

デュアル/クワッド・マイクロパワー 260 μ W C-Loadピコアンペア バイアス電流JFET入力オペアンプ

特長

- 入力バイアス電流：20pA最大
- 電源電流/アンプ：45 μ A最大
- C-Load™によって10nFまでユニティゲインで安定
- 入力同相範囲には正レールが含まれる
- $\pm 5V$ 、 $\pm 15V$ 電源でスペックを保証
- 利得バンド幅積：175kHz標準
- スルーレート：0.13V/ μ s標準
- マッチング特性を保証
- 標準ピン配置：SO-8、SO-14パッケージ

アプリケーション

- バッテリー電源機器
- フォトカレント・アンプ
- 低周波、マイクロパワー・アクティブフィルタ
- 低垂下りトラック&ホールド回路

概要

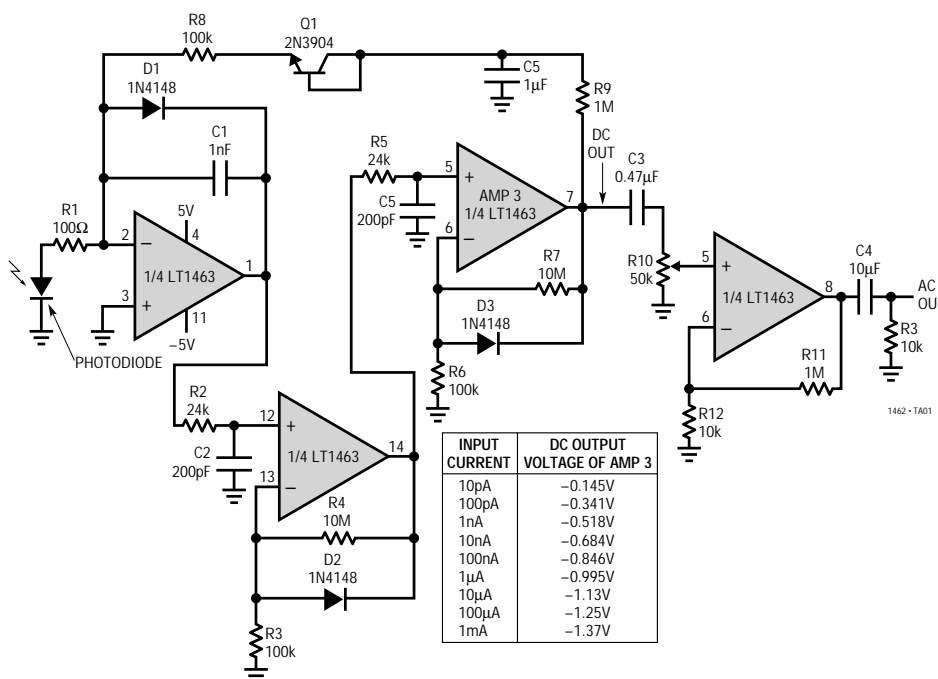
LT®1462(デュアル)およびLT1463(クワッド)は、ピコアンペア入力バイアス電流(1pA標準)と10nFまでの容量性負荷に対してユニティゲイン安定動作を提供する最初のマイクロパワー・オペアンプ(1アンプあたり最大45 μ A)です。出力は、1桁以上高い電流を必要とするオペアンプと同様に、10k負荷をいずれかの電源の1.5V以内に振幅させることができます。このユニークな性能を兼ね備えているため、LT1462/LT1463は広範な入力および出力インピーダンスに対し最適なデバイスです。

LT1462/LT1463の設計およびテストでは、特に $\pm 15V$ および $\pm 5V$ 電源を使用する低コストのSO-8(デュアル)および14ピンSOパッケージ(クワッド)で最適な性能が得られるよう配慮されています。入力同相範囲には正電源レールが含まれます。また、スルーレート(0.08V/ μ s最小)と利得バンド幅積(125kHz最小)は100%テストされています。さらに、完全なマッチング仕様も提供されています。

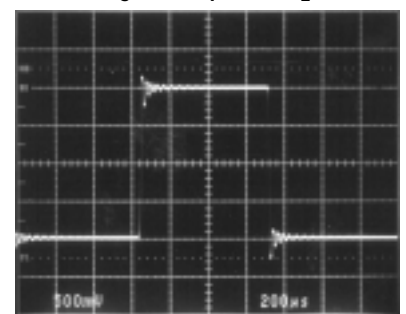
LT、LTC、LTはリアテクノロジー社の登録商標です。
C-Loadはリアテクノロジーの商標です。

TYPICAL APPLICATION

Low Power Logging Amplifier



Small-Signal Response, $C_L = 10nF$



$A_V = 1$
 $V_S = \pm 5V, \pm 15V$
 $C_L = 10nF$

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	±20V	Specified Temperature Range	-40°C to 85°C
Differential Input Voltage	±40V	Maximum Junction Temperature	150°C
Input Current	20mA	Storage Temperature Range	-65°C to 150°C
Output Short-Circuit Duration	Indefinite	Lead Temperature (Soldering, 10 sec)	300°C
Operating Temperature Range	-40°C to 85°C		

PACKAGE/ORDER INFORMATION

<p>N8 PACKAGE 8-LEAD PDIP</p> <p>S8 PACKAGE 8-LEAD PLASTIC SO</p> <p>$T_{JMAX} = 150^{\circ}C, \theta_{JA} = 130^{\circ}C/W (N)$ $T_{JMAX} = 150^{\circ}C, \theta_{JA} = 190^{\circ}C/W (S)$</p>	ORDER PART NUMBER	<p>N PACKAGE 14-LEAD PDIP</p> <p>S PACKAGE 14-LEAD PLASTIC SO</p> <p>$T_{JMAX} = 150^{\circ}C, \theta_{JA} = 110^{\circ}C/W (N)$ $T_{JMAX} = 150^{\circ}C, \theta_{JA} = 150^{\circ}C/W (S)$</p>	ORDER PART NUMBER
	LT1462CN8 LT1462CS8		LT1463CN LT1463CS
	S8 PART MARKING		
	1462		

Consult factory for Industrial and Military grade parts.

ELECTRICAL CHARACTERISTICS $V_S = \pm 15V, V_{CM} = 0V, T_A = 25^{\circ}C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS (Note 1)	MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	$V_S = \pm 5V$		0.4	0.8	mV
		$V_S = \pm 15V$		0.6	2.0	mV
I_{OS}	Input Offset Current			0.5	15	pA
I_B	Input Bias Current			±1	±20	pA
e_n	Input Noise Voltage	0.1Hz to 10Hz		2		μV_{p-p}
	Input Noise Voltage Density	$f_0 = 10Hz$		92		nV/\sqrt{Hz}
		$f_0 = 1000Hz$		76		nV/\sqrt{Hz}
	Input Noise Current Density	$f_0 = 10Hz, 1kHz$ (Note 3)		0.5		fA/\sqrt{Hz}
CMRR	Common Mode Rejection Ratio	$V_{CM} = -12.5V$ to 15V	74	89		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 2.5V$ to $\pm 20V$	78	90		dB
R_{IN}	Input Resistance—Differential Common Mode Common Mode	$V_{CM} = -12.5V$ to 8V		10^{12}		Ω
		$V_{CM} = 8V$ to 15V		10^{12}		Ω
				10^{11}		Ω
C_{IN}	Input Capacitance			3		pF
A_{VOL}	Large-Signal Voltage Gain	$V_0 = \pm 10V, R_L = 10k$	100	600		V/mV
		$V_S = \pm 5V, V_0 = \pm 2V, R_L = 10k$	50	200		V/mV

ELECTRICAL CHARACTERISTICS $V_S = \pm 15V$, $V_{CM} = 0V$, $T_A = 25^\circ C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS (Note 1)	MIN	TYP	MAX	UNITS
V_{OUT}	Output Voltage Swing	$R_L = 10k$	± 13.5	± 13.7		V
		$R_L = 2k$	± 11.0	± 12.4		V
		$V_S = \pm 5V$, $R_L = 2k$	± 3.5	± 3.7		V
I_O	Output Current		± 13	± 17		mA
SR	Slew Rate	(Note 4) $R_L = 10k$	0.08	0.13		V/ μs
GBW	Gain Bandwidth Product	$f = 10kHz$	125	175		kHz
I_S	Supply Current per Amplifier	$V_S = \pm 5V$		28	45	μA
					26	43
	Channel Separation	$f = 10Hz$, $V_O = \pm 10V$, $R_L = 10k$		132		dB
V_{OS}	Offset Voltage Match (Note 7)	$V_S = \pm 5V$ $V_S = \pm 15V$		0.5	1.3	mV
				0.8	3.0	mV
ΔI_B^+	Noninverting Bias Current Match (Note 7)			0.5	20	pA
$\Delta CMRR$	Common Mode Rejection Match	(Notes 5, 7)	72	85		dB
$\Delta PSRR$	Power Supply Rejection Match	(Notes 5, 7)	76	88		dB

$V_S = \pm 15V$, $V_{CM} = 0V$, $0^\circ C \leq T_A \leq 70^\circ C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS (Note 1)	MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	$V_S = \pm 5V$ $V_S = \pm 15V$	●	0.5	1.4	mV
			●	0.9	2.8	mV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Input Offset Voltage Drift	(Note 6)	●	7	20	$\mu V/^\circ C$
I_{OS}	Input Offset Current		●	25	450	pA
I_B	Input Bias Current		●	150	750	pA
CMRR	Common Mode Rejection Ratio	$V_{CM} = -12V$ to $15V$	●	72	88	dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 3V$ to $\pm 20V$	●	76	89	dB
A_{VOL}	Large-Signal Voltage Gain	$V_O = \pm 10V$, $R_L = 10k$ $V_S = \pm 5V$, $V_O = \pm 2V$, $R_L = 10k$	●	90	600	V/mV
			●	45	140	V/mV
I_O	Output Current		●	± 11	± 14	mA
V_{OUT}	Output Voltage Swing	$R_L = 10k$ $R_L = 2k$ $V_S = \pm 5V$, $R_L = 2k$	●	± 13.4	± 13.6	V
			●	± 10.5	± 12.1	V
			●	± 3.4	± 3.6	V
SR	Slew Rate	$R_L = 10k$ (Note 4)	●	0.075	0.128	V/ μs
GBW	Gain Bandwidth Product	$f = 10kHz$	●	100	140	kHz
I_S	Supply Current per Amplifier	$V_S = \pm 5V$	●	31	45	μA
			●	28	43	μA
V_{OS}	Offset Voltage Match (Note 7)	$V_S = \pm 5V$ $V_S = \pm 15V$	●	0.7	2.0	mV
			●	0.9	3.5	mV
ΔI_B^+	Noninverting Bias Current Match (Note 7)		●	35	500	pA
$\Delta CMRR$	Common Mode Rejection Match	(Notes 5, 7)	●	70	84	dB
$\Delta PSRR$	Power Supply Rejection Match	(Notes 5, 7)	●	74	87	dB

ELECTRICAL CHARACTERISTICS $V_S = \pm 15V$, $V_{CM} = 0V$, $-40^\circ C \leq T_A \leq 85^\circ C$ (Note 2), unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS (Note 1)	MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	$V_S = \pm 5V$	●	0.6	1.5	mV
		$V_S = \pm 15V$	●	1.0	3.0	mV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Input Offset Voltage Drift	(Note 6)	●	7	20	$\mu V/^\circ C$
I_{OS}	Input Offset Current		●	60	700	pA
I_B	Input Bias Current		●	300	2500	pA
CMRR	Common Mode Rejection Ratio	$V_{CM} = -12V$ to $15V$	●	70	87	dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 3V$ to $\pm 20V$	●	74	88	dB
A_{VOL}	Large-Signal Voltage Gain	$V_O = \pm 10V$, $R_L = 10k$	●	80	500	V/mV
		$V_S = \pm 5V$, $V_O = \pm 2V$, $R_L = 10k$	●	40	120	V/mV
I_O	Output Current		●	± 10	± 13	mA
V_{OUT}	Output Voltage Swing	$R_L = 10k$	●	± 13.2	± 13.4	V
		$R_L = 2k$	●	± 10.0	± 11.8	V
		$V_S = \pm 5V$, $R_L = 2k$	●	± 3.2	± 3.4	V
SR	Slew Rate	$R_L \geq 10k$ (Note 4)	●	0.070	0.126	V/ μs
GBW	Gain Bandwidth Product	$f = 10kHz$	●	95	135	kHz
I_S	Supply Current per Amplifier		●	33	50	μA
		$V_S = \pm 5V$	●	31	48	μA
V_{OS}	Offset Voltage Match (Note 7)	$V_S = \pm 5V$	●	0.8	2.5	mV
		$V_S = \pm 15V$	●	1.0	4.0	mV
ΔI_B^+	Noninverting Bias Current Match (Note 7)		●	70	800	pA
$\Delta CMRR$	Common Mode Rejection Match	(Notes 5, 7)	●	68	83	dB
$\Delta PSRR$	Power Supply Rejection Match	(Notes 5, 7)	●	72	86	dB

The ● denotes specifications which apply over the full operating temperature range.

Note 1: Typical parameters are defined as 60% yield of parameter distributions of individual amplifiers, i.e., out of 100 LT1463s (or 100 LT1462s) typically 240 op amps (or 120) will be better than the indicated specification.

Note 2: The LT1462 and LT1463 are designed, characterized and expected to meet these extended temperature limits, but are not tested at $-40^\circ C$ and $85^\circ C$. Guaranteed I grade parts are available, consult factory.

Note 3: Current noise is calculated from the formula: $i_n = (2qI_b)^{1/2}$ where $q = (1.6)(10^{-19})$ coulomb. The noise of source resistors up to 1G swamps the contribution of current noise.

Note 4: Slew rate is measured in $A_V = -1$; input signal is $\pm 7.5V$, output is measured at $\pm 2.5V$.

Note 5: $\Delta CMRR$ and $\Delta PSRR$ are defined as follows:

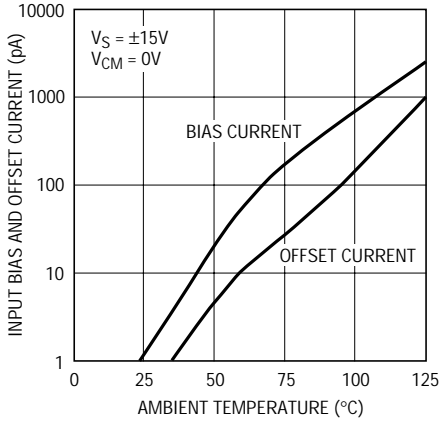
1. CMRR and PSRR are measured in $\mu V/V$ on the individual amplifiers.
2. The difference is calculated between the matching sides in $\mu V/V$.
3. The result is converted to dB.

Note 6: This parameter is not 100% tested.

Note 7: Matching parameters are the difference between amplifiers A and D and between B and C on the LT1463; between the two amplifiers on the LT1462.

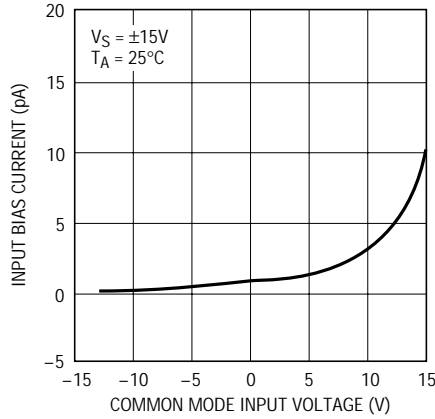
TYPICAL PERFORMANCE CHARACTERISTICS

Input Bias and Offset Current vs Temperature



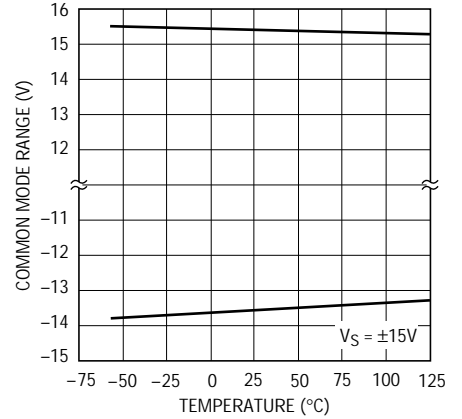
LT1462 • TPC01

Input Bias Current Over the Common Mode Range



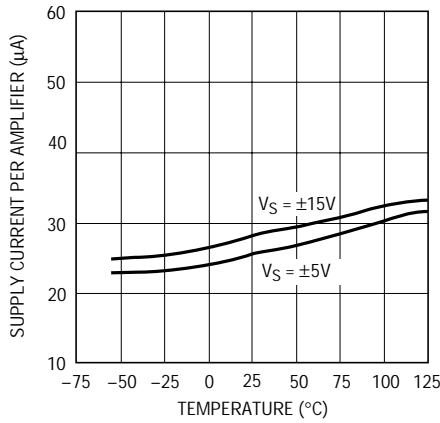
LT1462 • TPC02

Common Mode Range vs Temperature



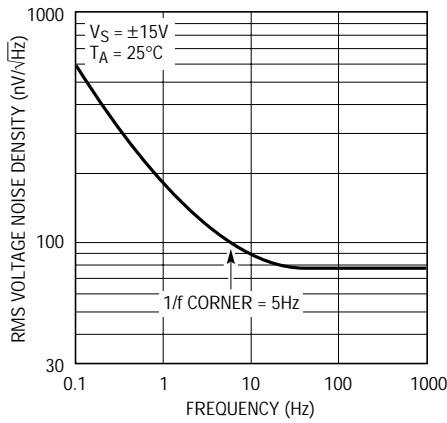
LT1462 • TPC03

Supply Current vs Temperature



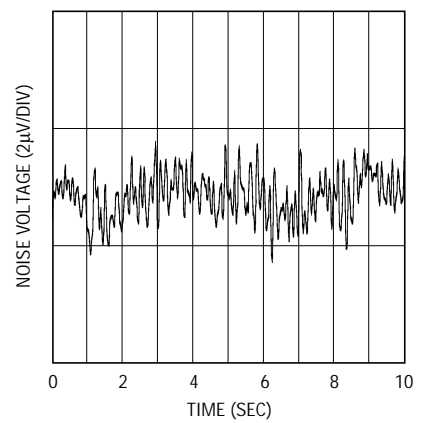
LT1462 • TPC04

Voltage Noise vs Frequency



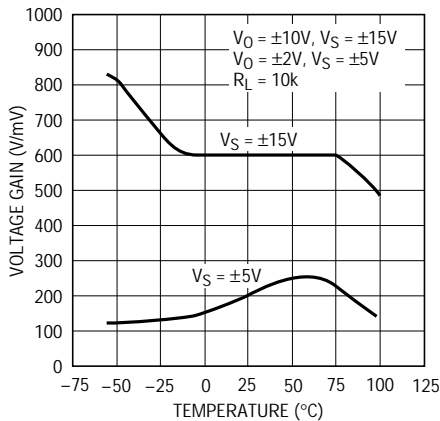
LT1462 • TPC05

0.1Hz to 10Hz Noise



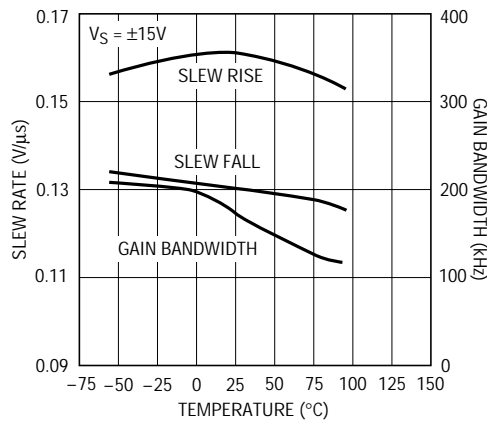
LT1462 • TPC06

Voltage Gain vs Temperature



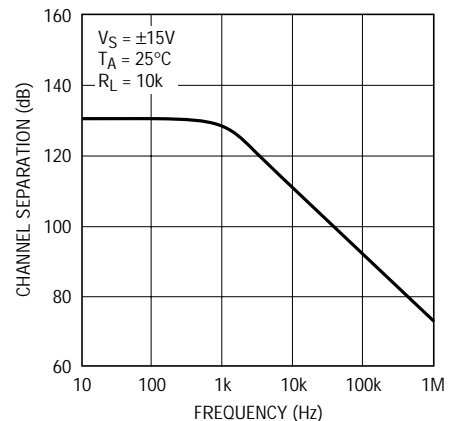
LT1463 • TPC07

Slew Rate, Gain Bandwidth Product vs Temperature



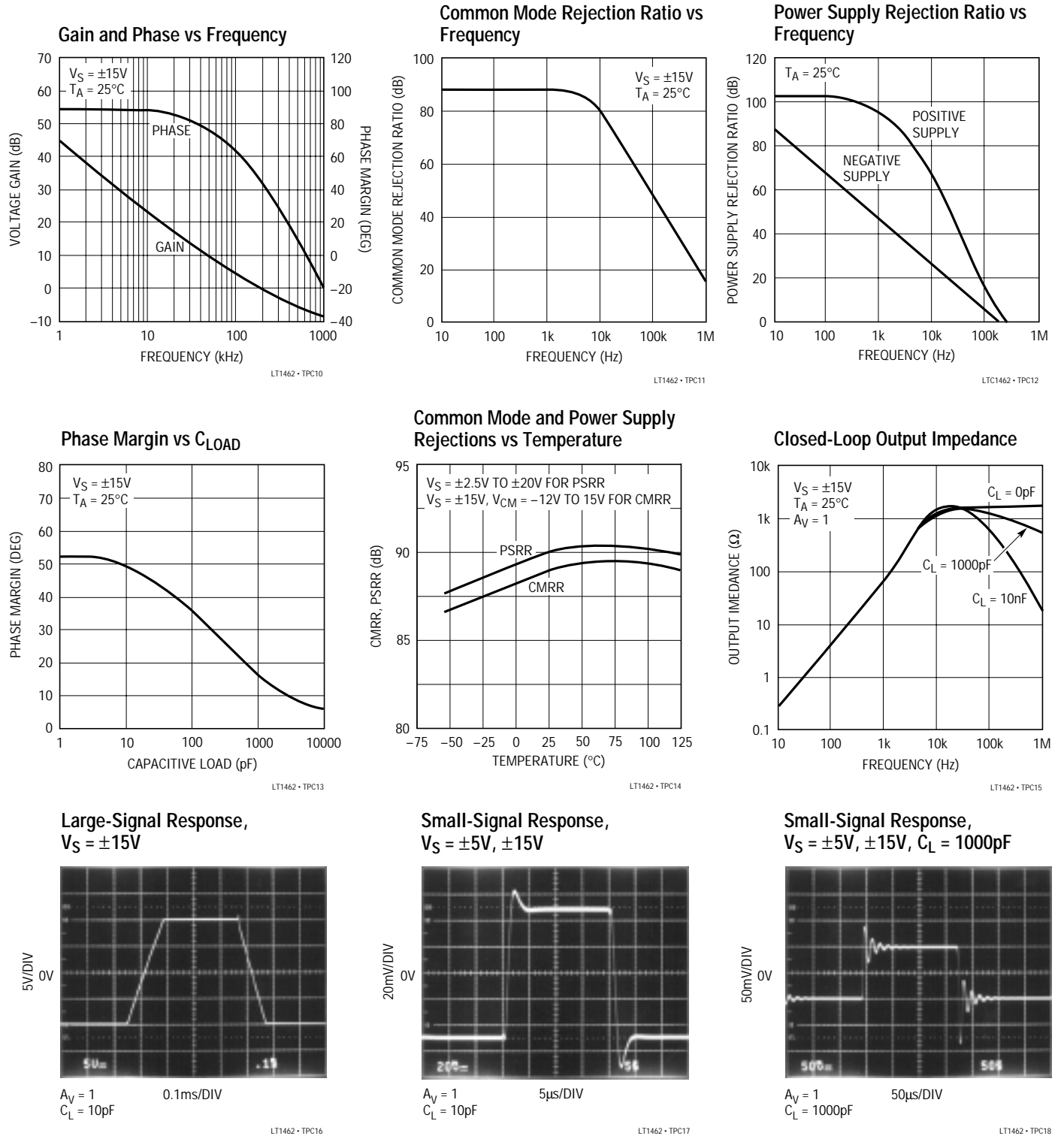
LT1462 • TPC08

Channel Separation vs Frequency



LT1462 • TPC09

TYPICAL PERFORMANCE CHARACTERISTICS



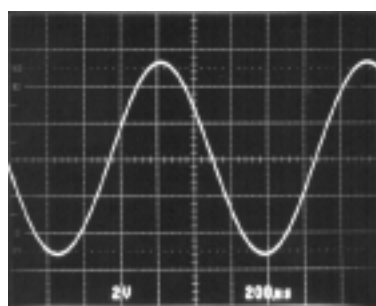
アプリケーション情報

逆位相保護

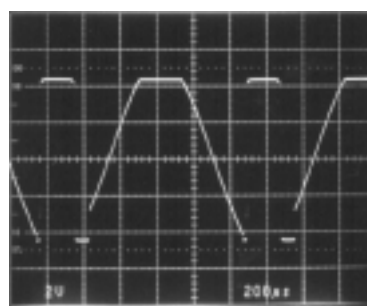
ほとんどの業界標準JFET入力シングル、デュアル、およびクワッドのオペアンプでは、入力が負の同相制限範囲を超えると、出力で位相反転が起こります。同相範囲は $\pm 5V$ 電源では重要です。以下の図に、 $\pm 5.2V$ の正弦波入力(図1a)、ユニティゲイン・フォロワモードでの競

合JFET入力オペアンプの応答(図1b)、およびLT1462/LT1463の応答(図1c)を示します。

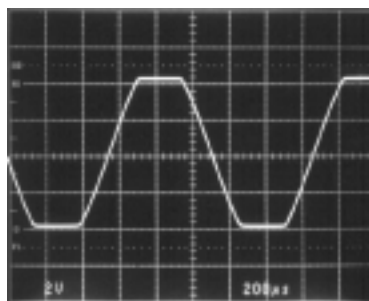
図1bのように位相反転が起こると、サーボ機構がロックアップする可能性があります。LT1462/LT1463は、同相入力が電源電圧内にあるときには位相反転を起こしません。



(1a) $\pm 5.2V$ Sine Wave



(1b) Typical JFET Input Op Amp with $\pm 5V$ Supplies

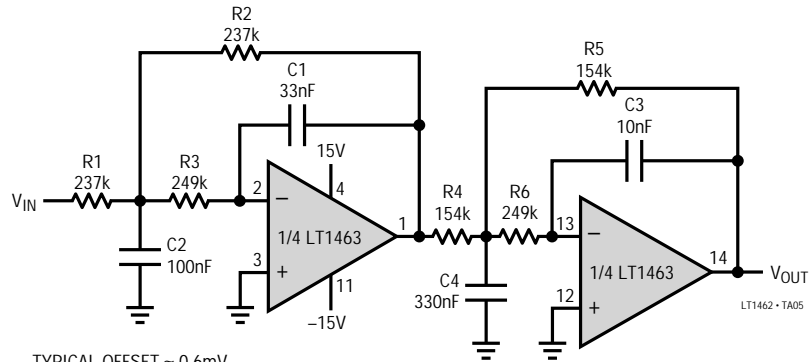


(1c) LT1462/LT1463 Output with $\pm 5V$ Supplies

Figure 1. Voltage Follower with Input Exceeding the Common Mode Range ($V_S = \pm 5V$)

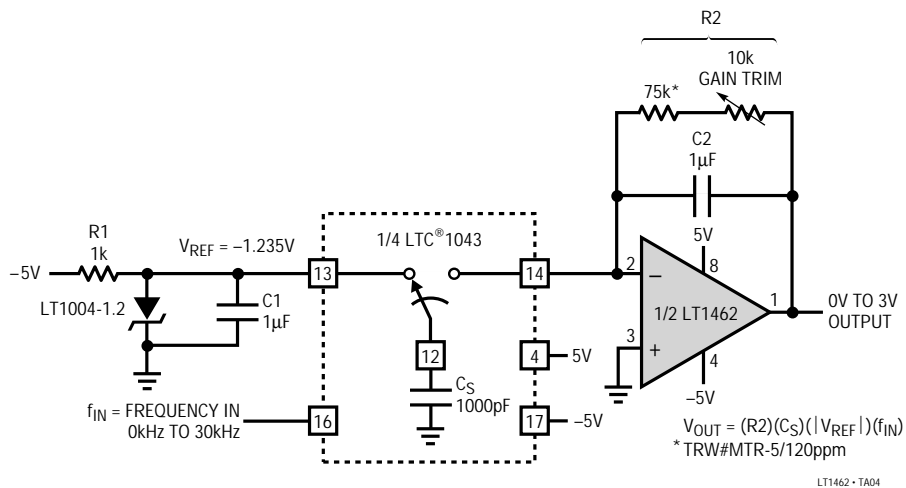
TYPICAL APPLICATIONS

10Hz 4th Order Chebyshev Lowpass Filter (0.01dB Ripple)

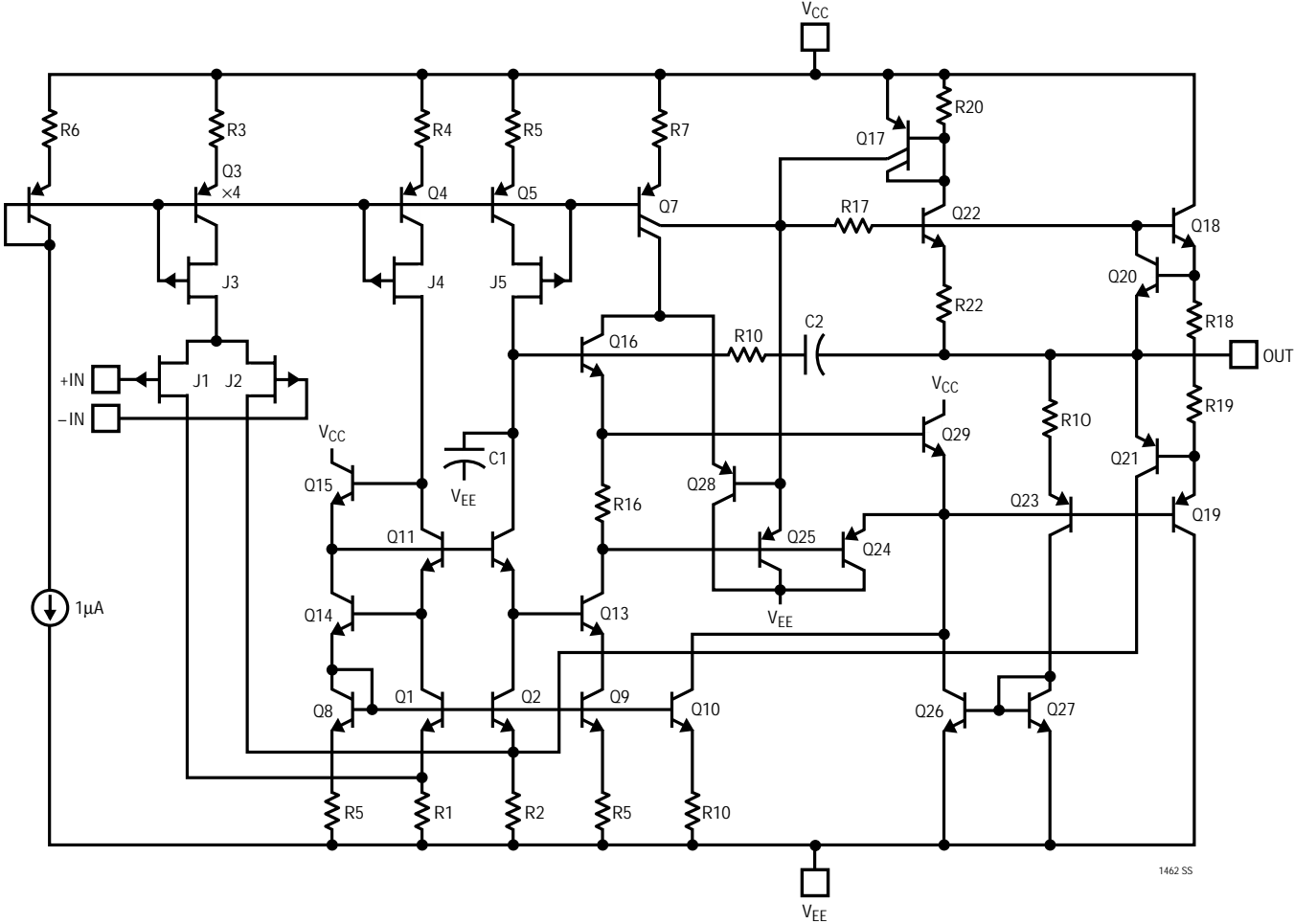


TYPICAL OFFSET \approx 0.6mV
 1% TOLERANCES
 FOR $V_{IN} = 10V_{p-p}$, $V_{OUT} = -110dB$ AT $f > 300Hz$
 $V_{OUT} = -6dB$ AT $f = 16Hz$
 THE LOW INPUT BIAS CURRENTS ALLOW THE USE OF HIGH RESISTOR VALUES

Micropower 0.026% Frequency-to-Voltage Converter

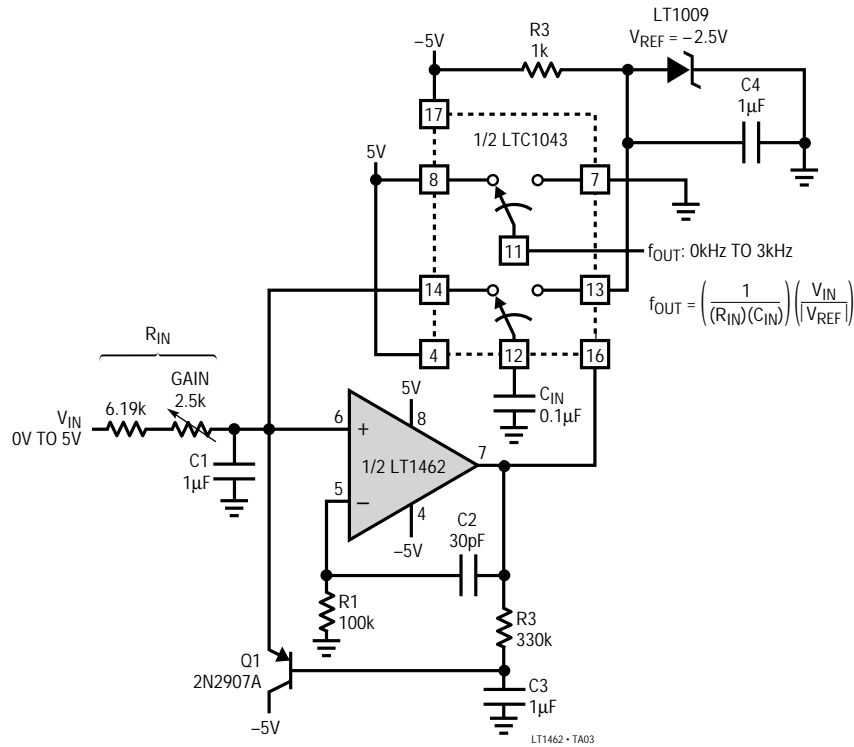


SIMPLIFIED SCHEMATIC



TYPICAL APPLICATION

Micropower 0.016% Voltage-to-Frequency Converter



RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1057	Dual JFET Input, Precision, High Speed Op Amp	Fast Settling Time, 14V/µs Slew Rate, 5MHz GBW, 450µV V _{OS(MAX)} , 50pA I _{OS(MAX)}
LT1113	Dual Low Noise, Precision, JFET Input Op Amp	6nV/√Hz Input Noise Voltage Density, 480pA I _B , 6.3MHz GBW
LT1169	Dual Low Noise, Picoampere Bias Current, JFET Input Op Amp	20pA I _B , 8nV/√Hz e _n , 5.3MHz GBW, 1.5pF Input Capacitance
LT1457	Dual Precision JFET Input Op Amp C-Load	Drives 10,000pF Capacitive Load, 450µV V _{OS(MAX)} , 4µV/°C Drift
LT1464/LT1465	Dual/Quad Micropower, C-Load Picoampere Bias Current JFET Input Op Amps	Drive 10nF Capacitive Loads, 1MHz GBW