

Dual Low-Noise Operational Amplifier

GENERAL DESCRIPTION

The XR-5533 dual low-noise operational amplifier is especially designed for applications in high quality professional audio equipment. The low-noise, wide bandwidth and output drive capability make it ideally suited for instrumentation and control circuits as well as active filter design.

The XR-5533A is the specially screened version of the XR-5533 with guaranteed worst-case noise specifications.

FEATURES

Direct Replacement for Signetics SE/NE 5533

Wide Small-Signal Bandwidth: 10 MHz

High-Current Drive Capability

(10V rms into 600Ω at $V_S = \pm 18V$)

High Slew Rate: 13 V/μs

Wide Power-Bandwidth: 200 kHz

Very Low Input Noise: 4 nV/√Hz

APPLICATIONS

High Quality Audio Amplification

Telephone Channel Amplifier

Servo control Systems

Low-Level Signal Detection

Active Filter Design

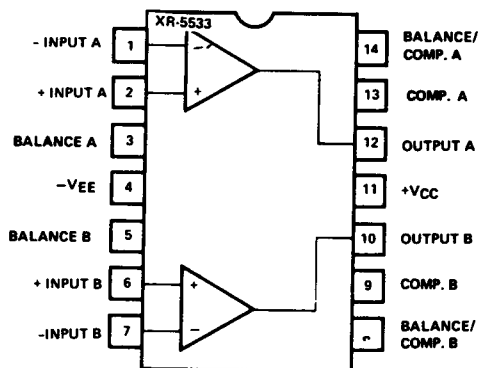
ABSOLUTE MAXIMUM RATINGS

Power Supply	$\pm 22V$
Input Common-Mode Range	$-V_{EE}$ to $+V_{CC}$
Differential Input Voltage (Note 1)	$\pm 0.5V$
Short Circuit Duration (Note 2)	Indefinite
Power Dissipation (Package Limitation)	
Ceramic Package 14-Pin	750 mW
Plastic Package 14-Pin	600 mW
Derate Above $T_A = 25^\circ C$	5 mW/°C
Storage Temperature	$-60^\circ C$ to $+150^\circ C$

Note 1: Diodes protect the inputs against over-voltage. Therefore, unless current-limiting resistors are used, large currents will flow if the differential input voltage exceeds 0.6V. Maximum current should be limited to ± 10 mA.

Note 2: Output may be shorted to ground at $V_{CC} = V_{EE} = 15V$, $T_A = 25^\circ C$. Temperature and/or supply voltages must be limited to ensure dissipation rating is not exceeded.

FUNCTIONAL BLOCK DIAGRAM



ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-5533AN	Ceramic	0°C to +70°C
XR-5533AP	Plastic	0°C to +70°C
XR-5533N	Ceramic	0°C to +70°C
XR-5533P	Plastic	0°C to +70°C

SYSTEM DESCRIPTION

The XR-5533 and XR-5533A are dual monolithic operational amplifiers featuring low noise and very large gain bandwidth products. The devices have low output resistance and can drive 10 Vrms into 600Ω. Input noise is 100% tested on the XR-5533A, and is typically only 4 nV/√Hz. The small signal bandwidth is 10 MHz and slew rate exceeds 13 V/μs.

XR-5533/5533A

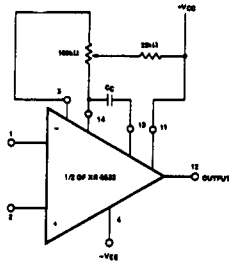
ELECTRICAL CHARACTERISTICS

Test Conditions: $T_A = 25^\circ\text{C}$, $V_{CC} = V_{EE} = 15\text{V}$ unless otherwise specified.

PARAMETERS	XR-5533A			XR-5533			UNITS	SYMBOL	CONDITIONS
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.			
DC CHARACTERISTICS									
Input Offset Voltage		0.5	4 5		0.5	4 5	mV mV	V _{OS}	T _A = 25°C T _A = Full Range
Input Offset Current		20	300 400		20	300 400	nA nA	I _{OS}	T _A = 25°C T _A = Full Range
Input Bias Current		500	1500 2000		500	1500 2000	nA nA	I _B	T _A = 25°C T _A = Full Range
Large Signal Voltage Gain	25 15	100		25 15	100		V/mV V/mV	A _{VOL}	R _L ≥ 600Ω, V _O = ±10V T _A = 25°C T _A = Full Range
Supply Current (Each Amplifier)		4	8		4	8	mA	I _{CC}	R _L = Open
Output Swing	±12 ±15	±13 ±16		±12 ±15	±13 ±16		V V	V _{OUT}	R _L ≥ 600Ω V _{CC} = V _{EE} = 15V V _{CC} = V _{EE} = 18V
Output Short Circuit Current		38			38		mA	I _{SC}	(Note 2)
Input Resistance	30	100		30	100		kΩ	R _{IN}	
Common-Mode Range	±12	±13		±12	±13		V	V _{ICM}	
Common-Mode Rejection	70	100		70	100		dB	CMRR	
Power Supply Rejection		10	100		10	100	μV/V	PSRR	
Channel Separation		110			110			dB	f = 1 kHz, R _S = 5 kΩ
AC CHARACTERISTICS									
Transient Response Rise Time		20			20		nsec	t _r	Voltage Follower R _L = 600Ω, C _C = 22 pF
Overshoot		20			20		%	t _o	C _L = 100 pF V _{IN} = 50 mV
AC Gain									f = 10 kHz
		6 2.2			6 2.2		V/mV V/mV		C _C = 0 C _C = 22 pF
Unity-Gain Bandwidth		10			10		MHz	BW	C _C = 22 pF, C _L = 100 pF
Slew Rate		13 6			13 6		V/μsec V/μsec		C _C = 0 C _C = 22 pF
Power Bandwidth		95 200			95 200		kHz kHz	f _p	V _{OUT} = ±10V, C _C = 22 pF C _C = 0 pF
NOISE CHARACTERISTICS									
Input Noise Voltage		5.5 3.5	7 4.5		7 4		nV/√Hz nV/√Hz	e _n	f ₀ = 30 Hz f ₀ = 1 kHz
Input Noise Current		1.5 0.4			2.5 0.6		pA/√Hz pA/√Hz	i _n	f ₀ = 30 Hz f ₀ = 1 kHz
Broadband Noise Figure		0.9			0.9		dB	R _N	F _S = 5 kΩ f = 10 Hz to 20 kHz

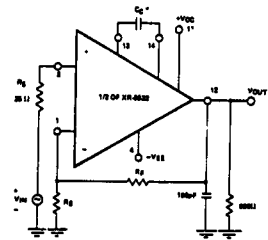
TEST CIRCUITS

FREQUENCY COMPENSATION AND OFFSET VOLTAGE ADJUSTMENT CIRCUIT



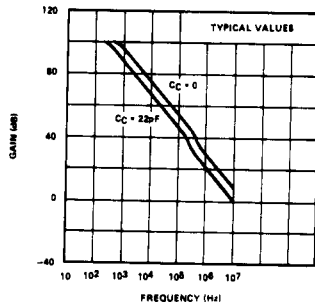
XR-5533/5533A

CLOSED LOOP FREQUENCY RESPONSE

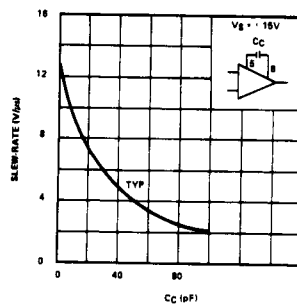


TYPICAL PERFORMANCE CHARACTERISTICS

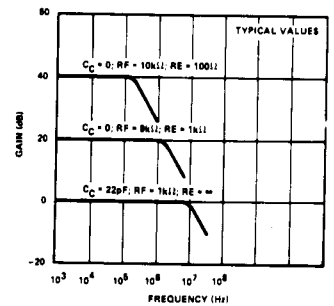
OPEN LOOP FREQUENCY RESPONSE



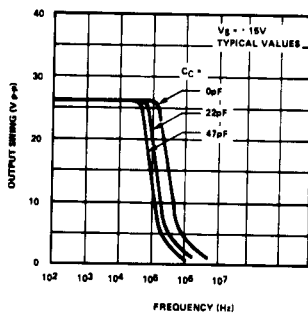
SLEW-RATE AS A FUNCTION OF COMPENSATION CAPACITANCE



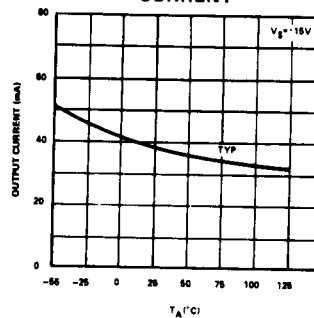
CLOSED LOOP FREQUENCY RESPONSE



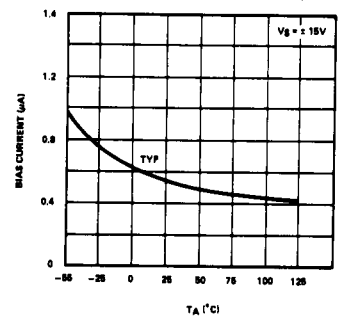
LARGE-SIGNAL FREQUENCY RESPONSE



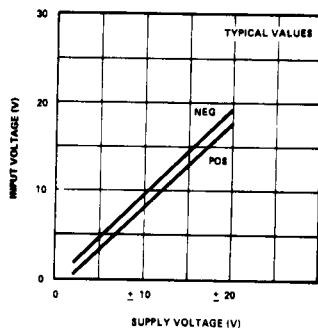
OUTPUT SHORT-CIRCUIT CURRENT



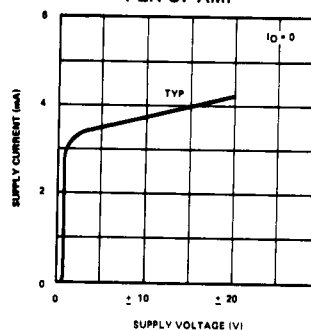
INPUT BIAS CURRENT



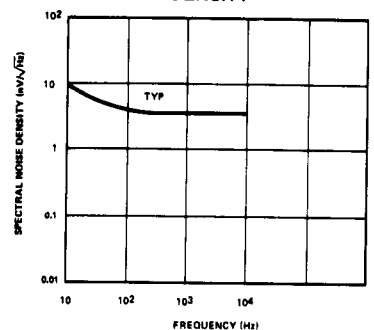
INPUT COMMON MODE VOLTAGE RANGE



SUPPLY CURRENT PER OP-AMP



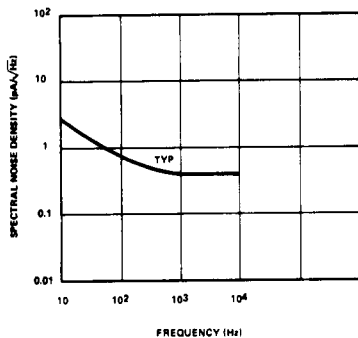
INPUT NOISE VOLTAGE DENSITY



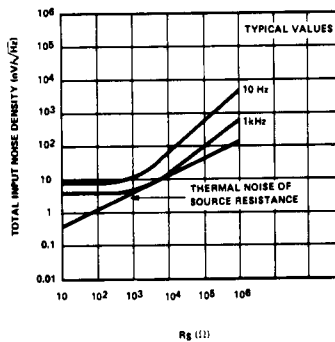
XR-5533/5533A

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

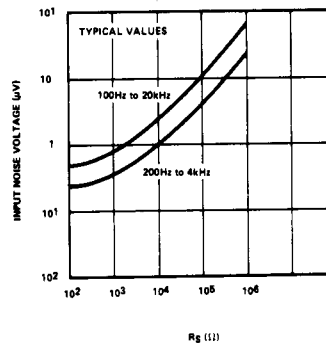
INPUT NOISE CURRENT DENSITY



TOTAL INPUT NOISE DENSITY

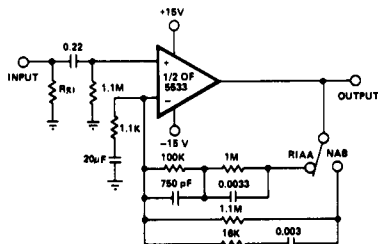


BROADBAND INPUT NOISE VOLTAGE

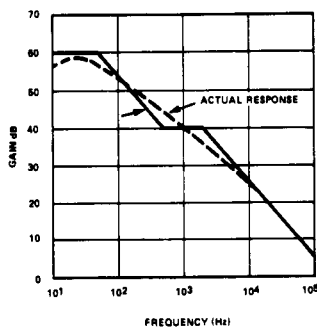


TYPICAL APPLICATION

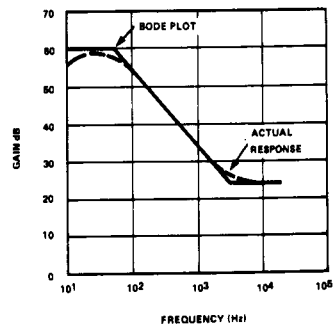
PREAMPLIFIER-RIAA/NAB COMPENSATION



*SELECT TO PROVIDE SPECIFIED TRANSDUCER LOADING
OUTPUT NOISE ≥ 0.8 mV rms (WITH INPUT SHORTED)
ALL RESISTOR VALUES ARE IN OHMS.

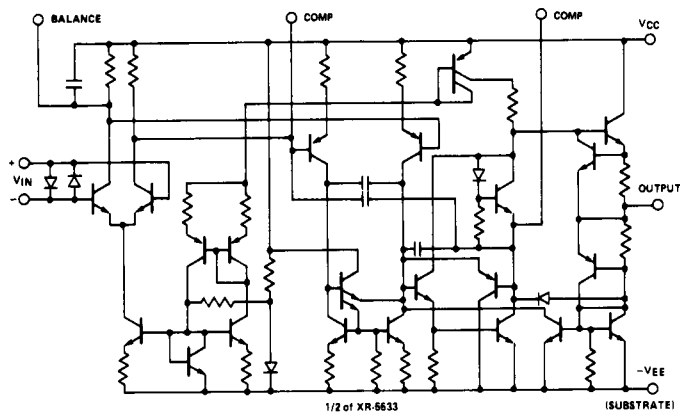


BODE PLOT OF RIAA EQUALIZATION AND THE
RESPONSE REALIZED IN AN ACTUAL CIRCUIT
USING THE XR-5533.



BODE PLOT OF NAB EQUALIZATION AND THE
RESPONSE REALIZED IN THE ACTUAL CIRCUIT USING
THE XR-5533

EQUIVALENT SCHEMATIC DIAGRAM



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EXAR

91D 04225

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XR-1488/1489A

Quad Line Driver/Receiver

GENERAL DESCRIPTION

The XR-1488 is a monolithic quad line driver designed to interface data terminal equipment with data communications equipment in conformance with the specifications of EIA Standard No. RS232C. This extremely versatile integrated circuit can be used to perform a wide range of applications. Features such as output current limiting, independent positive and negative power supply driving elements, and compatibility with all DTL and TTL logic families greatly enhance the versatility of the circuit.

The XR-1489A is a monolithic quad line receiver designed to interface data terminal equipment with data communications equipment. The XR-1489A quad receiver along with its companion circuit, the XR-1488 quad driver, provide a complete interface system between DTL or TTL logic levels and the RS232C defined voltage and impedance levels.

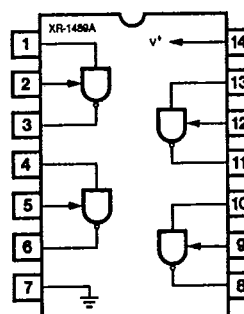
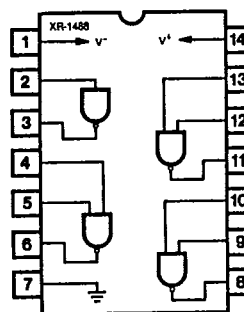
ABSOLUTE MAXIMUM RATINGS

Power Supply	
XR-1488	± 15 Vdc
XR-1489A	+ 10 Vdc
Power Dissipation	
Ceramic Package	1000 mW
Derate above +25°C	6.7 mW/°C
Plastic Package	650 mW/°C
Derate above +25°C	5 mW/°C

ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-1488N	Ceramic	0°C to +70°C
XR-1488P	Plastic	0°C to +70°C
XR-1489AN	Ceramic	0°C to +70°C
XR-1489AP	Plastic	0°C to +70°C

FUNCTIONAL BLOCK DIAGRAMS



SYSTEM DESCRIPTION

The XR-1488 and XR-1489A are a matched set of quad line drivers and line receivers designed for interfacing between TTL/DTL and RS232C data communication lines.

The XR-1488 contains four independent split supply line drivers, each with a ± 10 mA current limited output. For RS232C applications, the slew rate can be reduced to the 30 V/ μ S limit by shunting the output to ground with a 410 pF capacitor. The XR-1489A contains four independent line receivers, designed for interfacing RS232C to TTL/DTL. Each receiver features independently programmable switching thresholds with hysteresis, and input protection to ± 30 V. The output can typically source 3 mA and sink 20 mA.