Range	Ambient temp.	-25		+85	*		*	-55		+125	°C
INPUT											
OFFSET VOLTAGE											
Input Offset Voltage	$V_{CM} = 0VDC$		± 450	2mV		*	$\pm 1.5mV$		± 550	$\pm 2.5mV$	μV
Average Drift		75	± 3		80	*		70	93		$\mu V/^\circ C$
Supply Rejection			96	178		*	100		22	316	dB
			16			*					$\mu V/V$
BIAS CURRENT											
Input Bias Current	$V_{CM} = 0VDC$		± 32	± 200		*	± 100		± 500	$\pm 5nA$	pA
OFFSET CURRENT											
Input Offset Current	$V_{CM} = 0VDC$		17	100		*	50		260	2.5nA	pA
VOLTAGE RANGE											
Common-Mode Input Range	$V_{IN} = \pm 10VDC$	± 10.2	$+12.7, -10.6$		*	*		± 10	$+12.6, -10.5$		V
Common-Mode Rejection		82	99		86	*		80	88		dB
OPEN-LOOP GAIN, DC											
Open-Loop Voltage Gain	$R_L \geq 2k\Omega$	82	94		86	*		80	88		dB
RATED OUTPUT											
Voltage Output	$R_L = 2k\Omega$	± 11.5	$+12.9, -13.8$		*	*		± 11	$+12.7, -13.8$		V
Current Output	$V_O = \pm 10VDC$	± 5	± 9		*	*		*	± 8		mA
Short Circuit Current	$V_O = 0VDC$	± 5	± 12	± 30	*	*	*	± 8	± 10	*	mA
POWER SUPPLY											
Current, Quiescent	$I_O = 0mADC$		9.3	10.5		*	*		9.4	11	mA

*Specification same as OPA404AL.

MECHANICAL



PIN CONFIGURATION



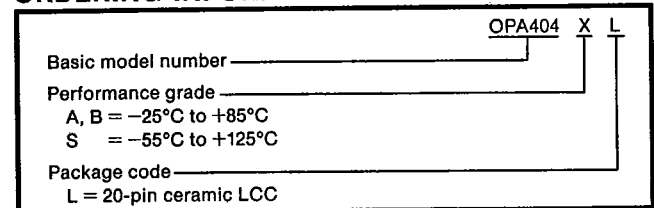
ABSOLUTE MAXIMUM RATINGS

Supply	$\pm 18VDC$
Internal Power Dissipation ⁽¹⁾	1000mW
Differential Input Voltage ⁽²⁾	$\pm 36VDC$
Input Voltage Range ⁽²⁾	$\pm 18VDC$
Storage Temperature Range	$-65/+150^\circ C$
Operating Temperature Range	$-55/+125^\circ C$
Output Short Circuit Duration ⁽³⁾	Continuous
Junction Temperature	$+175^\circ C$

NOTES:

- (1) Packages must be derated based on $\theta_{JC} = 40^\circ C/W$.
- (2) For supply voltages less than $\pm 18VDC$ the absolute maximum input voltage is equal to: $18V > V_{IN} > -V_{CC} - 8V$. See Figure 2.
- (3) Short circuit may be to power supply common only. Rating applies to $+25^\circ C$ ambient. Observe dissipation limit and T_J .

ORDERING INFORMATION



TYPICAL PERFORMANCE CURVES

$T_A = +25^\circ\text{C}$, $V_{CC} = \pm 15\text{VDC}$ unless otherwise noted. Refer to PDS-677 for complete typical curves and applications information.

