RC4558
Dual High-Gain Operational Amplifier

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.

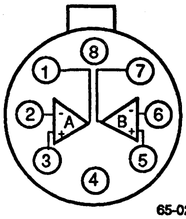
Combining the features of the 741 with the close parameter matching and tracking of a dual device on a monolithic chip results in unique performance characteristics. Excellent channel separation allows the use of this dual device in dense single 741 operational amplifier applications. It is especially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

Features

- 2.5 MHz unity gain bandwidth
- Supply voltage ±22V for RM4558 and ±18V for RC/RV4558
- 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

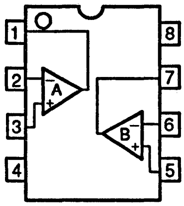
Connection Information

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



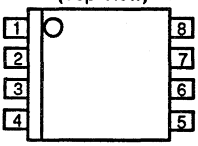
65-0209

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



65-0210

8-Lead Plastic
Dual In-Line SO-8
(Top View)



65-02666

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

Ordering Information

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

Absolute Maximum Ratings

Supply Voltage
RM4558 ....±22V
RC4558 ....±18V
Input Voltage[1] ....±15V
Differential Input Voltage 30V
Output Short Circuit Duration[2] .... Indefinite
Operating Temperature Range
RM4558 ....-55°C to +125°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

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

Thermal Characteristics

	8-Lead Small Outline	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	4.17 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	Test Conditions	RM/RC4558 Typ	Units
Voltage Gain	$R_L \geq 2$ kΩ	±1.0	dB
Input Bias Current	$R_L \geq 2$ kΩ	±15	nA
Input Offset Current	$R_L \geq 2$ kΩ	±7.5	nA

Linear

Electrical Characteristics

($V_S = \pm15V$ and $T_A = +25°C$ unless otherwise specified)

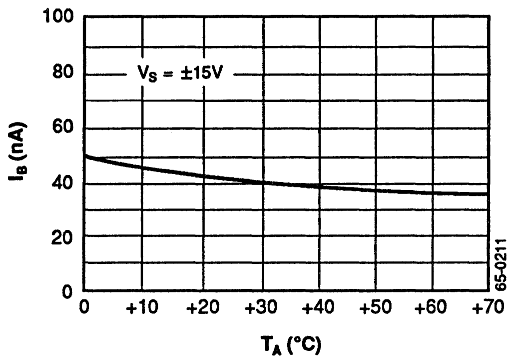
Parameters	Test Conditions	RM4558 Min	RM4558 Typ	RM4558 Max	RC4558 Min	RC4558 Typ	RC4558 Max	Units
Input Offset Voltage	$R_S \leq 10k\Omega$		1.0	5.0		2.0	6.0	mV
Input Offset Current			5.0	200		5.0	200	nA
Input Bias Current			40	500		40	500	nA
Input Resistance		0.3	1.0		0.3	1.0		MΩ
Large Signal Voltage Gain	$R_L \geq 2k\Omega$, $V_{OUT} = \pm10V$	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
Input Voltage Range		±12	±13		±12	±13		V
Common Mode Rejection Ratio	$R_S \leq 10k\Omega$	70	100		70	100		dB
Power Supply Rejection Ratio	$R_S \leq 10k\Omega$	76	100		76	100		dB
Power Consumption	$R_L = \infty$		100	170		100	170	mW
Transient Response	$V_{IN} = 20\ mV$							
Rise Time	$R_L = 2k\Omega$		0.3			0.3		µS
Overshoot	$C_L \leq 100pF$		35			35		%
Slew Rate	$R_L \geq 2k\Omega$		0.8			0.8		V/µS
Channel Separation	$F = 10kHz$, $R_S = 1k\Omega$		90			90		dB
Unity Gain Bandwidth (Gain = 1)		2.5	3.0		2.0	3.0		MHz

The following specifications apply for RM = $-55°C \leq T_A \leq +125°C$, RC = $0° \leq T_A \leq +70°C$

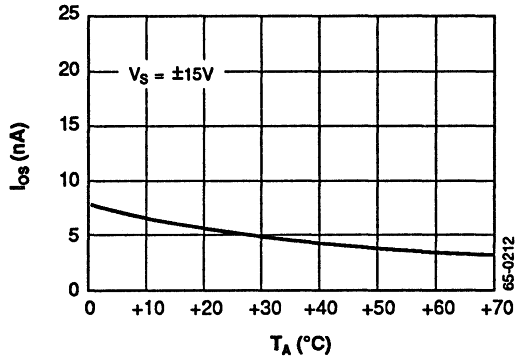
Input Offset Voltage	$R_S \leq 10k\Omega$			6.0			7.5	mV
Input Offset Current RC4558				500			300	nA
Input bias Current RC4558				1500			800	nA
Large Signal Voltage Gain	$R_L \geq 2k\Omega$, $V_{OUT} = \pm10$	25			15			V/mV
Output Voltage Swing	$R_L \geq 2k\Omega$	±10			±10			V
Power Consumption	$R_L = \infty$		120	200		120	200	mW

Typical Performance Characteristics

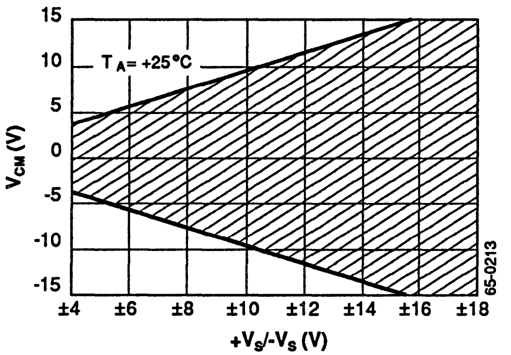
Input Bias Current vs. Temperature



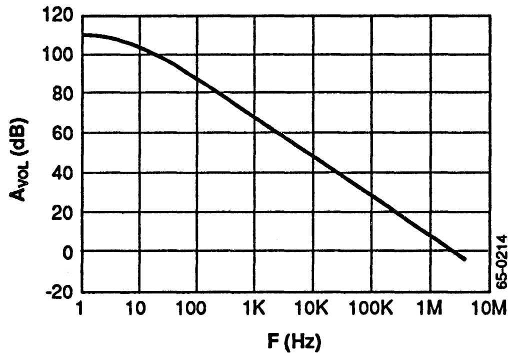
Input Offset Current vs. Temperature



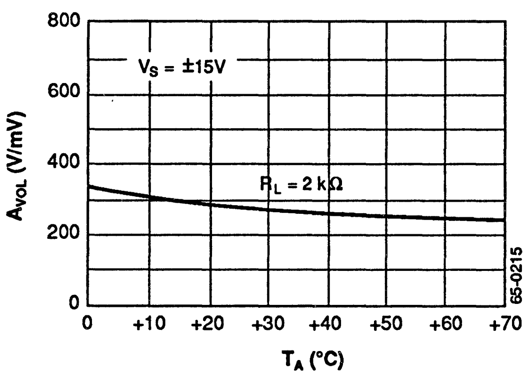
Input Common Mode Voltage Range vs. Supply Voltage



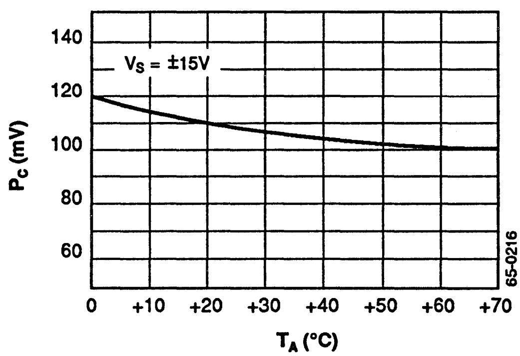
Open Loop Voltage Gain vs. Frequency



Open Loop Voltage Gain vs. Temperature



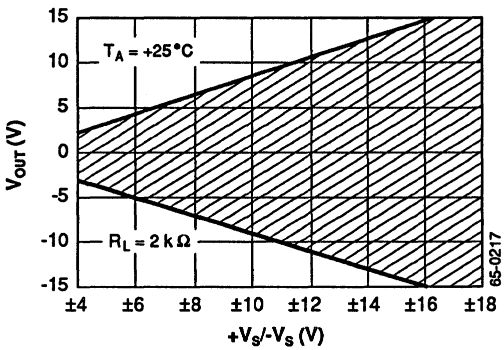
Power Consumption vs. Temperature



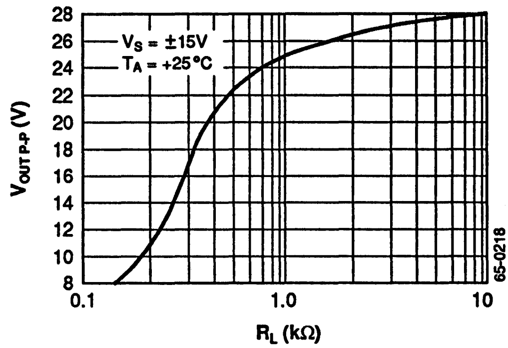
Linear

Typical Performance Characteristics (Continued)

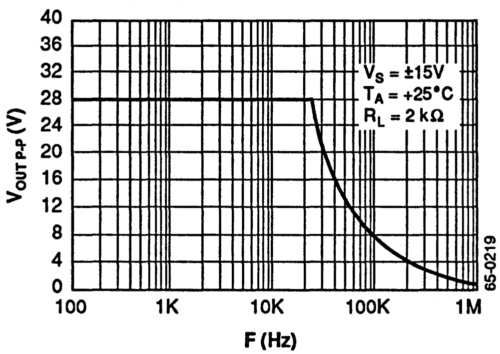
Output Voltage Swing vs. Supply Voltage



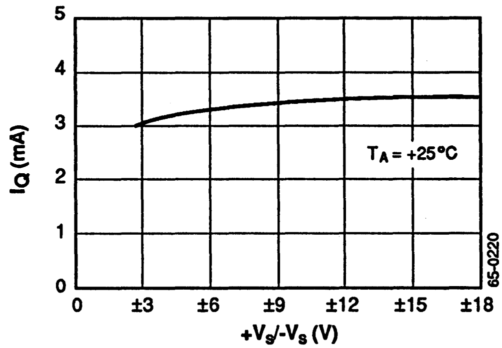
Output Voltage Swing vs. Load Resistance



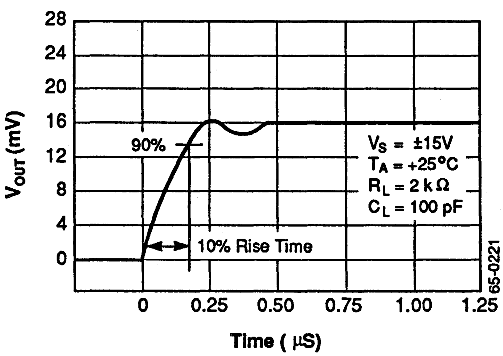
Output Voltage Swing vs. Frequency



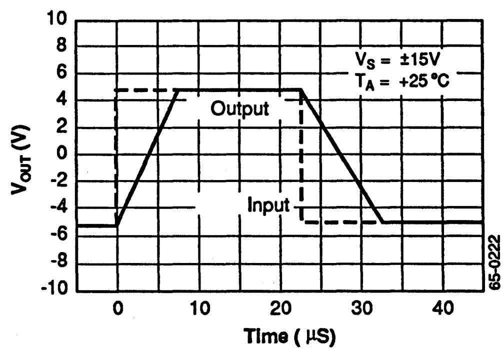
Quiescent Current vs. Supply Voltage



Transient Response
Output Voltage vs. Time

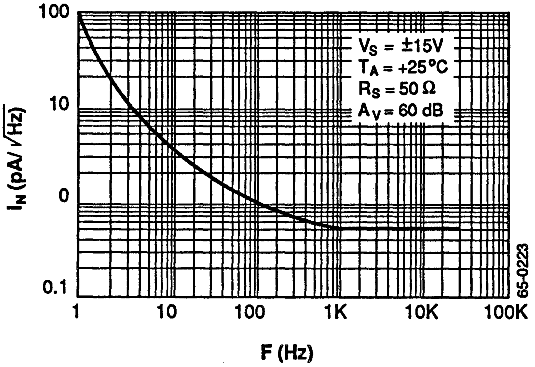


Follower Large Signal Pulse Response
Output Voltage vs. Time

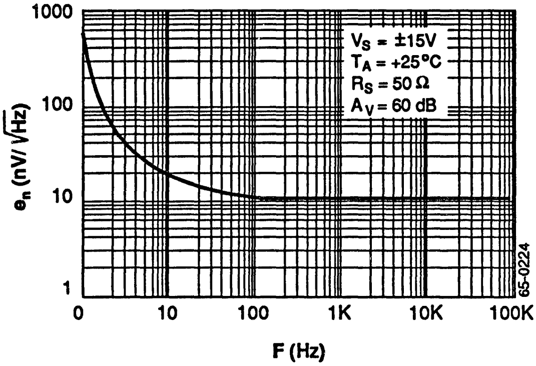


Typical Performance Characteristics (Continued)

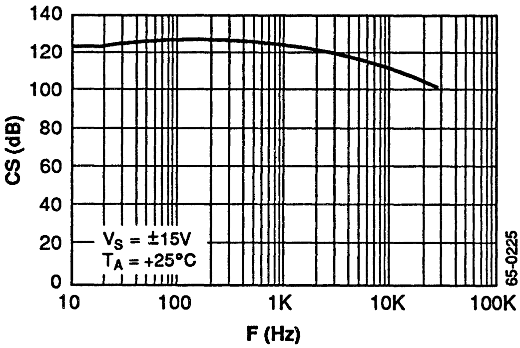
Input Noise Current Density vs. Frequency



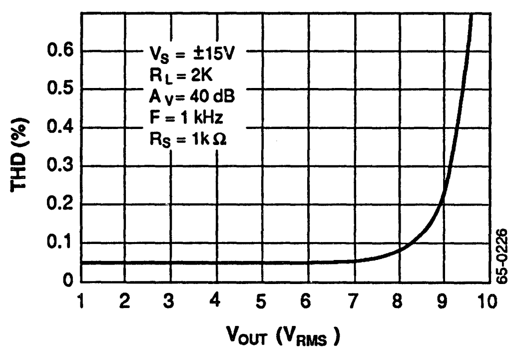
Input Noise Voltage Density vs. Frequency



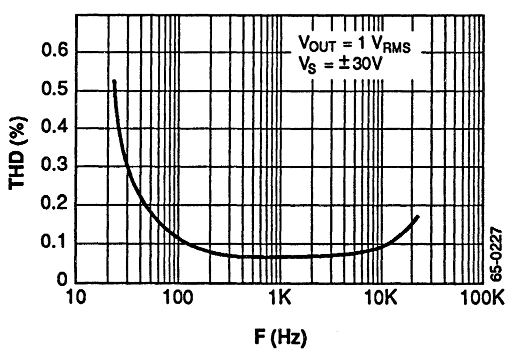
Channel Separation vs. Frequency



Total Harmonic Distortion vs. Output Voltage



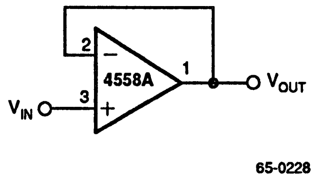
Distortion vs. Frequency



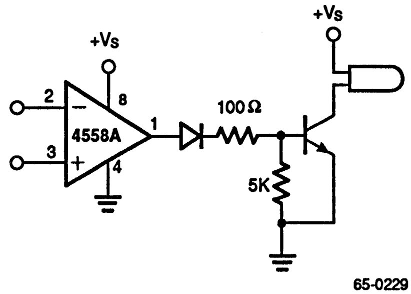
Linear

Typical Applications

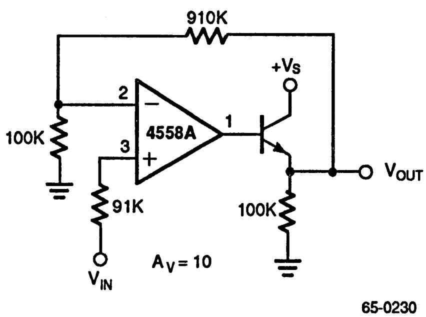
Voltage Follower



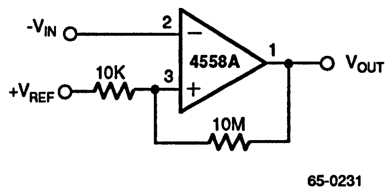
Lamp Driver



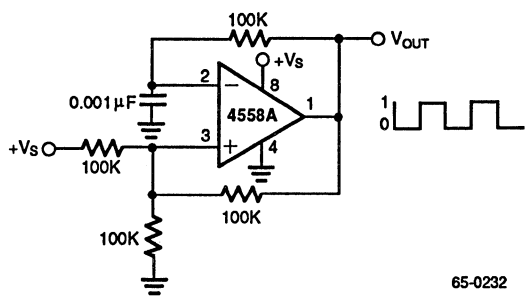
Power Amplifier



Comparator With Hysteresis

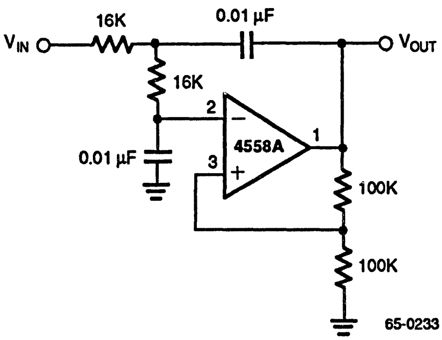


Squarewave Oscillator

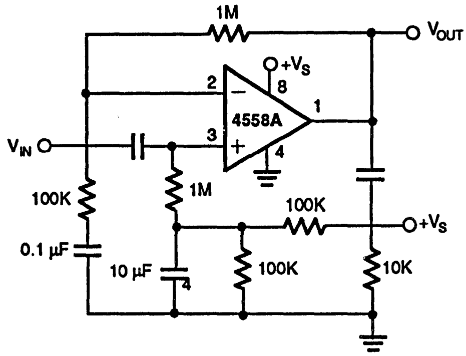


Typical Applications (Continued)

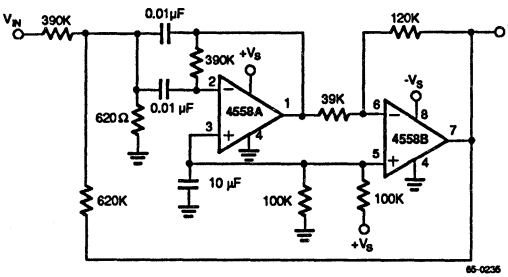
DC Coupled 1kHz Low-Pass Active Filter



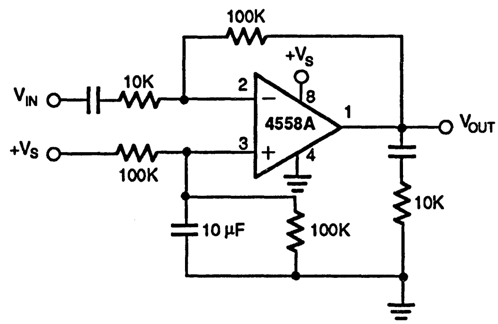
AC Coupled Non-Inverting Amplifier



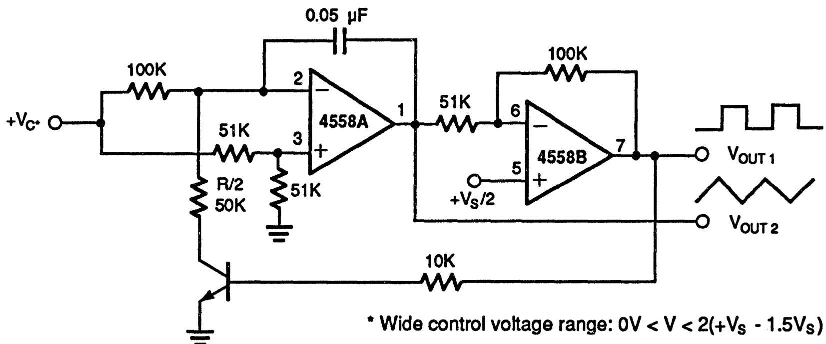
1kHz Bandpass Active Filter



AC Coupled Inverting Amplifier



Voltage Controlled Oscillator (VCO)

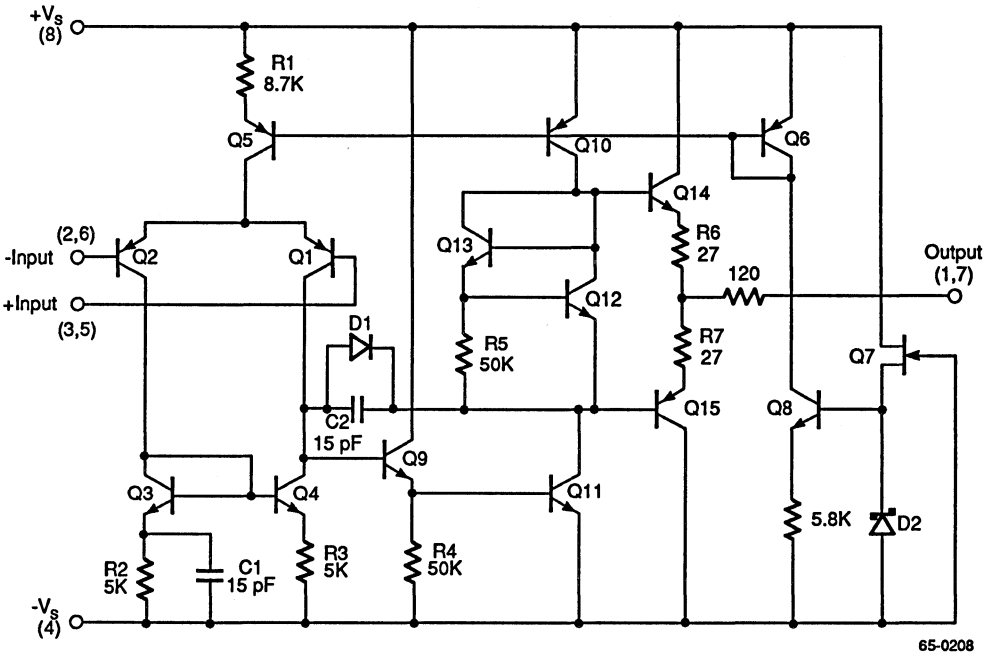


* Wide control voltage range: $0V < V < 2(+V_S - 1.5V_S)$

65-0237

Linear

Schematic Diagram



RC4559
High-Gain Dual Operational Amplifier

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.

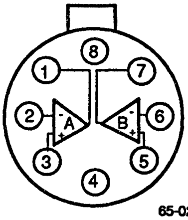
The 4559 also has more output drive capability than 741-type amplifiers and can be used to drive a 600Ω load.

Features

- Unity gain bandwidth — 4.0 MHz
- Slew rate — 2.0 V/µS
- Low noise voltage — 1.4 μV_{RMS}
- Supply voltage — ±22V for RM4559 and ±18V for RC/RV4559
- 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

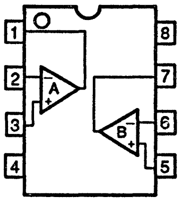
Connection Information

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



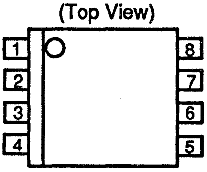
65-0209

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



65-0210

8-Lead Plastic
Dual In-Line SO-8
(Top View)



65-02666

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

Ordering Information

Part Number	Package	Operating Temperature Range
RC4559M	M	0°C to +70°C
RC4559N	N	0°C to +70°C
RC4559D	D	0°C to +70°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

Absolute Maximum Ratings

Supply Voltage
- RM4559 ....±22V
- RC4559 ....±18V

Input Voltage[1] ....±15V
Differential Input Voltage 30V
Output Short Circuit Duration[2] .... Indefinite
Operating Temperature Range
- RM4559 ....-55°C to +125°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

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

Thermal Characteristics

	8-Lead Small Outline	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	4.17 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	Test Conditions	RM/RC4559 Typ	Units
Voltage Gain	$R_L \geq 2$ kΩ	±1.0	dB
Input Bias Current		±15	nA
Input Offset Current		±7.5	nA

Linear

Electrical Characteristics

($V_S = \pm 15V$ and $T_A = +25°C$ unless otherwise specified)

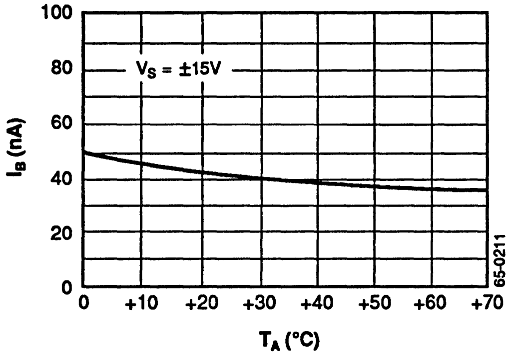
Parameters	Test Conditions	RM4559 Min	RM4559 Typ	RM4559 Max	/RC4559 Min	/RC4559 Typ	/RC4559 Max	Units
Input Offset Voltage	$R_S \leq 10k\Omega$		1.0	5.0		2.0	6.0	mV
Input Offset Current			5.0	100		5.0	100	nA
Input Bias Current			40	250		40	250	nA
Input Resistance (Differential Mode)		0.3	1.0		0.3	1.0		MΩ
Large Signal Voltage Gain	$R_L \geq 2k\Omega$, $V_{OUT} = \pm 10V$	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	$V_{IN} = 20mV$							
Rise Time	$R_L = 2k\Omega$		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	$V_{OUT} = 20V_{p-p}$	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, $R_S = 1k\Omega$		90			90		dB

The following specifications apply for RM = $-55°C \leq T_A \leq +125°C$, RC = $0°C \leq T_A \leq +70°C$ RM4559/RC4559

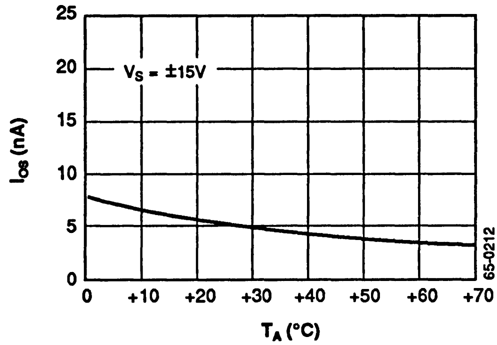
Parameters	Test Conditions	RM4559 Min	RM4559 Typ	RM4559 Max	/RC4559 Min	/RC4559 Typ	/RC4559 Max	Units
Input Offset Voltage	$R_S \leq 10k\Omega$			6.0			7.5	mV
Input Offset Current				300			200	nA
Input Bias Current				500			500	nA
Large Signal Voltage Gain	$R_L \geq 2k\Omega$, $V_{OUT} = \pm 10V$	25			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

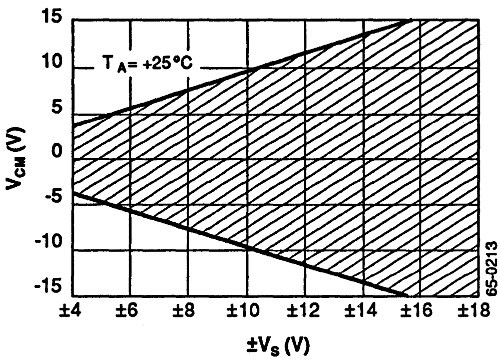
Input Bias Current vs. Temperature



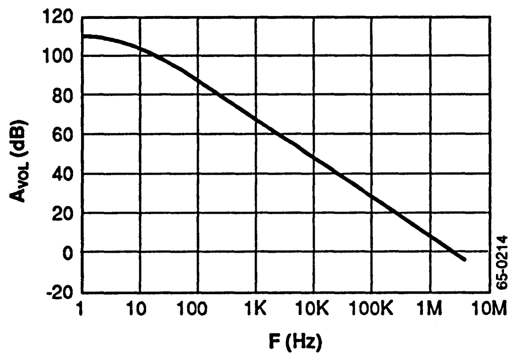
Input Offset Current vs. Temperature



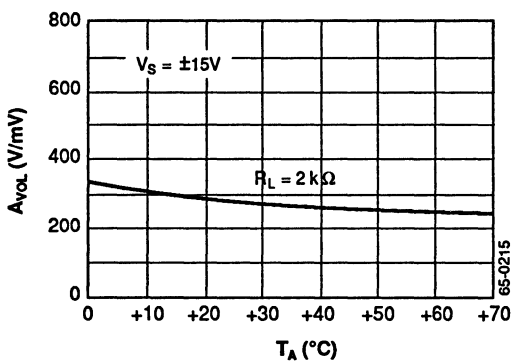
Input Common Mode Voltage Range vs. Supply Voltage



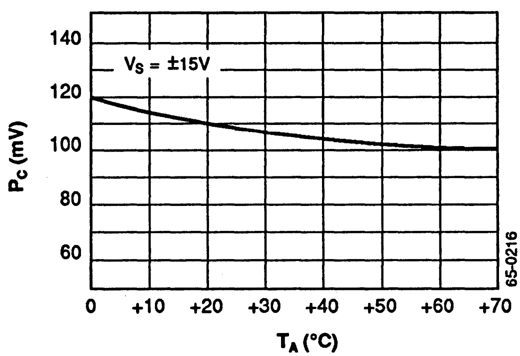
Open Loop Voltage Gain vs. Frequency



Open Loop Voltage Gain vs. Temperature

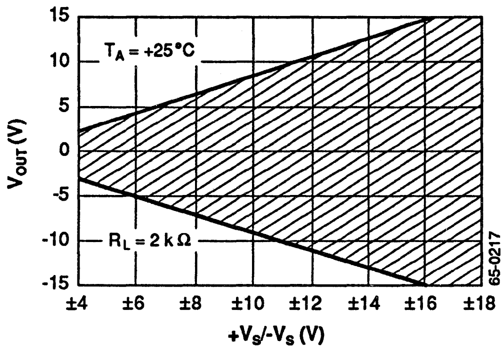


Power Consumption vs. Temperature

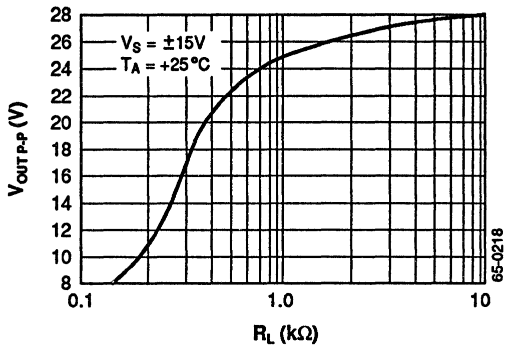


Typical Performance Characteristics (Continued)

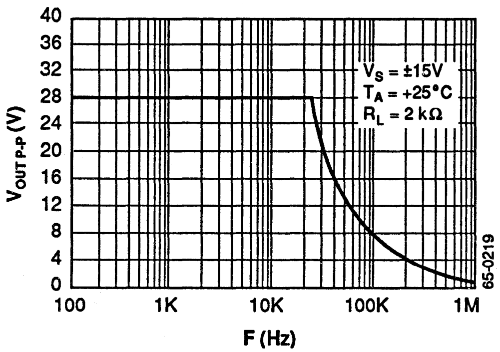
Output Voltage Swing vs. Supply Voltage



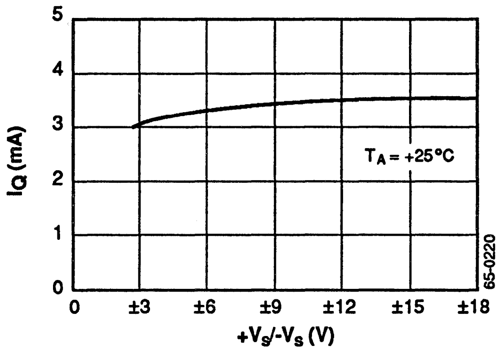
Output Voltage Swing vs. Load Resistance



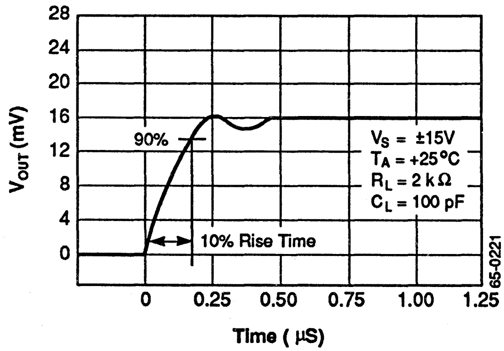
Output Voltage Swing vs. Frequency



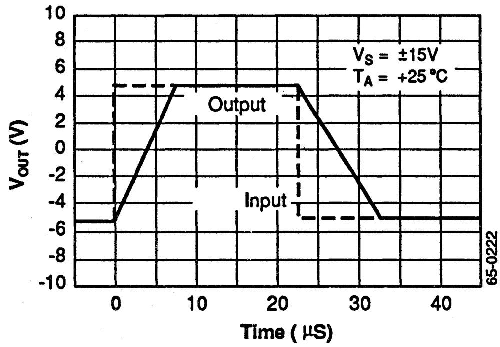
Quiescent Current vs. Supply Voltage



Transient Response
Output Voltage vs. Time

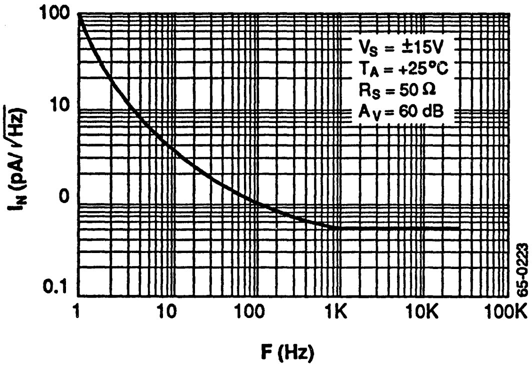


Follower Large Signal Pulse Response
Output Voltage vs. Time

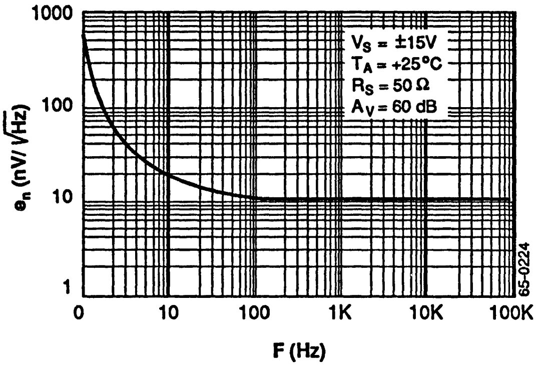


Typical Performance Characteristics (Continued)

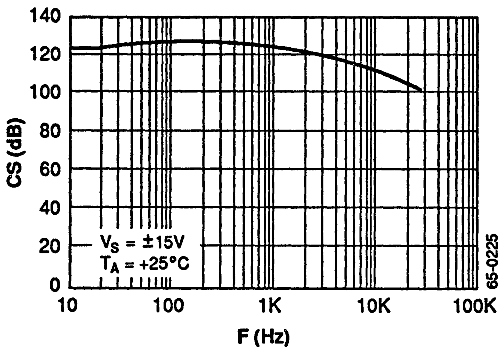
Input Noise Current Density vs. Frequency



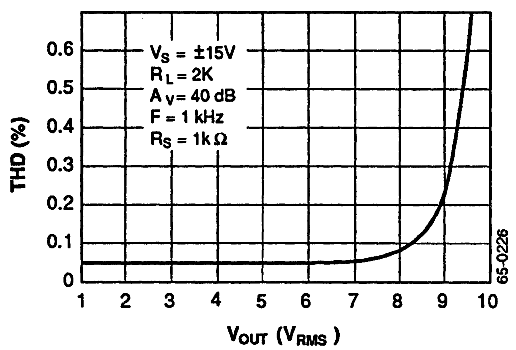
Input Noise Voltage Density vs. Frequency



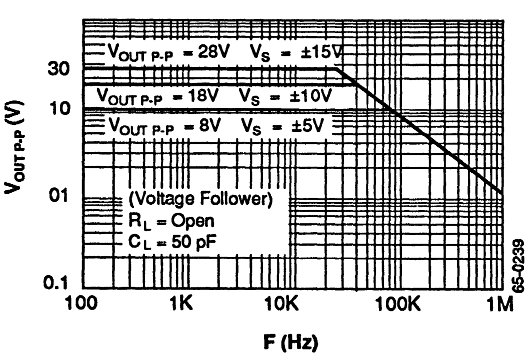
Channel Separation vs. Frequency



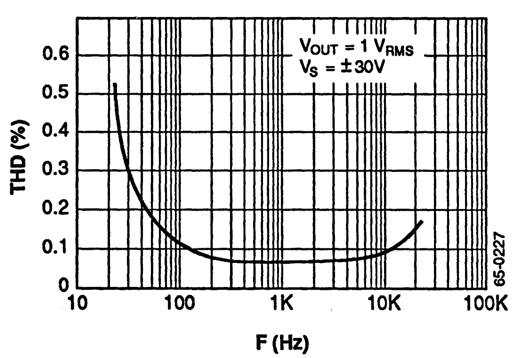
Total Harmonic Distortion vs. Output Voltage



Output Voltage Swing vs. Frequency



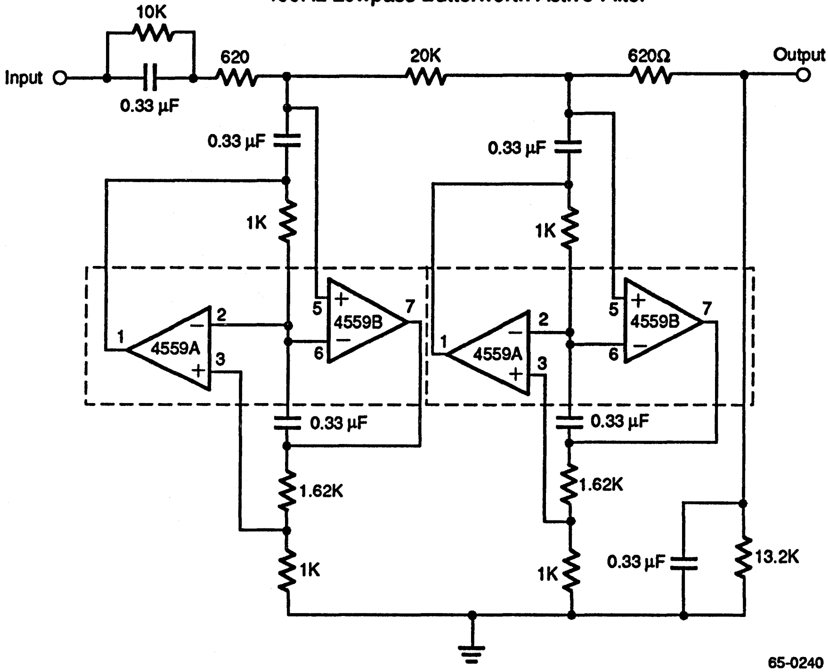
Total Harmonic Distortion vs. Frequency



Linear

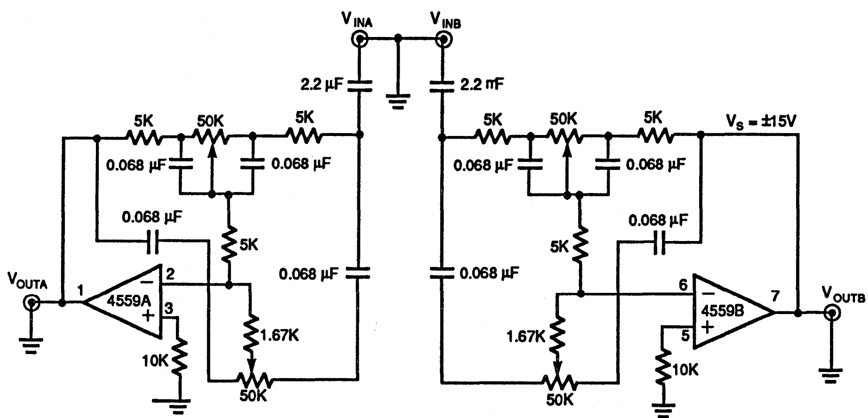
Typical Applications

400Hz Lowpass Butterworth Active Filter



65-0240

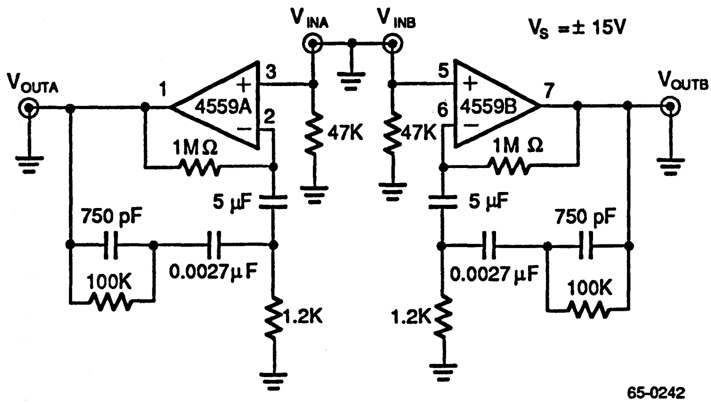
Stereo Tone Control



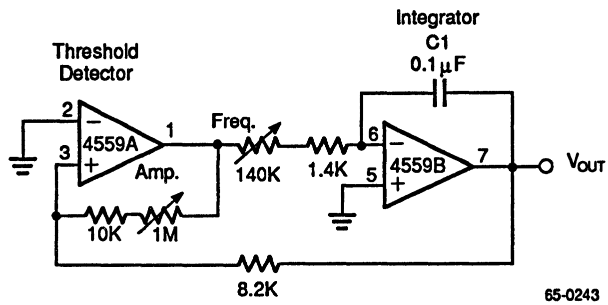
65-0241

Typical Applications (Continued)

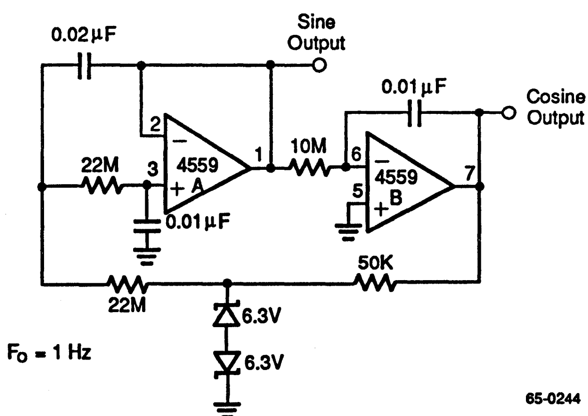
RIAA Preamplifier



Triangular-Wave Generator



Low Frequency Sine Wave Generator with Quadrature Output



Schematic Diagram