RC4558 High-Gain Dual Operational Amplifier

Features

- 2.5 MHz unity gain bandwidth guaranteed
- Supply voltage ±22V for RM4558 and ±15V for RC4558
- Short-circuit protection
- No frequency compensation required
- No latch-up
- Large common-mode and differential voltage ranges
- Low power consumption
- Parameter tracking over temperature range
- Gain and phase match between amplifiers

Description

The 4558 integrated circuit is a dual high-gain operational amplifier internally compensated and constructed on a single silicon IC using an advanced epitaxial process.

Combining the features of the 741 with the close parameter matching and tracking of a dual device on a monolithic chip results in unique performance characteristics. Excellent channel separation allows the use of the dual device in single 741 operational amplifier applications providing density. It is especially well suited for applications in differential-in, differential-out as well as in potentiometric amplifiers and where gain and phase matched channels are mandatory.

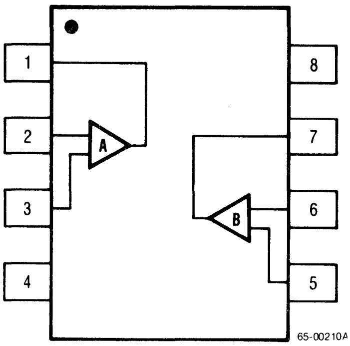
Ordering Information

Part Number	Package	Operating Temperature Range
RC4558M	M	0°C to +70°C
RC4558N	N	0°C to +70°C
RV4558D	D	-25°C to +85°C
RV4558N	N	-25°C to +85°C
RM4558D	D	-55°C to +125°C
RM4558D/883B	D	-55°C to +125°C
RM4558T	T	-55°C to +125°C
RM4558T/883B	T	-55°C to +125°C

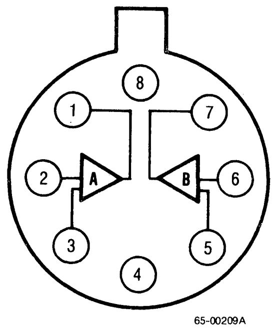
Notes:
/883B suffix denotes Mil-Std-883, Level B processing
N = 8-lead plastic DIP
D = 8-lead ceramic DIP
T = 8-lead metal can (TO-99)
M = 8-lead plastic SOIC
Contact a Raytheon sales office or representative for ordering information on special package/temperature range combinations.

Connection Information

8-Lead
Dual In-Line Package
(Top View)



8-Lead
Metal Can TO-99
(Top View)



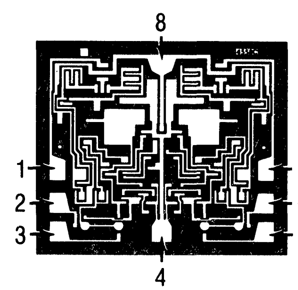
Pin	Function
1	Output (A)
2	-Input (A)
3	+Input (A)
4	$-V_S$
5	+Input (B)
6	-Input (B)
7	Output (B)
8	$+V_S$

Absolute Maximum Ratings

Supply Voltage
RM4558 .... ±22V
RC4558 .... ±18V
Input Voltage* .... ±15V
Differential Input Voltage 30V
Output Short Circuit Duration* .... Indefinite
Operating Temperature Range
RM4558 .... -55°C to +125°C
RV4558 .... -25°C to +85°C
RC4558 .... 0°C to +70°C
Lead Soldering Temperature
(SO-8; 10 sec) .... +260°C
Lead Soldering Temperature
(DIP, TO-99; 60 sec) .... +300°C

*For supply voltages less than -15V, the absolute maximum input voltage is equal to the supply voltage.
**Short circuit may be to ground on one amp only. Rating applies to +75°C ambient temperature.

Mask Pattern



Die Size: 52 x 61 mils
Min. Pad Dimensions: 4 x 4 mils

Thermal Characteristics

	8-Lead Small Outline Plastic SO-8	8-Lead Plastic DIP	8-Lead Ceramic DIP	8-Lead TO-99 Metal Can
Max. Junction Temp.	+125°C	+125°C	+175°C	+175°C
Max. P_D T_A <50°C	300 mW	468 mW	833 mW	658 mW
Therm. Res θ_{JC}	—	—	45°C/W	50°C/W
Therm. Res. θ_{JA}	240°C/W	160°C/W	150°C/W	190°C/W
For T_A >50°C Derate at	4.1 mW/°C	6.25 mW/°C	8.33 mW/°C	5.26 mW/°C

Matching Characterisitics

(V_S = ±15V, T_A = +25°C unless otherwise specified)

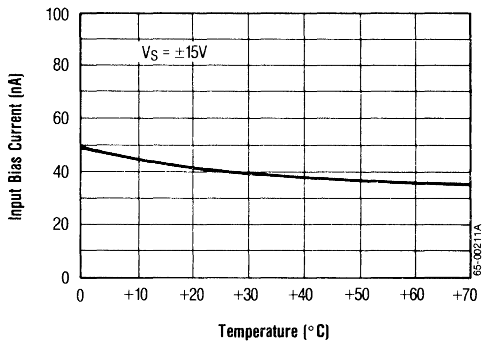
Parameter	Conditions	RC4558 Typ	Units
Voltage Gain	$R_L \geq 2\ k\Omega$	±1.0	dB
Input Bias Current	$R_L \geq 2\ k\Omega$	±15	nA
Input Offset Current	$R_L \geq 2\ k\Omega$	±7.5	nA

Electrical Characteristics (V_S = ±15V and T_A = +25°C unless otherwise specified)

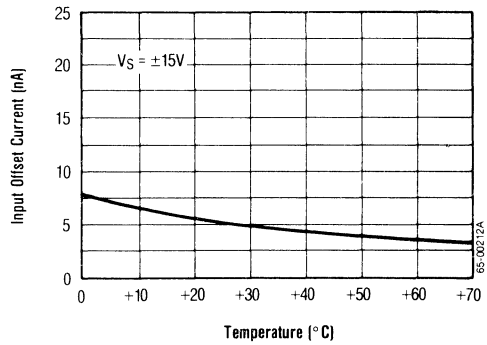
Parameters	Test Conditions	RM4558 Min	RM4558 Typ	RM4558 Max	RV/RC4558 Min	RV/RC4558 Typ	RV/RC4558 Max	Units
Input Offset Voltage	$R_S \le 10k\Omega$		1.0	5.0		2.0	6.0	mV
Input Offset Current			5.0	200		5.0	200	nA
Input Bias Current			40	500		40	500	nA
Input Resistance		0.3	1.0		0.3	1.0		MΩ
Large Signal Voltage Gain	$R_L \ge 2k\Omega$, V_{OUT} = ±10V	50	300		20	300		V/mV
Output Voltage Swing	$R_L \ge 10k\Omega$	±12	±14		±12	±14		V
	$R_L \ge 2k\Omega$	±10	±13		±10	±13		V
Input Voltage Range		±12	±13		±12	±13		V
Common Mode Rejection Ratio	$R_S \le 10k\Omega$	70	100		70	100		dB
Power Supply Rejection Ratio	$R_S \le 10k\Omega$	76	100		76	100		dB
Power Consumption	$R_L = \infty$		100	170		100	170	mW
Transient Response Rise Time	V_{IN} = 20mV R_L = 2kΩ		0.3			0.3		μS
Overshoot	$C_L \le 100pF$		35			35		%
Slew Rate	$R_L \ge 2k\Omega$		0.8			0.8		V/μS
Channel Separation	f = 10kHz, R_S = 1kΩ		90			90		dB
Unity Gain Bandwidth (Gain = 1)		2.5	3.0		2.0	3.0		MHz
The following specifications apply for −55°C ≤ T_A ≤ +125°C for RM4558; 0°C ≤ T_A ≤ +70°C for RC4558; −25°C ≤ T_A ≤ +85°C for RV4558								
Input Offset Voltage	$R_S \le 10k\Omega$			6.0			7.5	mV
Input Offset Current RC4558 RV4558				 500 500			 300 500	 nA nA
Input Bias Current RC4558 RV4558				 1500 1500			 800 1500	 nA nA
Large Signal Voltage Gain	$R_L \ge 2k\Omega$, V_{OUT} = ±10V	25			15			V/mV
Output Voltage Swing	$R_L \ge 2k\Omega$	±10			±10			V
Power Consumption	$R_L = \infty$		120	200		120	200	mW

Typical Performance Characteristics

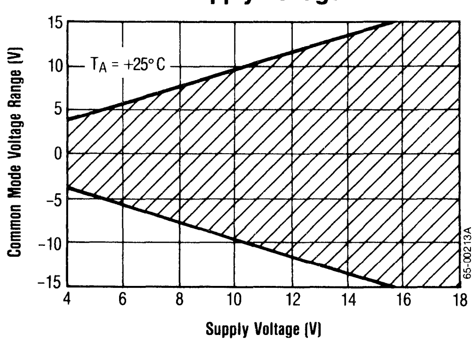
Input Bias Current as a Function of Ambient Temperature



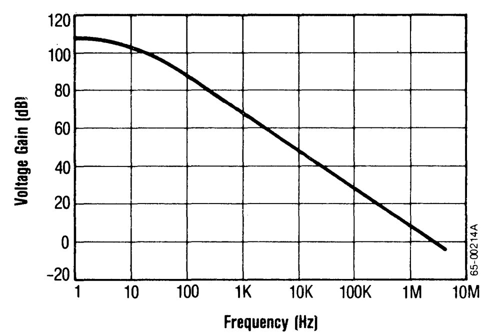
Input Offset Current as a Function of Ambient Temperature



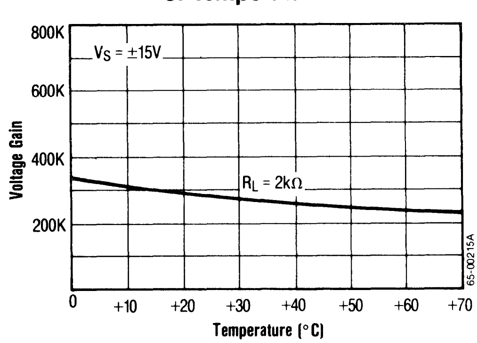
Common Mode Range as a Function of Supply Voltage



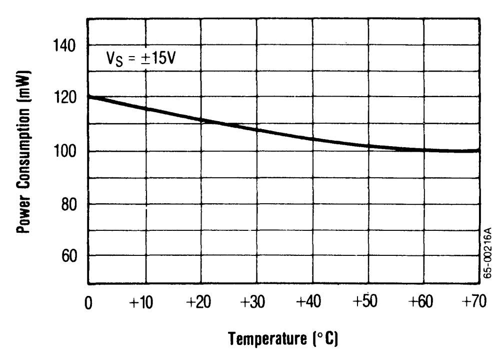
Open Loop Voltage Gain as a Function of Frequency



Open Loop Gain as a Function of Temperature

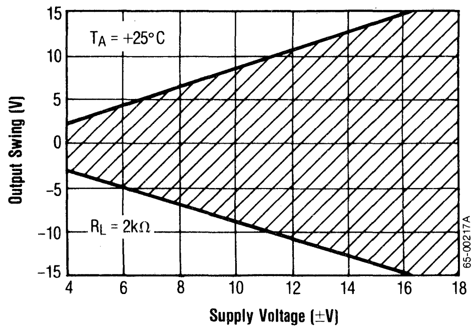


Power Consumption as a Function of Ambient Temperature

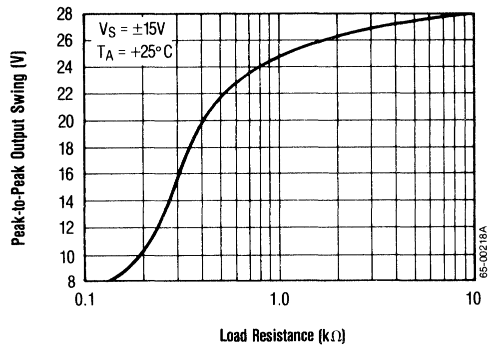


Typical Performance Characteristics (Continued)

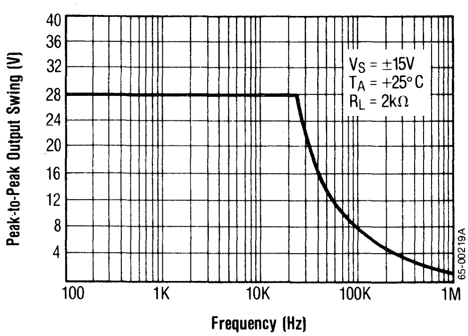
Typical Output Voltage as a Function of Supply Voltage



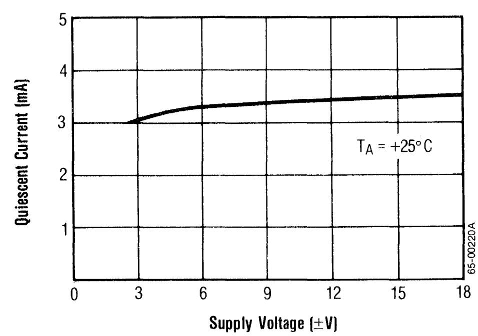
Output Voltage Swing as a Function of Load Resistance



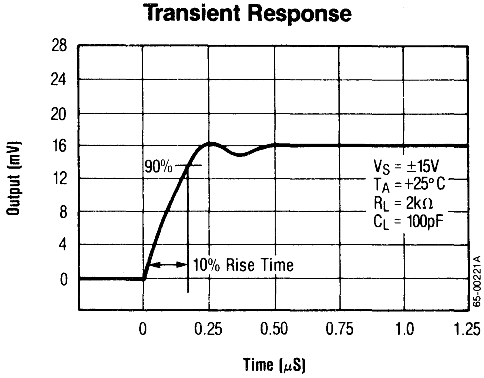
Output Voltage Swing as a Function of Frequency



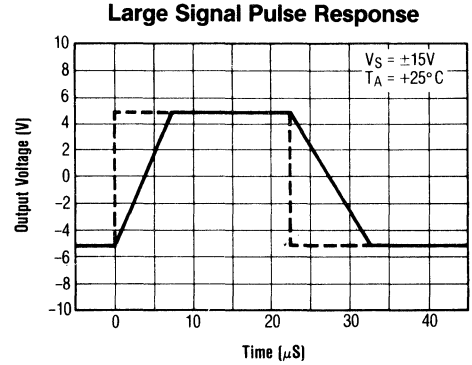
Quiescent Current as a Function of Supply Voltage



Transient Response

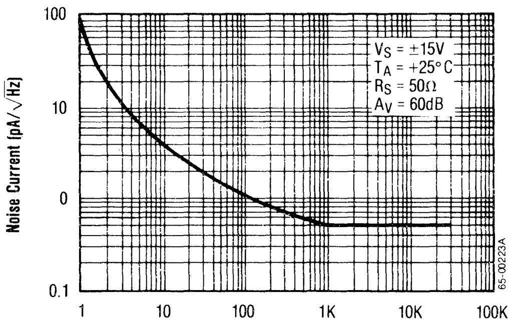


Voltage Follower Large Signal Pulse Response

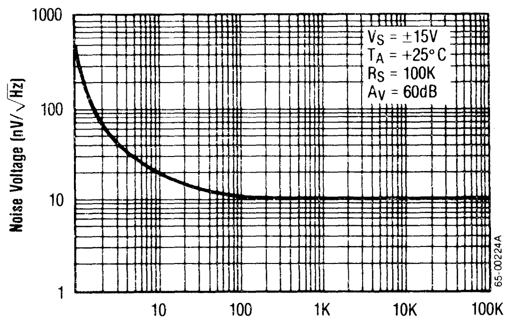


Typical Performance Characteristics (Continued)

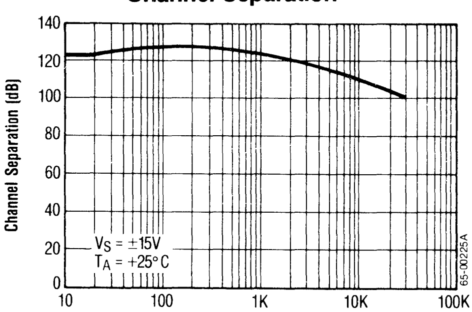
Input Noise Current as a Function of Frequency



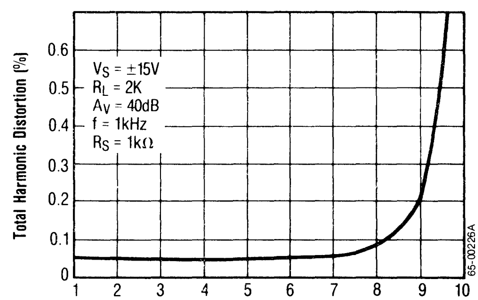
Input Noise Voltage as a Function of Frequency



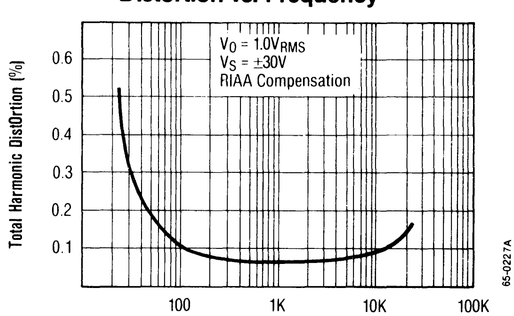
Channel Separation



Total Harmonic Distortion vs. Output Voltage

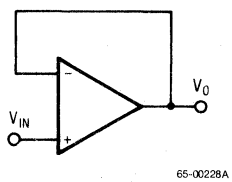


Distortion vs. Frequency

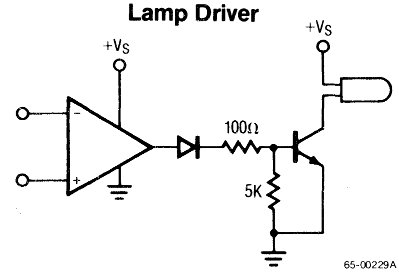


Typical Applications

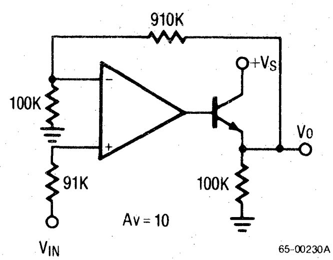
Voltage Follower



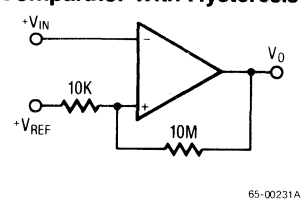
Lamp Driver



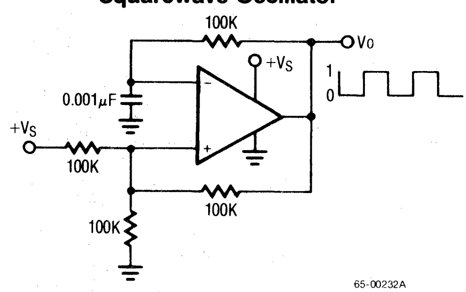
Power Amplifier



Comparator With Hysteresis

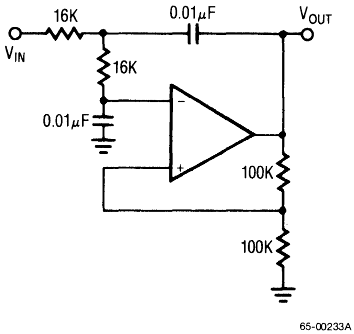


Squarewave Oscillator

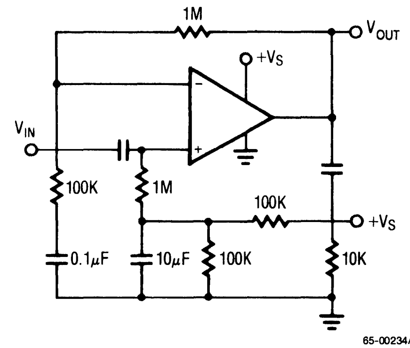


Typical Applications (Continued)

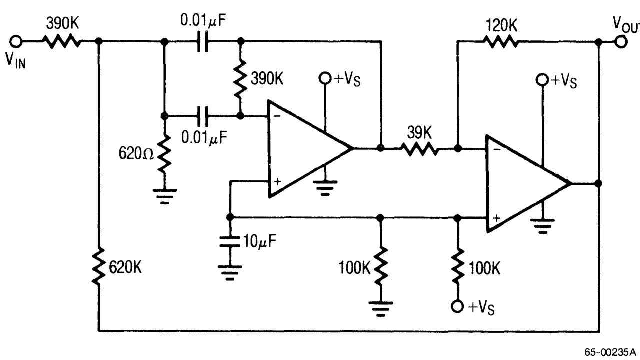
DC Coupled 1kHz Low-Pass Active Filter



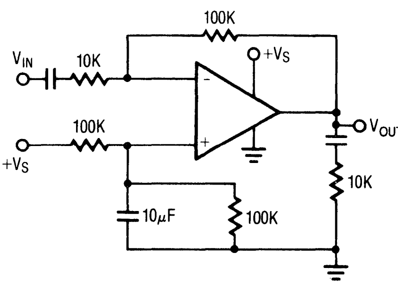
AC Coupled Non-Inverting Amplifier



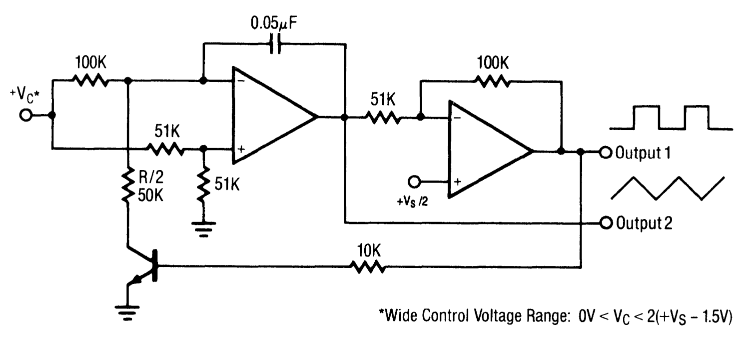
1kHz Bandpass Active Filter



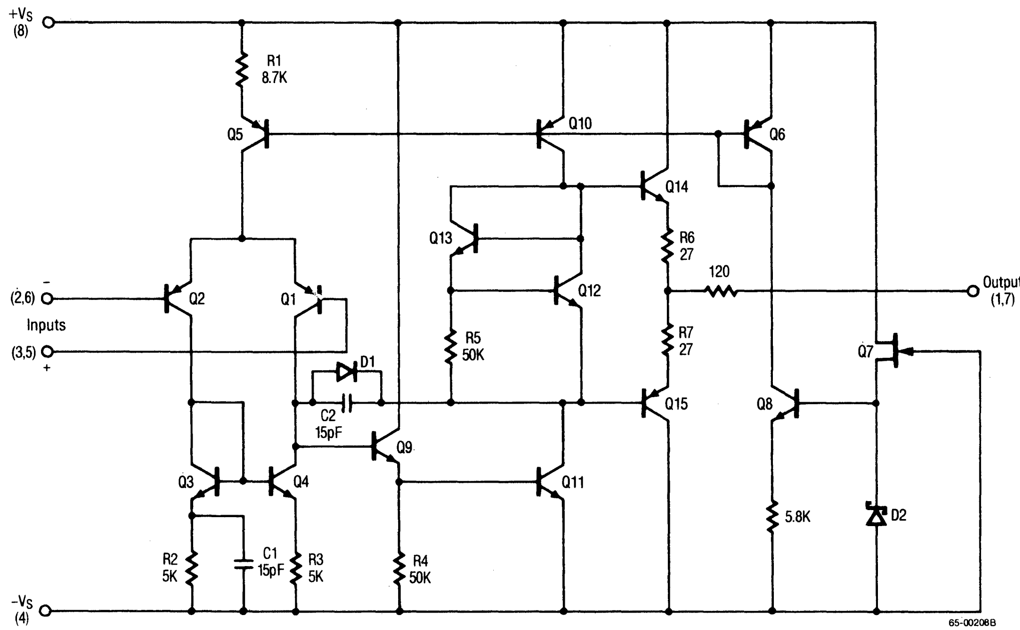
AC Coupled Inverting Amplifier



Voltage Controlled Oscillator (VCO)



Schematic Diagram (1/2 Shown)



RC4559 High-Gain Dual Operational Amplifier

Features

- Unity gain bandwidth — 4.0 MHz typical, 3.0 MHz guaranteed
- Slew rate — 2.0 V/µS typical, 1.5 V/µS guaranteed
- Low noise voltage — 1.4 μV_{RMS} typical, 2.0 μV_{RMS} guaranteed
- Supply voltage — ±22V for RM4559 and ±18V for RC4559
- No frequency compensation required
- No latch up
- Large common mode and differential voltage ranges
- Low power consumption
- Parametric tracking over temperature range
- Gain and phase match between amplifiers

Description

The 4559 integrated circuit is a high performance dual operational amplifier internally compensated and constructed on a single silicon chip using an advanced epitaxial process.

These amplifiers feature guaranteed ac performance which far exceeds that of the 741-type amplifiers. The specially designed low-noise input transistors allow the 4559 to be used in low-noise signal processing applications such as audio preamplifiers and signal conditioners.

The 4559 also has more output drive capability than 741-type amplifiers and can be used to drive a 600Ω load.

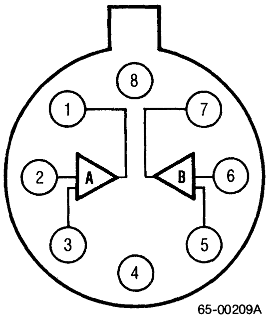
Ordering Information

Part Number	Package	Operating Temperature Range
RC4559M	M	0°C to +70°C
RC4559N	N	0°C to +70°C
RV4559D	D	-25°C to +85°C
RV4559N	N	-25°C to +85°C
RM4559D	D	-55°C to +125°C
RM4559D/883B	D	-55°C to +125°C
RM4559T	T	-55°C to +125°C
RM4559T/883B	T	-55°C to +125°C

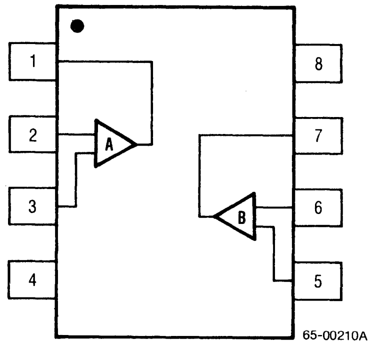
Notes:
/883B suffix denotes Mil-Std-883, Level B processing
N = 8-lead plastic DIP
D = 8 lead ceramic DIP
T = 8-lead metal can (TO-99)
M = 8-lead plastic SOIC
Contact a Raytheon sales office or representative for ordering information on special package/temperature range combinations.

Connection Information

8-Lead Metal Can TO-99
(Top View)



8-Lead Dual In-Line Package
(Top View)



Pin	Function
1	Output (A)
2	-Input (A)
3	+Input (A)
4	$-V_S$
5	+Input (B)
6	-Input (B)
7	Output (B)
8	$+V_S$

Absolute Maximum Ratings

Supply Voltage
- RM4559 .... ±22V
- RC/RV4559 .... ±18V

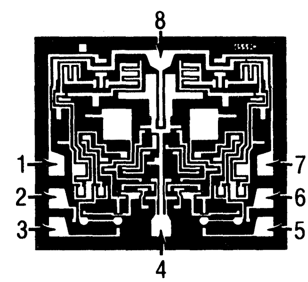
Input Voltage* .... ±15V
Differential Input Voltage 30V
Output Short Circuit Duration* .... Indefinite
Operating Temperature Range
- RM4559 .... -55°C to +125°C
- RV4559 .... -25°C to +85°C
- RC4559 .... 0°C to +70°C

Lead Soldering Temperature
- (SO-8; 10 sec) .... +260°C

Lead Soldering Temperature
- (DIP, TO-99; 60 sec) .... +300°C

*For supply voltages less than -15V, the absolute maximum input voltage is equal to the supply voltage.
**Short circuit may be to ground on one amp only. Rating applies to +75°C ambient temperature.

Mask Pattern



65-01537A

Die Size: 52 x 61 mils
Min. Pad Dimensions: 4 x 4 mils

Thermal Characteristics

	8-Lead Small Outline Plastic SO-8	8-Lead Plastic DIP	8-Lead Ceramic DIP	8-Lead TO-99 Metal Can
Max. Junction Temp.	125°C	125°C	175°C	175°C
Max. P_D T_A <50°C	300 mW	468 mW	833 mW	658 mW
Therm. Res θ_{JC}	—	—	45°C/W	50°C/W
Therm. Res. θ_{JA}	240°C/W	160°C/W	150°C/W	190°C/W
For T_A >50°C Derate at	4.1 mW/°C	6.25 mW/°C	8.33 mW/°C	5.26 mW/°C

Matching Characteristics

(V_S = ±15V, T_A = +25°C unless otherwise specified)

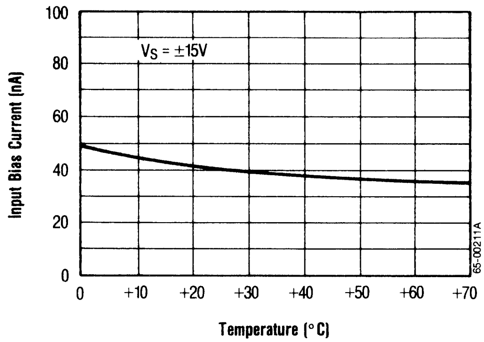
Parameter	Conditions	RC4559 Typ	Units
Voltage Gain	$R_L \geq 2\ k\Omega$	±1.0	dB
Input Bias Current		±15	nA
Input Offset Current		±7.5	nA

Electrical Characteristics (V_S = ±15V and T_A = +25°C unless otherwise specified)

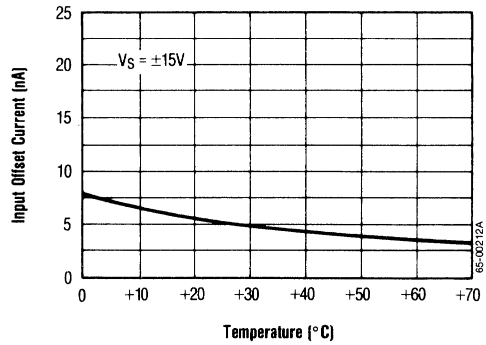
Parameters	Test Conditions	RM4559 Min	RM4559 Typ	RM4559 Max	RV/RC4559 Min	RV/RC4559 Typ	RV/RC4559 Max	Units
Input Offset Voltage	$R_S \leq 10k\Omega$		1.0	5.0		2.0	6.0	mV
Input Offest Current			5.0	100		5.0	100	nA
Input Bias Current			40	250		40	250	nA
Input Resistance (Differential Mode)		0.3	1.0		0.3	1.0		MΩ
Large Signal Voltage Gain	$R_L \geq 2k\Omega$ V_{OUT} = ±10V	50	300		20	300		V/mV
Output Voltage Swing	$R_L \geq 10k\Omega$	±12	±14		±12	±14		V
	$R_L \geq 2k\Omega$	±10	±13		±10	±13		V
	$R_L \geq 600\Omega$	±9.5	±10		±9.5	±10		V
Input Voltage Range		±12	±13		±12	±13		V
Common Mode Rejection Ratio	$R_S \leq 10k\Omega$	80	100		80	100		dB
Power Supply Rejection Ratio	$R_S \leq 10k\Omega$	82	100		82	100		dB
Supply Current	$R_L = \infty$		3.3	5.6		3.3	5.6	mA
Transient Response Rise Time	V_{IN} = 20mV R_L = 2kΩ		80			80		nS
Overshoot	$C_L \leq 100pF$		35			35		%
Slew Rate		1.5	2.0		1.5	2.0		V/μS
Unity Gain Bandwidth		3.0	4.0		3.0	4.0		MHz
Power Bandwidth	$V_O = 20V_{p-p}$	24	32		24	32		kHz
Input Noise Voltage	f = 20Hz to 20kHz		1.4	2.0		1.4	2.0	μV_{RMS}
Input Noise Current	f = 20Hz to 20kHz		25			25		pA_{RMS}
Channel Separation	Gain = 100, f = 10kHz R_S = 1kΩ		90			90		dB
The following specifications apply for -55°C ≤ T_A ≤ +125°C for RM4559; 0°C ≤ T_A ≤ +70°C for RC4559; -25°C ≤ T_A ≤ +85°C for RV4559								
Input Offset Voltage	$R_S \leq 10k\Omega$			6.0			7.5	mV
Input Offset Current				300			200	nA
Input Bias Current				500			500	nA
Large Signal Voltage Gain	$R_L \geq 2k\Omega$ V_{OUT} = ±10V	25			15			V/mV
Output Voltage Swing	$R_L \geq 2k\Omega$	±10			±10			V
Supply Current	$R_L = \infty$		4.0	6.6		4.0	6.6	mA

Typical Performance Characteristics

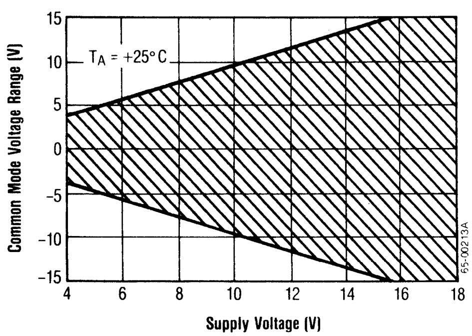
Input Bias Current as a Function of Ambient Temperature



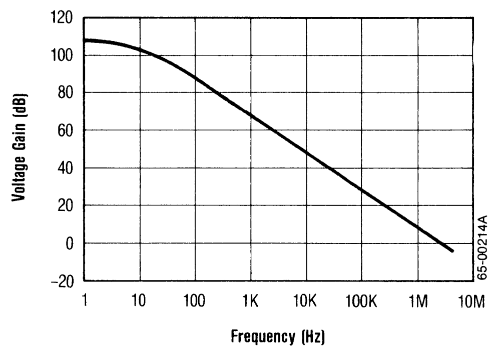
Input Offset Current as a Function of Ambient Temperature



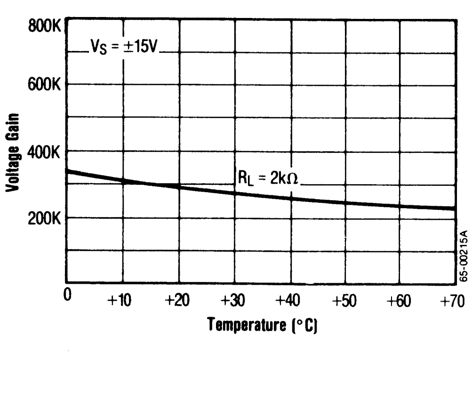
Common Mode Range as a Function of Supply Voltage



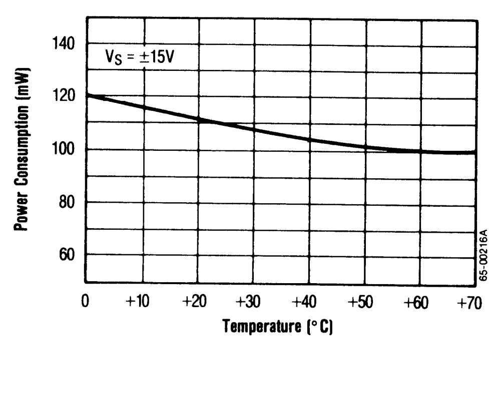
Open Loop Voltage Gain as a Function of Frequency



Open Loop Gain as a Function of Temperature

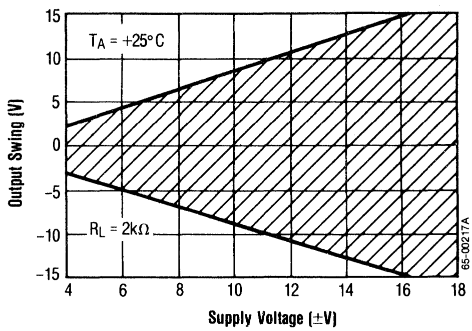


Power Consumption as a Function of Ambient Temperature

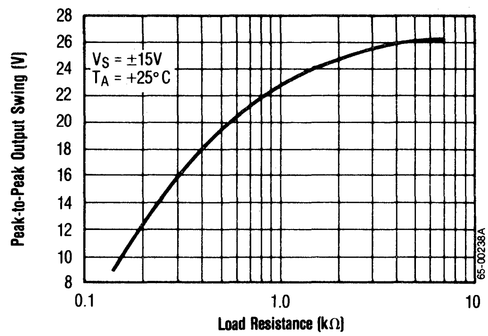


Typical Performance Characteristics (Continued)

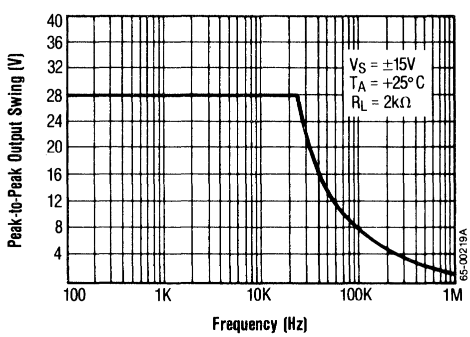
Typical Output Voltage as a Function of Supply Voltage



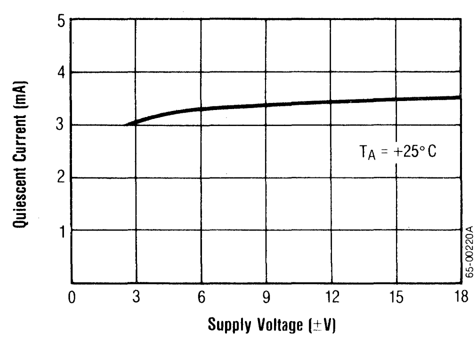
Output Voltage Swing as a Function of Load Resistance



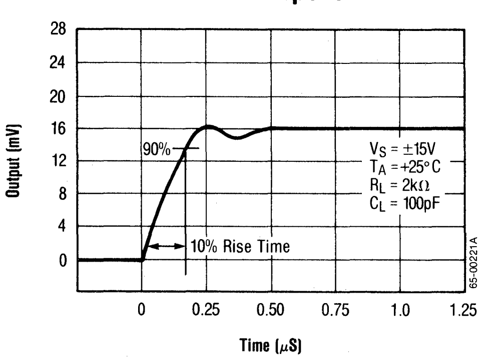
Output Voltage Swing as a Function of Frequency



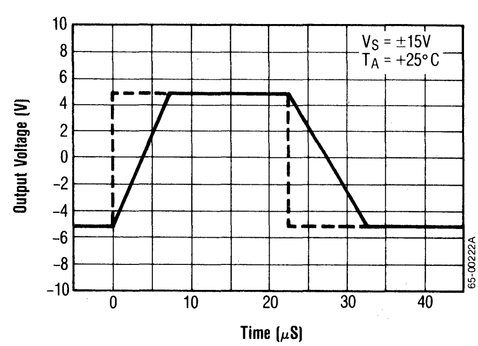
Quiescent Current as a Function of Supply Voltage



Transient Response

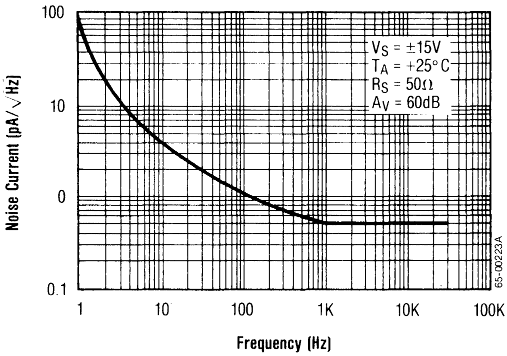


Voltage Follower Large Signal Pulse Response

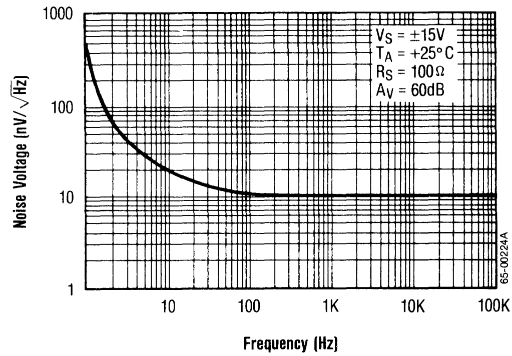


Typical Performance Characteristics (Continued)

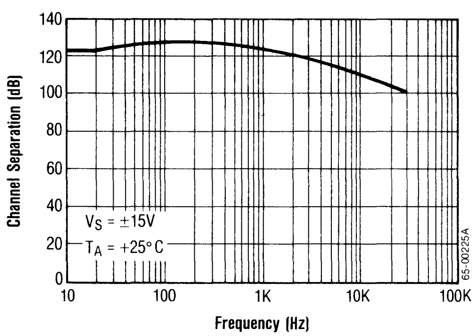
Input Noise Current as a Function of Frequency



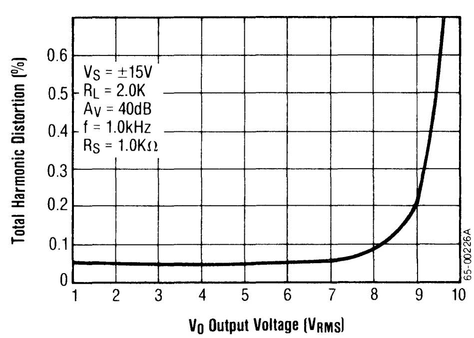
Input Noise Voltage as a Function of Frequency



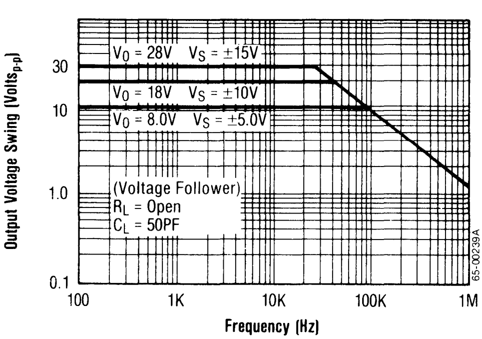
Channel Separation



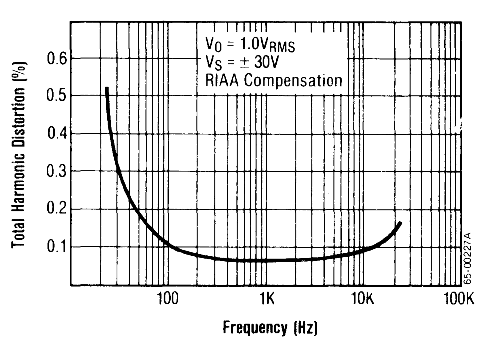
Total Harmonic Distortion vs. Output Voltage



Output Voltage Swing vs. Frequency

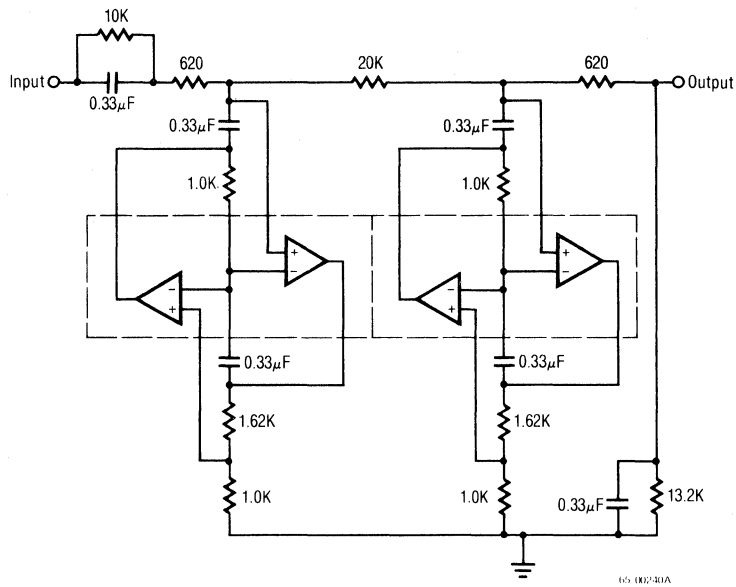


Distortion vs. Frequency

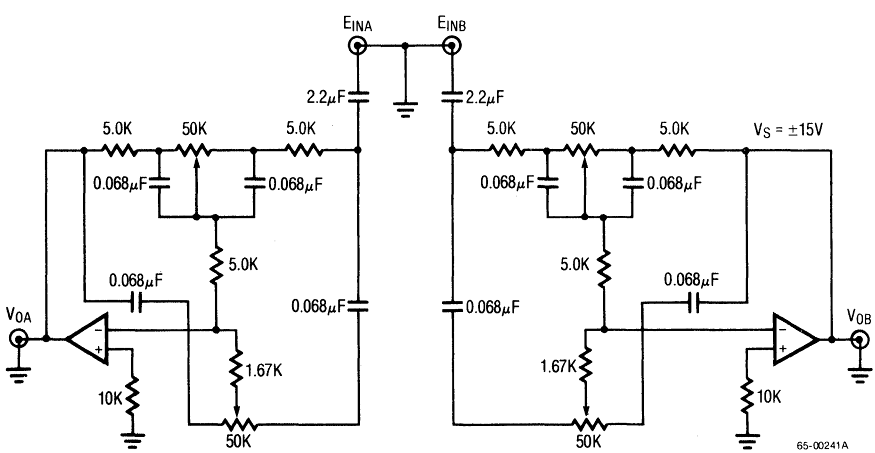


Typical Applications

400Hz Lowpass Butterworth Active Filter

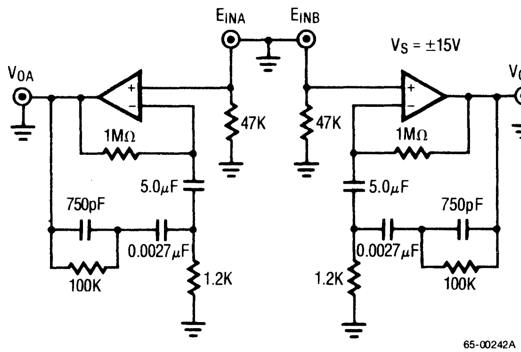


Stereo Tone Control

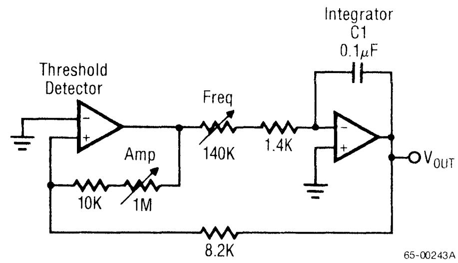


Typical Applications (Continued)

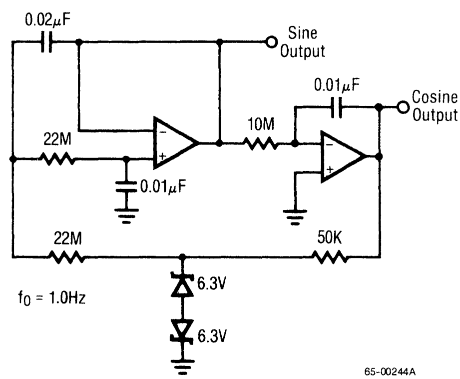
RIAA Preamplifier



Triangular-Wave Generator



Low Frequency Sine Wave Generator With Quadrature Output



Schematic Diagram