Operational Multiplier

GENERAL DESCRIPTION

The XR-2208 operational multiplier combines a four-quadrant analog multiplier (or modulator), a high frequency buffer amplifier, and an operational amplifier in a monolithic circuit that is ideally suited for both analog computation and communications signal processing application. As shown in the functional block diagram, for maximum versatility the multiplier and operational amplifier sections are not internally connected. They can be interconnected, with a minimum number of external components, to perform arithmetic computation, such as multiplication, division, square-root extraction. The operational amplifier can also function as a pre-amplifier for low-level input signals, or as a post detection amplifier for synchronous demodulator applications. For signal processing, the high frequency buffer amplifier output is available at pin 15. This multiplier/ buffer amplifier combination extends the small -signal 3-db bandwidth to 8-MHz and the transconductance bandwidth to 100 MHz.

The XR-2208 operates over a wide range of supply voltages, ±4.5V to ±16V. Current and voltage levels are internally regulated to provide excellent power supply rejection and temperature stability.

FEATURES

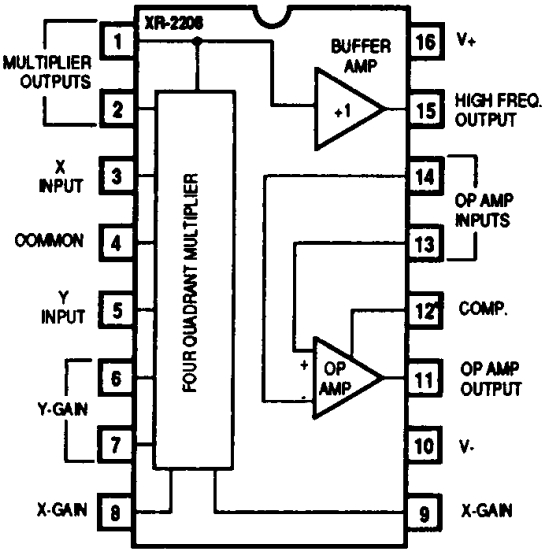
Maximum Versatility
  Independent Multiplier, 0p Amp, and Buffer
Excellent Linearity (0.3% typ.)
Wide Bandwidth
  3 dB B.W.-8 MHz typ,
  3^0^ Phase Shift B.W-1.2 MHz typ.
  Transconductance B.W-100 MHz typ.
Simplified Offset Adjustments
Wide Supply Voltage Range (+4.5V to ±16V)

APPLICATIONS

Analog Computation	Triangle-to-Sine wave
Multiplication	Converter
Division	AGC Amplifier
Squaring	Phase Detector
Square-Root	Phase-Locked Loop (PLL)
Signal Processing	Applications
AM Generation	Motor Speed Control
Frequency Doubling	Precision PLL
Frequency Translation	Carrier Detection
Synchronous AM Detection	Phase-Locked AM Demodulation

Rev-B

FUNCTIONAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Power Supply V^+	+18 Volts
V^-	-18 Volts
Power Dissipation	
Ceramic Package	750mW
Derate above +25° C	6mW/°C
Storage Temperature Range	-65°C to + 150°C

SYSTEM DESCRIPTION

The XR-2208 operational multiplier contains a four-quadrant multiplier with a buffer amplifier for one of the differential outputs for applications requiring high frequency applications. The inputs have a dynamic response of 4 MHz (8 MHz for the X input) and a transconductance bandwidth of 100 MHz for phase detector applications. The fully independent operational amplifier features high gain and a large common mode rejection ratio (90 dB). The device can be powered by voltages from ±4.5 VDC to ±16 VDC.

ELECTRICAL PERFORMANCE CHARACTERISTICS - XR-2208

TEST	SYMBOL	CONDITIONS	TEMPERATURE	LIMITS MIN	LIMITS MAX	UNIT	GROUP A SUBGROUP
Supply Current	Icc	Vs = ±4.5V	TA = +25°C		7.0	mA	1
			-55°C≤TA≤+125°C		7.0	mA	2,3
Supply Current	Icc	Vs = ±16.0V	TA = +25°C		7.0	mA	1
			-55°C≤TA≤+125°C		7.0	mA	2,3
Multiplier Output Voltage	Mvo	Pin 1	TA = +25°C	12.2	13.7	V	1
			-55°C≤TA≤+125°C	12.2	13.7	V	2,3
Multiplier Output Voltage	Mvo	Pin 2	TA = +25°C	12.2	13.7	V	1
			-55°C≤TA≤+125°C	12.2	13.7	V	2,3
Multiplier Output Offset Voltage	Mvos		TA = +25°C	-80	80	mV	1
			-55°C≤TA≤+125°C	-80	80	mV	2,3
Feedthrough	VFT	Vx = -10V, Vy = 0	TA = +25°C	-150	150	mV	4
			-55°C≤TA≤+125°C	-150	150	mV	5,6
Feedthrough	VFT	Vx = 0, Vy = -10V	TA = +25°C	-150	150	mV	4
			-55°C≤TA≤ +125°C	-150	150	mV	5,6
Feedthrough	VFT	Vx = 0, Vy = 10V	TA = +25°C	-150	150	mV	4
			-55°C≤TA≤+125°C	-150	150	mV	5,6
Feedthrough	VFT	Vx = 0, Vy = 10V	TA = +25°C	-150	150	mV	4
			-55°C≤TA≤+125°C	-150	150	mV	5,6
Nonlinearity	NLIN	Vx = 10V	TA = +25°C	-0.5	0.5	%	9
		-10V≤Vy≤10V	-55°C≤TA≤+125°C	-1.0	1.0	%	10,11
Nonlinearity	NLIN	Vx = -10V	TA = +25°C	-0.5	0.5	%	9
		-10V≤Vy≤10V	-55°C≤TA≤+125°C	-1.0	1.0	%	10,11
Nonlinearity	NLIN	Vy = +10V	TA = +25°C	-0.5	0.5	%	9
		-10V≤Vx≤10V	-55°C≤TA≤+125°C	-1.0	1.0	%	10,11
Nonlinearity	NLIN	Vy =10V	TA = +25°C	-0.5	0.5	%	9
		-10V≤Vx≤10V	-55°C≤TA≤+125°C	-1.0	1.0	%	10,11
Input Bias Current	IBX	XINPUT	TA = +25°C	-6.0	6.0	µA	1
			-55°C≤TA≤+125°C	-6.0	6.0	µA	2,3
Input Bias Current	IBY	YINPUT	TA = +25°C	-6.0	6.0	µA	1
			-55°C≤TA≤+125°C	-6.0	6.0	µA	2,3
Input Bias Current	IBC	Common Input	TA = +25°C	-12.0	12.0	µA	1
			-55°C≤TA≤+125°C	-12.0	12.0	µA	2,3
Buffer Voltage Gain	BG		TA = +25°C	0.8	1.1		4
			-55°C≤TA≤+125°C	0.8	1.1		5,6
Buffer Output Voltage High	BVO	Vx = 10V, Vy = -10V	TA = +25°C	10.0	13.0	V	1
			-55°C≤TA≤+125°C	10.0	13.0	V	2,3

Buffer Output Voltage Difference	B_{VOD}	Vx = -10V, Vy = 10V	T_A = +25°C	-2.1	-0.55	V	1
			-55°C≤T_A≤+125°C	-2.1	-0.55	V	2,3
Input Offset Voltage	Vos		T_A = +25°C	-3.0	3.0	mV	1
			-55°C≤T_A≤+125°C	-3.0	3.0	mV	2,3
Input Offset Voltage	I_{OS}		T_A = +25°C	-75.0	75.0	nA	1
			-55°C≤T_A≤+125°C	-75.0	75.0	nA	2,3
Input Bias Current	I_B		T_A = +25°C	-200	200	nA	1
			-55°C≤T_A≤+125°C	-200	200	nA	2.3
Common Mode Rejection Ratio	CMRR		T_A = +25°C	70		dB	1
			-55°C≤T_A≤+125°C	70		dB	2.3
Voltage Gain	A_{VOL}		T_A = +25°C	70		dB	4
			-55°C≤T_A≤+125°C	70		dB	5,6
Power Supply Rejection	PSR R		T_A = +25°C	70		dB	1
			-55°C≤T_A≤+125°C	70		dB	2,3
Output Voltage Swing Positive	V_{OSWP}		T_A = +25°C	10.0		V	4
			-55°C≤T_A≤+125°C	10.0		V	5,6
Output Voltage Swing Negative	V_{OSWN}		T_A = +25°C		-10.0	V	4
			-55°C≤T_A≤+125°C		-10.0	V	5,6
Short Circuit Current Negative	I_{SCN}		T_A = +25°C	-30.0	-5.0	mA	1
			-55°C≤T_A≤+125°C	-30.0	-5.0	mA	2.3
Short Circuit Current Positive	I_{SCP}		T_A = +25°C	5.0	30.0	mA	1
			-55°C≤T_A≤+125°C	5.0	30.0	mA	2.3

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