MC1537
MC1437

OPERATIONAL AMPLIFIERS

HIGHLY MATCHED MONOLITHIC DUAL OPERATIONAL AMPLIFIERS

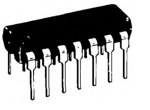
. . . designed for use as summing amplifiers, integrators, or amplifiers with operating characteristics as a function of the external feedback components. Ideal for chopper stabilized applications where extremely high gain is required with excellent stability.

Typical Amplifier Features:

- High-Performance Open Loop Gain Characteristics – A_{VOL} = 45,000 typical
- Low Temperature Drift – ±3 μV/°C
- Large Output Voltage Swing – ±14 V typical @ ±15 V Supply

DUAL MC1709
MONOLITHIC SILICON OPERATIONAL AMPLIFIERS INTEGRATED CIRCUIT

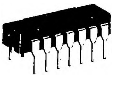
P SUFFIX
PLASTIC PACKAGE
CASE 605
TO-116



(MC1437 only)

(top view)

L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116



MAXIMUM RATINGS (T_A = +25°C)

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}	±V^+	Volts
Output Short Circuit Duration	t_S	5.0	s
Power Dissipation (Package Limitation) Ceramic Package Derate above T_A = +25°C Plastic Package Derate above T_A = +25°C	P_D	 750 6.0 625 5.0	 mW mW/°C mW mW/°C
Operating Temperature Range MC1537 MC1437	T_A	 -55 to +125 0 to +75	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

FIGURE 1 – CIRCUIT SCHEMATIC

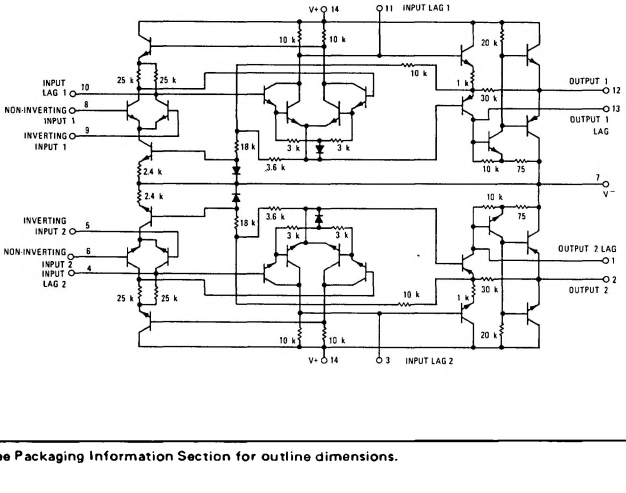
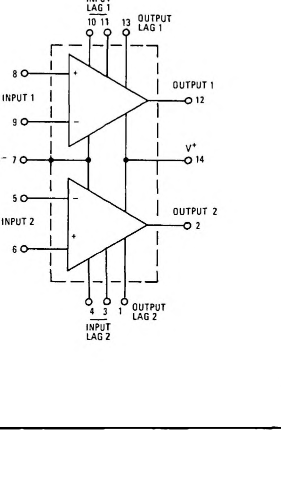


FIGURE 2 – EQUIVALENT CIRCUIT



See Packaging Information Section for outline dimensions.

MC1537, MC1437 (continued)

ELECTRICAL CHARACTERISTICS — Each Amplifier (V^+ = +15 Vdc, V^- = −15 Vdc, T_A = 25°C unless otherwise noted)

Characteristic	Symbol	MC1537 Min	MC1537 Typ	MC1537 Max	MC1437 Min	MC1437 Typ	MC1437 Max	Unit
Open Loop Voltage Gain (R_L = 5.0 kΩ, V_o = ±10 V, T_A = T_{low} ① to T_{high} ②)	A_{VOL}	25,000	45,000	70,000	15,000	45,000	–	–
Output Impedance (f = 20 Hz)	Z_o	–	30	–	–	30	–	Ω
Input Impedance (f = 20 Hz)	Z_{in}	150	400	–	50	150	–	kΩ
Output Voltage Swing	V_o							V_{peak}
(R_L = 10 kΩ)		±12	±14	–	±12	±14	–	
(R_L = 2.0 kΩ)		±10	±13	–	–	–	–	
Input Common-Mode Voltage Swing	CMV_{in}	±8.0	±10	–	±8.0	±10	–	V_{peak}
Common-Mode Rejection Ratio	CM_{rej}	70	100	–	65	100	–	dB
Input Bias Current $\left(I_b = \frac{I_1 + I_2}{2}\right)$	I_b							µA
(T_A = +25°C)		–	0.2	0.5	–	0.4	1.5	
(T_A = T_{low} ①)		–	0.5	1.5	–	–	2.0	
Input Offset Current	$\vert I_{io}\vert$							µA
($I_{io} = I_1 - I_2$)		–	0.05	0.2	–	0.05	0.5	
($I_{io} = I_1 - I_2$, T_A = T_{low} ①)		–	–	0.5	–	–	0.75	
($I_{io} = I_1 - I_2$, T_A = T_{high} ②)		–	–	0.2	–	–	0.75	
Input Offset Voltage	$\vert V_{io}\vert$							mV
(T_A = +25°C)		–	1.0	5.0	–	1.0	7.5	
(T_A = T_{low} ① to T_{high} ②)		–	–	6.0	–	–	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	–	–	0.8	–	µs
	t_{pd}	–	0.38	–	–	0.38	–	µs
	dV_{out}/dt ③	–	12	–	–	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	–	–	0.6	–	µs
	t_{pd}	–	0.34	–	–	0.34	–	µs
	dV_{out}/dt ③	–	1.7	–	–	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	–	–	2.2	–	µs
	t_{pd}	–	1.3	–	–	1.3	–	µs
	dV_{out}/dt ③	–	0.25	–	–	0.25	–	V/µs
Average Temperature Coefficient of Input Offset Voltage	$\vert TC_{Vio}\vert$							µV/°C
(R_S = 50 Ω, T_A = T_{low} ① to T_{high} ②)		–	1.5	–	–	1.5	–	
($R_S \leqq$ 10 kΩ, T_A = T_{low} ① to T_{high} ②)		–	3.0	–	–	3.0	–	
Average Temperature Coefficient of Input Offset Voltage	$\vert TC_{Iio}\vert$							nA/°C
(T_A = T_{low} ① to +25°C)		–	0.7	–	–	0.7	–	
(T_A = +25°C to T_{high} ②)		–	0.7	–	–	0.7	–	
DC Power Dissipation (Total) (Power Supply = ±15 V, V_o = 0)	P_D	–	160	225	–	160	225	mW
Positive Supply Sensitivity (V^- constant)	S^+	–	10	150	–	10	200	µV/V
Negative Supply Sensitivity (V^+ constant)	S^-	–	10	150	–	10	200	µV/V

① T_{low} = 0°C for MC1437
= −55°C for MC1537

② T_{high} = +75°C for MC1437
= +125°C for MC1537

③ dV_{out}/dt = Slew Rate

MATCHING CHARACTERISTICS

Characteristic	Symbol	MC1537 Min	MC1537 Typ	MC1537 Max	MC1437 Min	MC1437 Typ	MC1437 Max	Unit
Open Loop Voltage Gain	A_{VOL1}-A_{VOL2}	–	±1.0	–	–	±1.0	–	dB
Input Bias Current	I_{b1}-I_{b2}	–	±0.15	–	–	±0.15	–	µA
Input Offset Current	$\vert I_{io1}\vert$-$\vert I_{io2}\vert$	–	±0.02	–	–	±0.02	–	µA
Average Temperature Coefficient	$\vert TC_{Iio1}\vert$-$\vert TC_{Iio2}\vert$	–	±0.2	–	–	±0.2	–	nA/°C
Input Offset Voltage	$\vert V_{io1}\vert$-$\vert V_{io2}\vert$	–	±0.2	–	–	±0.2	–	mV
Average Temperature Coefficient	$\vert TC_{Vio1}\vert$-$\vert TC_{Vio2}\vert$	–	±0.5	–	–	±0.5	–	µV/°C
Channel Separation (f = 10 kHz)	$\frac{e_{out\,1}}{e_{out\,2}}$	–	90	–	–	90	–	dB

TYPICAL OUTPUT CHARACTERISTICS

FIGURE 3 – TEST CIRCUIT

$V^+ = +15$ Vdc, $V^- = 15$ Vdc, $T_A = 25^\circ C$

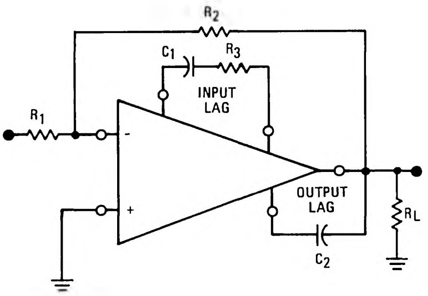


FIGURE NO.	CURVE NO.	VOLTAGE GAIN	TEST CONDITIONS $R_1(\Omega)$	$R_2(\Omega)$	$R_3(\Omega)$	C_1(pF)	C_2(pF)	OUTPUT NOISE (mV(rms))
4	1	1	10 k	10 k	1.5 k	5.0 k	200	0.10
	2	10	10 k	100 k	1.5 k	500	20	0.14
	3	100	10 k	1.0 M	1.5 k	100	3.0	0.7
	4	1000	1.0 k	1.0 M	0	10	3.0	5.2
5	1	1	10 k	10 k	1.5 k	5.0 k	200	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
6	1	A_{VOL}	0	∞	1.5 k	5.0 k	200	5.5
	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 4 – LARGE SIGNAL SWING versus FREQUENCY

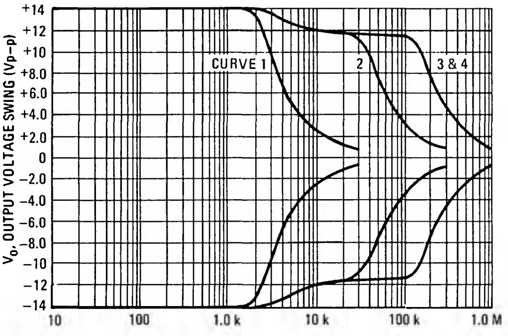


FIGURE 5 – VOLTAGE GAIN versus FREQUENCY

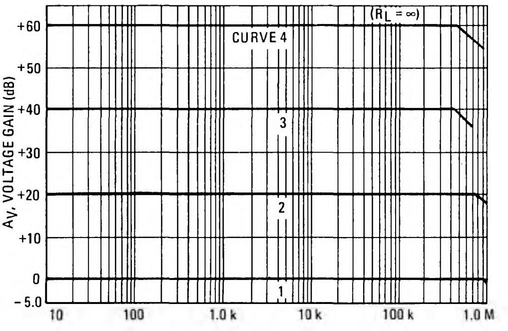


FIGURE 6 – OPEN LOOP VOLTAGE GAIN versus FREQUENCY

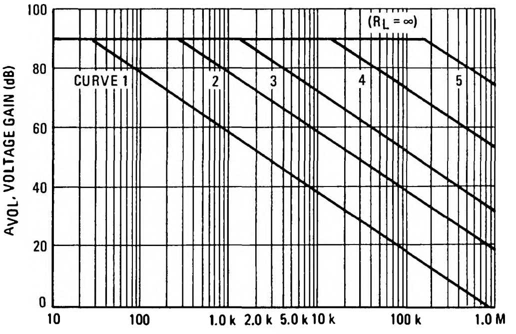
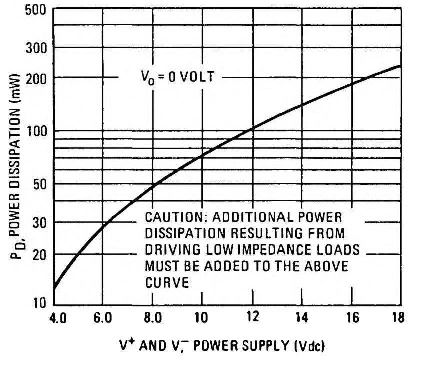


FIGURE 7 – TOTAL POWER DISSIPATION versus POWER SUPPLY VOLTAGE



TYPICAL CHARACTERISTICS (continued)

FIGURE 8 – VOLTAGE GAIN versus POWER SUPPLY VOLTAGE

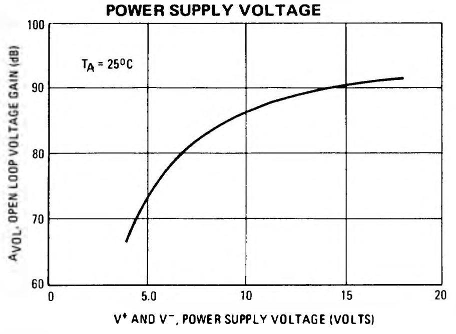


FIGURE 9 – COMMON INPUT SWING versus POWER SUPPLY VOLTAGE

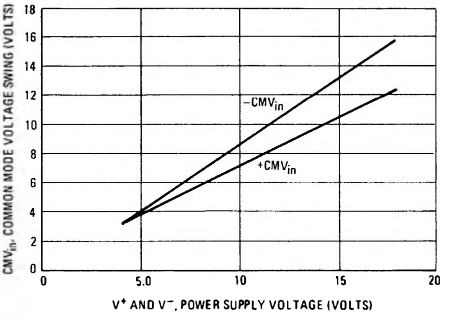


FIGURE 10 – INPUT OFFSET VOLTAGE versus TEMPERATURE

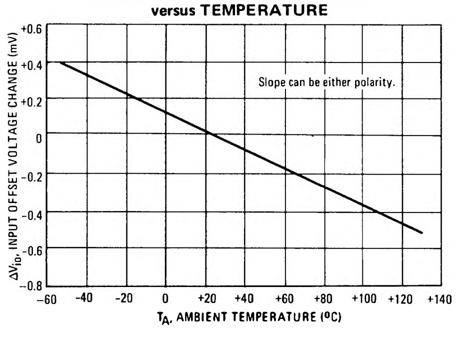


FIGURE 11 – OUTPUT NOISE VOLTAGE versus SOURCE RESISTANCE

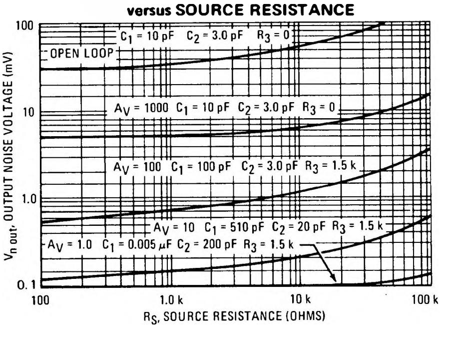
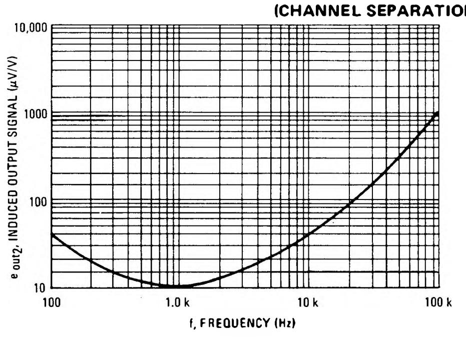
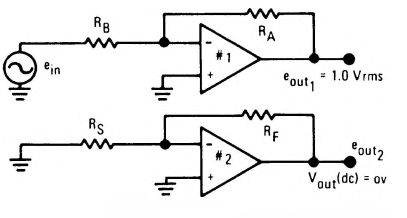


FIGURE 12 – INDUCED OUTPUT SIGNAL (CHANNEL SEPARATION) versus FREQUENCY





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