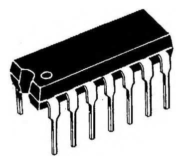
MC1437P
(DUAL MC1709CP)

. . . designed for use as summing amplifiers, integrators, or amplifiers with operating characteristics as a function of the external feedback components. Ideal for chopper stabilized applications where extremely high gain is required with excellent stability.



CASE 93
(TO-116)
"P" SUFFIX

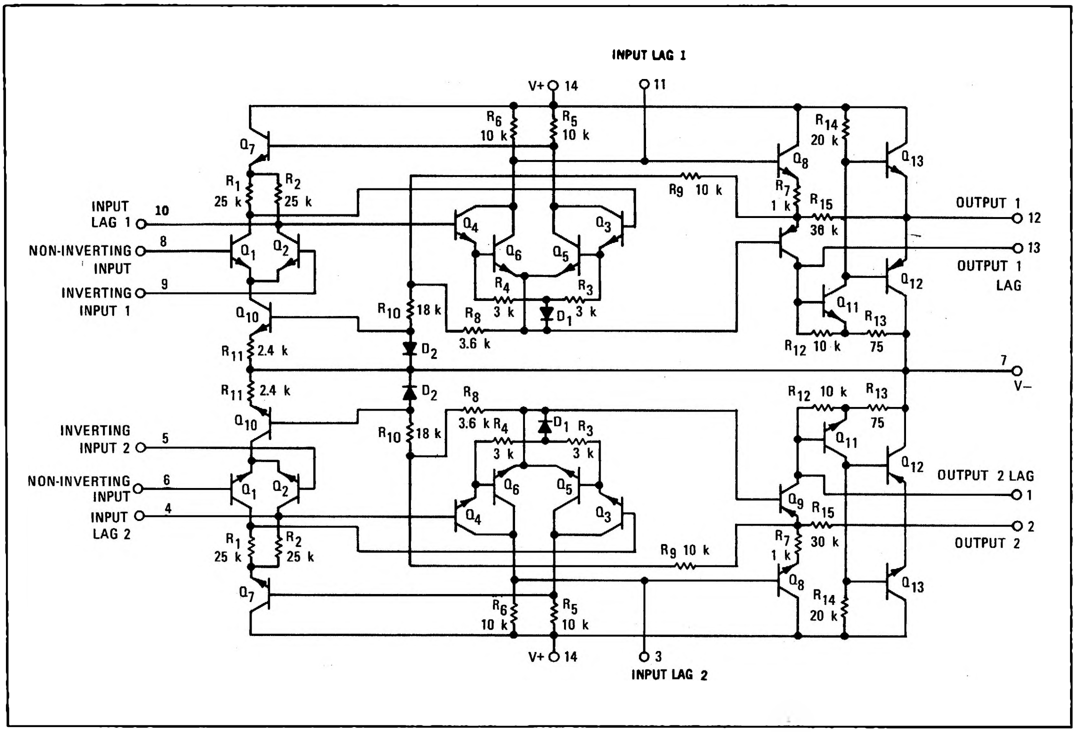
Typical Amplifier Features:

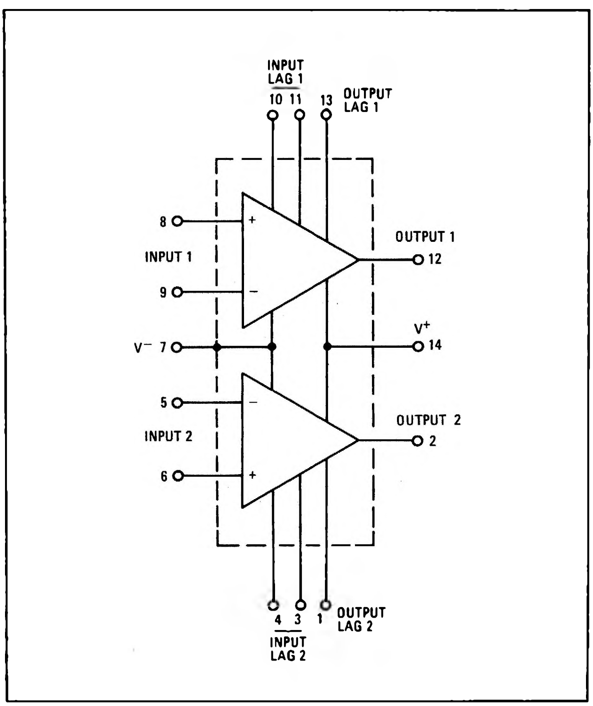
- High-Performance Open Loop Gain Characteristics A_{VOL} = 45,000 typical
- Low Temperature Drift – ±3.0 µV/°C
- Large Output Voltage Swing – ±14 V typical @ ±15 V Supply
- Low Output Impedance – Z_{out} = 30 ohms typical

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+ V^-	+18 -18	Vdc Vdc
Differential Input Signal	V_{in}	±5.0	Volts
Common Mode Input Swing	CMV_{in}	$\pm V^+$	Volts
Output Short Circuit Duration	t_S	5.0	s
Power Dissipation (Package Limitation) Plastic Package Derate above 25° C	P_D	 415 3.3	 mW mW/°C
Operating Temperature Range	T_A	0 to +75	°C
Storage Temperature Range Plastic Package	T_{stg}	 -65 to +125	°C

CIRCUIT SCHEMATIC

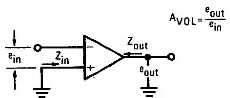
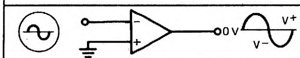
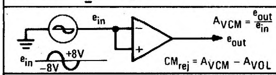
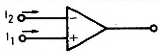
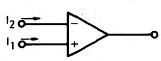
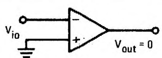
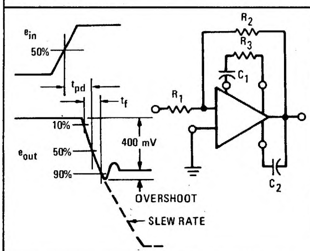
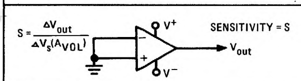




EQUIVALENT CIRCUIT

ELECTRICAL CHARACTERISTICS (each amplifier)

(V^+ = +15 Vdc, V^- = −15 Vdc, T_A = 25°C unless otherwise noted)

Characteristic Definitions (linear operation)	Characteristic	Symbol	Min	Typ	Max	Unit
	Open Loop Voltage Gain (R_L = 5.0 kΩ, V_{out} = ±10 V, T_A = 0°C to +75°C)	A_{VOL}	15,000	45,000	-	-
	Output Impedance (f = 20 Hz)	Z_{out}	-	30	-	Ω
	Input Impedance (f = 20 Hz)	Z_{in}	50	150	-	kΩ
	Output Voltage Swing (R_L = 10 kΩ)	V_{out}	±12	±14	-	V_{peak}
	Input Common Mode Voltage Swing	CMV_{in}	±8.0	±10	-	V_{peak}
	Common Mode Rejection Ratio	CM_{rej}	65	100	-	dB
	Input Bias Current $\left(I_b = \frac{I_1 + I_2}{2}\right)$, ($T_A$ = +25°C)	I_b	-	0.4	1.5	μA
	(T_A = 0°C)		-	-	2.0	
	Input Offset Current ($I_{io} = I_1 - I_2$)	I_{io}	-	0.05	0.5	μA
	($I_{io} = I_1 - I_2$, T_A = 0°C)		-	-	0.75	
	($I_{io} = I_1 - I_2$, T_A = +75°C)		-	-	0.75	
	Input Offset Voltage (T_A = 25°C)	V_{io}	-	1.0	7.5	mV
	(T_A = 0°C, +75°C)		-	-	10	
	Step Response: Gain = 100, 5% overshoot, R_1 = 1 kΩ, R_2 = 100 kΩ, R_3 = 1.5 kΩ, C_1 = 100 pF, C_2 = 3.0 pF	t_f	-	0.8	-	μs
		t_{pd}	-	0.38	-	μs
		dV_{out}/dt ①	-	12	-	V/μs
	Gain = 10, 10% overshoot, R_1 = 1 kΩ, R_2 = 10 kΩ, R_3 = 1.5 kΩ, C_1 = 500 pF, C_2 = 20 pF	t_f	-	0.6	-	μs
		t_{pd}	-	0.34	-	μs
		dV_{out}/dt ①	-	1.7	-	V/μs
	Gain = 1, 5% overshoot, R_1 = 10 kΩ, R_2 = 10 kΩ, R_3 = 1.5 kΩ, C_1 = 5000 pF, C_2 = 200 pF	t_f	-	2.2	-	μs
		t_{pd}	-	1.3	-	μs
		dV_{out}/dt ①	-	0.25	-	V/μs
	Average Temperature Coefficient of Input Offset Voltage (R_S = 50 Ω, T_A = 0°C to +75°C)	TC_{Vio}	-	1.5	-	μV/°C
	($R_S \leq$ 10 kΩ, T_A = 0°C to +75°C)		-	3.0	-	
	Average Temperature Coefficient of Input Offset Current (T_A = 0° to +25°C)	TC_{Iio}	-	0.7	-	nA/°C
	(T_A = +25°C to +75°C)		-	0.7	-	
	DC Power Dissipation (Power Supply = ±15 V, V_{out} = 0)	P_D	-	150	225	mW
	Positive Supply Sensitivity (V^- constant)	S^+	-	10	200	μV/V
	Negative Supply Sensitivity (V^+ constant)	S^-	-	10	200	μV/V

① dV_{out}/dt = Slew Rate

MATCHING CHARACTERISTICS

Characteristic Definitions	Characteristic	Symbol	Min	Typ	Max	Unit
Same characteristic definitions as shown for each amplifier above.	Open Loop Voltage Gain	$A_{VOL1}-A_{VOL2}$	-	±1.0	-	dB
	Input Bias Current	$I_{b1}-I_{b2}$	-	±0.15	-	μA
	Input Offset Current	$I_{io1}-I_{io2}$	-	±0.02	-	μA
	Average Temperature Coefficient	$TC_{Iio1}-TC_{Iio2}$	-	±0.2		nA/°C
	Input Offset Voltage	$V_{io1}-V_{io2}$	-	±0.2	-	mV
	Average Temperature Coefficient	$TC_{Vio1}-TC_{Io2}$		±0.5		μV/°C
	Channel Separation (f = 10 kHz)	$\frac{e_{out\,1}}{e_{out\,2}}$	-	90	-	dB

TYPICAL OUTPUT CHARACTERISTICS

FIGURE 1–TEST CIRCUIT

$V^+ = +15$ Vdc, $V^- = -15$ Vdc, $T_A = 25^oC$

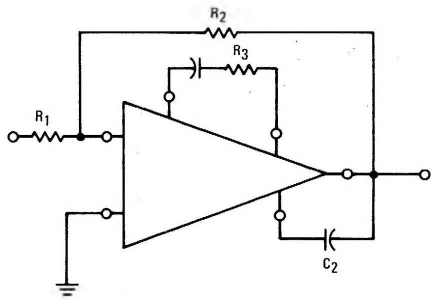


FIGURE NO.	CURVE NO.	VOLTAGE GAIN	TEST CONDITIONS $R_1(\Omega)$	$R_2(\Omega)$	$R_3(\Omega)$	C_1(pF)	C_2(pF)	OUTPUT NOISE (mV rms)
2	1	1	10 k	10 k	1.5 k	5.0 k	200	0.10
	2	10	10 k	100 k	1.5 k	500	20	0.14
	3	100	10 k	1.0 M	1.5 k	100	3.0	0.7
	4	1000	1.0 k	1.0 M	0	10	3.0	5.2
3	1	1	10 k	10 k	1.5 k	5.0 k	200	0.10
	2	10	10 k	100 k	1.5 k	500	20	0.14
	3	100	10 k	1.0 M	1.5 k	100	3.0	0.7
	4	1000	1.0 k	1.0 M	0	10	3.0	5.2
4	1	A_{VOL}	0	∞	1.5 k	5.0 k	200	5.6
	2	A_{VOL}	0	∞	1.5 k	500	20	10.5
	3	A_{VOL}	0	∞	1.5 k	100	3.0	21.0
	4	A_{VOL}	0	∞	0	10	3.0	39.0
	5	A_{VOL}	0	∞	∞	0	3.0	—

FIGURE 2–LARGE SIGNAL SWING versus FREQUENCY

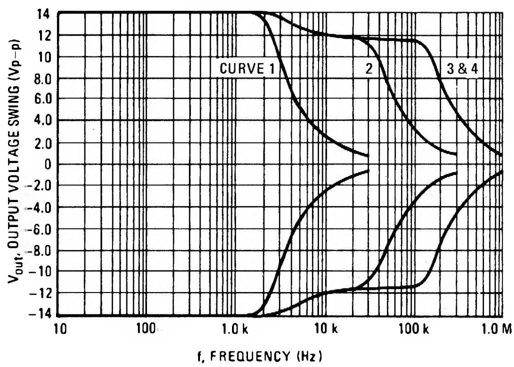


FIGURE 3–VOLTAGE GAIN versus FREQUENCY

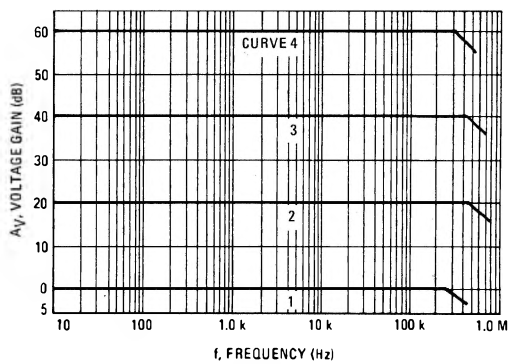


FIGURE 4–OPEN LOOP VOLTAGE GAIN versus FREQUENCY

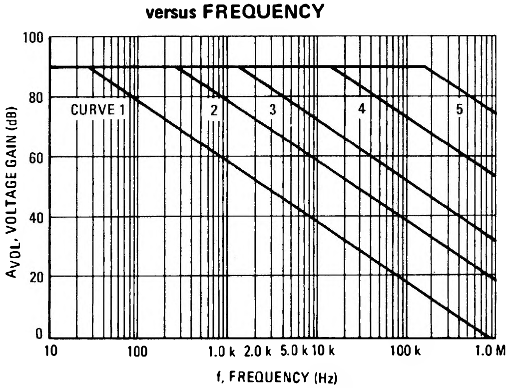


FIGURE 5–POWER DISSIPATION versus POWER SUPPLY VOLTAGE

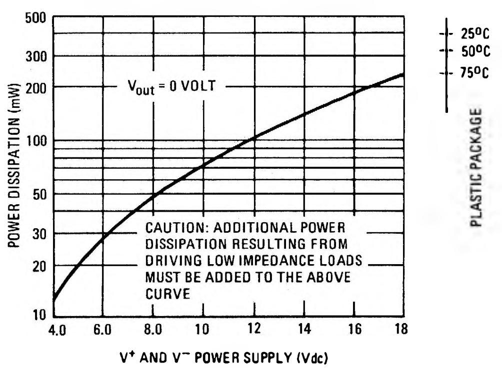


FIGURE 6—VOLTAGE GAIN versus POWER SUPPLY VOLTAGE

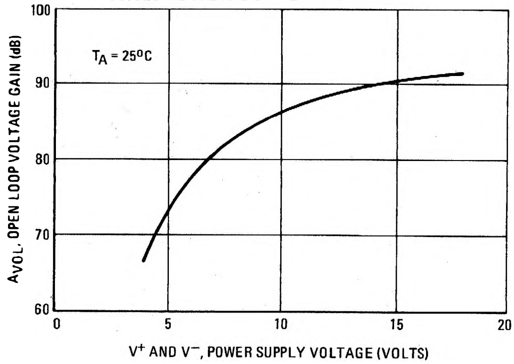


FIGURE 7—COMMON SWING versus POWER SUPPLY VOLTAGE

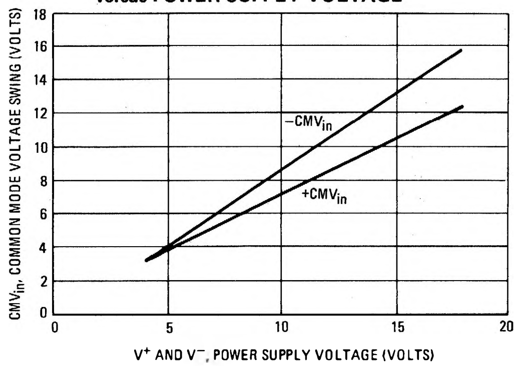


FIGURE 8—INPUT OFFSET VOLTAGE versus TEMPERATURE

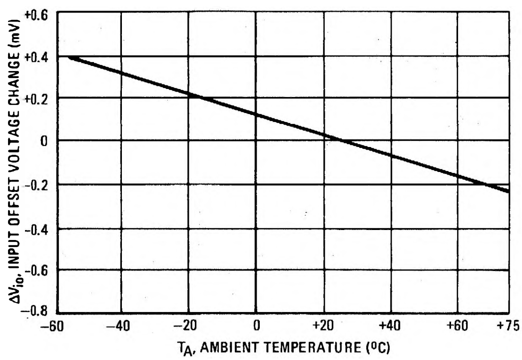


FIGURE 9—OUTPUT NOISE VOLTAGE versus SOURCE RESISTANCE

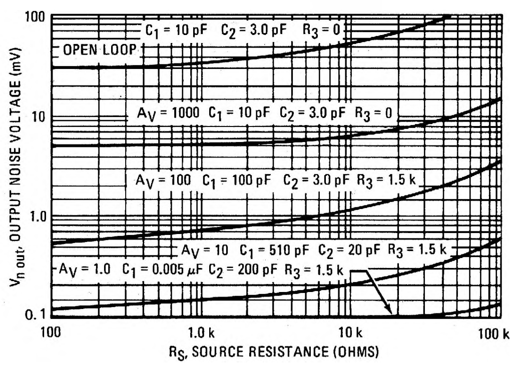
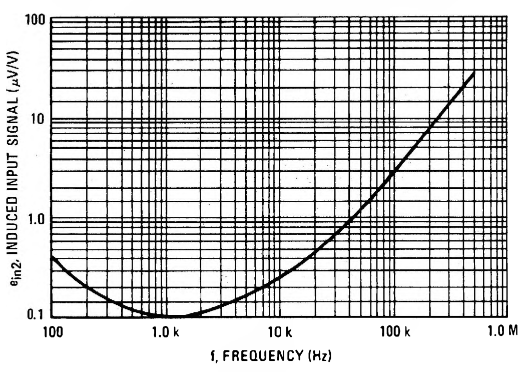
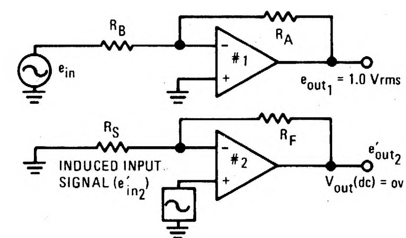


FIGURE 10—INDUCED INPUT SIGNAL (CHANNEL SEPARATION) versus FREQUENCY





Induced input signal (µV of induced input signal in amplifier #2 per volt of output signal at amplifier #1)

$e'_{out\,2} = e'_{in_2}\left(1 + \frac{R_F}{R_S}\right)$, where e'_{out_2} is the component of e_{out_2} due only to lack of perfect separation between the two amplifiers.