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

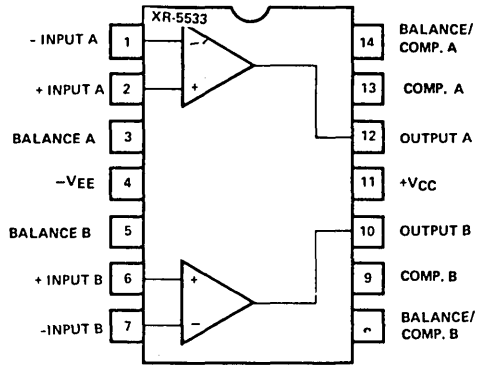
ABSOLUTE MAXIMUM RATINGS

Power Supply	±22V
Input Common-Mode Range	$-V_{EE}$ to $+V_{CC}$
Differential Input Voltage (Note 1)	±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 $T_A = 25°C$	5 mW/°C
Storage Temperature	−60°C to +150°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 $V_{CC} = V_{EE} = 15V$, $T_A = 25°C$. 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°C, V_{CC} = V_{EE} = 15V 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}	$R_L \geq 600\Omega$, $V_O = \pm 10V$ 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}	$R_L \geq 600\Omega$ $V_{CC} = V_{EE}$ = 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	$V_{OUT} = \pm 10V$, 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

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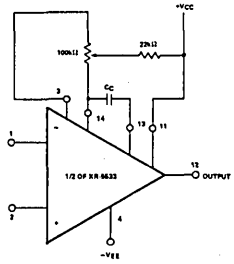
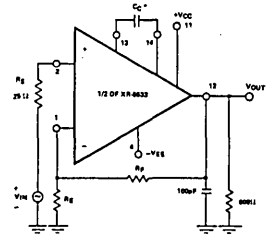
TEST CIRCUITS

FREQUENCY COMPENSATION AND OFFSET VOLTAGE ADJUSTMENT CIRCUIT

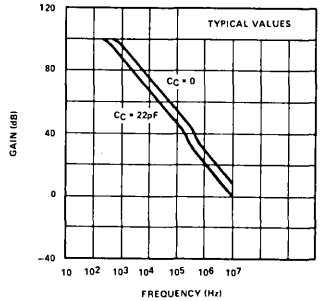


CLOSED LOOP FREQUENCY RESPONSE

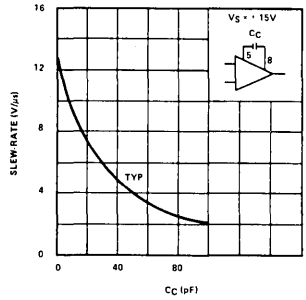


TYPICAL PERFORMANCE CHARACTERISTICS

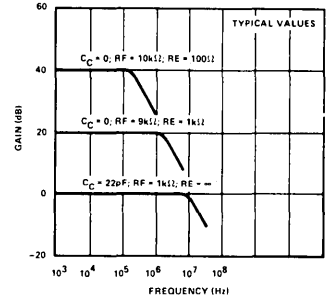
OPEN LOOP FREQUENCY RESPONSE



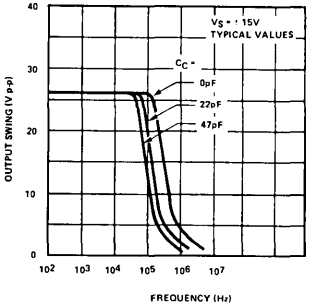
SLEW-RATE AS A FUNCTION OF COMPENSATION CAPACITANCE



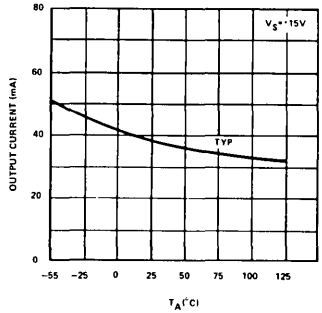
CLOSED LOOP FREQUENCY RESPONSE



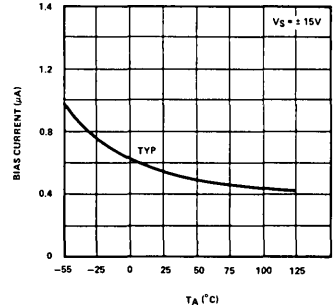
LARGE-SIGNAL FREQUENCY RESPONSE



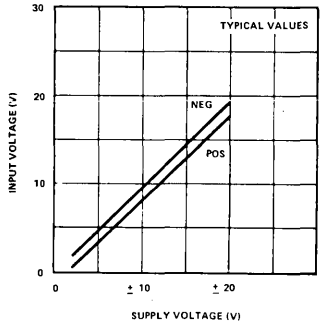
OUTPUT SHORT-CIRCUIT CURRENT



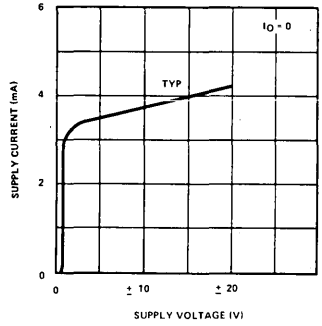
INPUT BIAS CURRENT



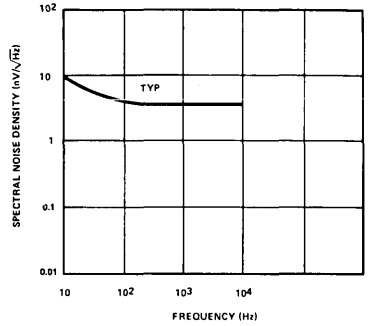
INPUT COMMON MODE VOLTAGE RANGE



SUPPLY CURRENT PER OP-AMP



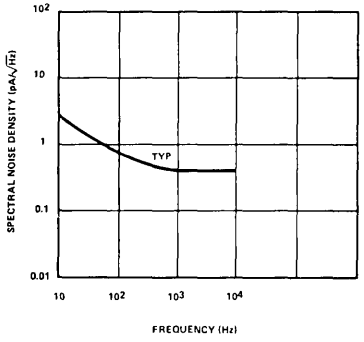
INPUT NOISE VOLTAGE DENSITY



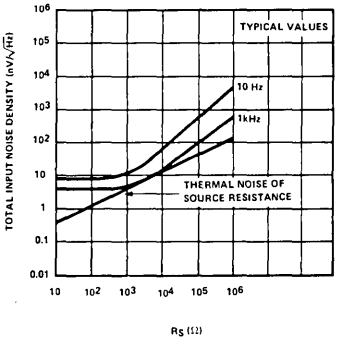
XR-5533/5533A

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

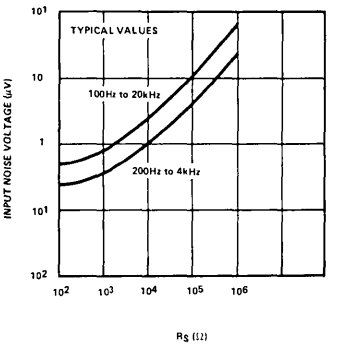
INPUT NOISE CURRENT DENSITY



TOTAL INPUT NOISE DENSITY

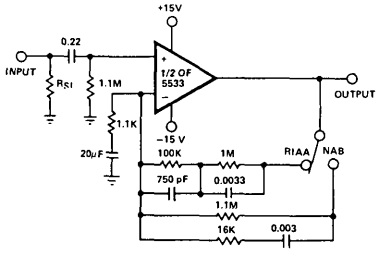


BROADBAND INPUT NOISE VOLTAGE

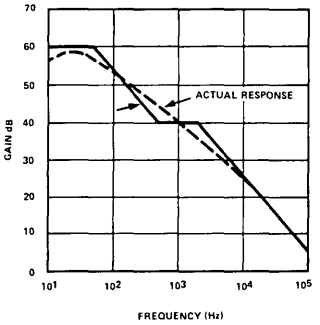


TYPICAL APPLICATION

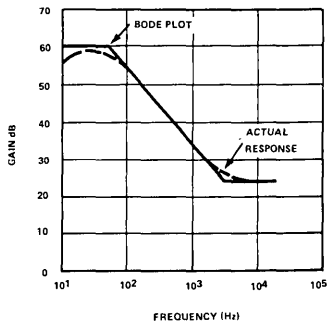
PREAMPLIFIER–RIAA/NAB COMPENSATION



*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