MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MC1437
MC1537

2

MATCHED DUAL OPERATIONAL AMPLIFIERS

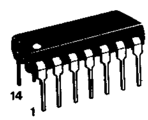
. . . designed for use as summing amplifiers, integrators, or amplifiers with operating characteristics as a function of the external feedback components. Ideal for chopper stabilized applications where extremely high gain is required with excellent stability.

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 OPERATIONAL AMPLIFIERS

SILICON MONOLITHIC INTEGRATED CIRCUIT



P SUFFIX
PLASTIC PACKAGE
CASE 646
(MC1437P Only)

MAXIMUM RATINGS (T_A = +25°C)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	+18	Vdc
	V_{EE}	-18	Vdc
Differential Input Voltage Range	V_{IDR}	±5.0	Volts
Common-Mode Input Voltage Range	V_{ICR}	±V_{CC}	Volts
Output Short Circuit Duration	t_S	5.0	s
Power Dissipation (Package Limitation)	P_D		
Ceramic Package		750	mW
Derate above T_A = +25°C		6.0	mW/°C
Plastic Package MC1437P		625	mW
Derate above T_A = +25°C		5.0	mW/°C
Operating Ambient Temperature Range	T_A		°C
MC1537		-55 to +125	
MC1437		0 to +70	
Storage Temperature Range	T_{stg}	-65 to +150	°C

PIN CONNECTIONS

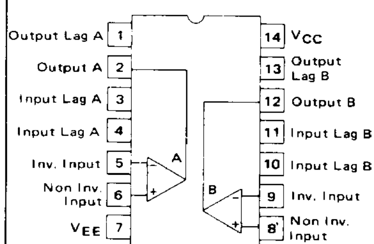
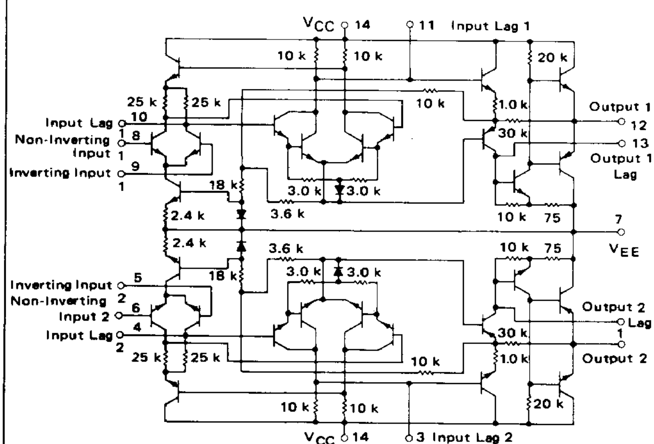
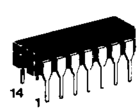


FIGURE 1 – CIRCUIT SCHEMATIC





L SUFFIX
CERAMIC PACKAGE
CASE 632

ORDERING INFORMATION

Device	Temperature Range	Package
MC1437L	0°C to +70°C	Ceramic DIP
MC1437P		Plastic DIP
MC1537L	–55°C to +125°C	Ceramic DIP

ELECTRICAL CHARACTERISTICS – Each Amplifier (V_{CC} = +15 Vdc, V_{EE} = –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_i	150	400	–	50	150	–	kΩ
Output Voltage Range (R_L = 10 kΩ) (R_L = 2.0 kΩ)	V_{OR}	 ±12 ±10	 ±14 ±13	 – –	 ±12 –	 ±14 –	 – –	V_{peak}
Input Common-Mode Voltage Range	V_{ICR}	±8.0	±10	–	±8.0	±10	–	V_{peak}
Common-Mode Rejection Ratio	CMRR	70	100	–	65	100	–	dB
Input Bias Current $\left(I_{IB} = \frac{I_1 + I_2}{2}\right)$ (T_A = +25°C) (T_A = T_{low} ①)	I_{IB}	 – –	 0.2 0.5	 0.5 1.5	 – –	 0.4 –	 1.5 2.0	µA
Input Offset Current (I_{IO} = $I_1 - I_2$) (I_{IO} = $I_1 - I_2$, T_A = T_{low} ①) (I_{IO} = $I_1 - I_2$, T_A = T_{high} ②)	I_{IO}	 – – –	 0.05 – –	 0.2 0.5 0.2	 – – –	 0.05 – –	 0.5 0.75 0.75	µA
Input Offset Voltage (T_A = +25°C) (T_A = T_{low} ① to T_{high} ②)	V_{IO}	 – –	 1.0 –	 5.0 6.0	 – –	 1.0 –	 7.5 10	mV
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_{TLH} t_{PLH}-t_{PHL} SR	 – – –	 0.8 0.38 12	 – – –	 – – –	 0.8 0.38 12	 – – –	 µs µs 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_{TLH} t_{PLH}-t_{PHL} SR	– – –	0.6 0.34 1.7	– – –	– – –	0.6 0.34 1.7	– – –	µs µs 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_{TLH} t_{PLH}-t_{PHL} SR	– – –	2.2 1.3 0.25	– – –	– – –	2.2 1.3 0.25	– – –	µs µs V/µs
Average Temperature Coefficient of Input Offset Voltage (R_S = 50 Ω, T_A = T_{low} ① to T_{high} ②) (R_S ≦ 10 kΩ, T_A = T_{low} ① to T_{high} ②)	$\Delta V_{IO}/\Delta T$	 – –	 1.5 3.0	 – –	 – –	 1.5 3.0	 – –	µV/°C
Average Temperature Coefficient of Input Offset Voltage (T_A = T_{low} ① to +25°C) (T_A = +25°C to T_{high} ②)	$\Delta I_{IO}/\Delta T$	 – –	 0.7 0.7	 – –	 – –	 0.7 0.7	 – –	nA/°C
DC Power Consumption (Total) (Power Supply = ±15 V, V_o = 0)	P_C	–	160	225	–	160	225	mW
Positive Supply Sensitivity (V_{EE} constant)	PSS+	–	10	150	–	10	200	µV/V
Negative Supply Sensitivity (V_{CC} constant)	PSS-	–	10	150	–	10	200	µV/V

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

② T_{high} = +70°C for MC1437
= +125°C for MC1537

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_{IB1}-I_{IB2}	–	±0.15	–	–	±0.15	–	µA
Input Offset Current	I_{IO1}-I_{IO2}	–	±0.02	–	–	±0.02	–	µA
Average Temperature Coefficient	$\left\vert\frac{\Delta I_{IO1}}{\Delta T}\right\vert - \left\vert\frac{\Delta I_{IO2}}{\Delta T}\right\vert$	–	±0.2	–	–	±0.2	–	nA/°C
Input Offset Voltage	V_{IO1}-V_{IO2}	–	±0.2	–	–	±0.2	–	mV
Average Temperature Coefficient	$\left\vert\frac{\Delta V_{IO1}}{\Delta T}\right\vert - \left\vert\frac{\Delta V_{IO2}}{\Delta T}\right\vert$	–	±0.5	–	–	±0.5	–	µV/°C
Channel Separation (f = 10 kHz)	$\frac{e_{o1}}{e_{o2}}$	–	90	–	–	90	–	dB

TYPICAL OUTPUT CHARACTERISTICS

FIGURE 3 – TEST CIRCUIT
V_{CC} = +15 Vdc, V_{EE} = 15 Vdc, T_A = 25°C

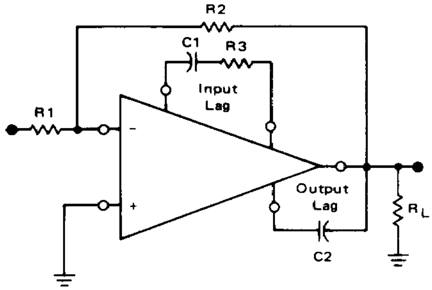


FIGURE NO.	CURVE NO.	VOLTAGE GAIN	TEST CONDITIONS R_1(Ω)	R_2(Ω)	R_3(Ω)	C_1(pF)	C_2(pF)	OUTPUT NOISE (mV(rms))
4	1	1	10 k	10 k	1.5 k	5.0 k	200	0.10
	2	10	10 k	100 k	1.5 k	500	20	0.14
	3	100	10 k	1.0 M	1.5 k	100	3.0	0.7
	4	1000	1.0 k	1.0 M	0	10	3.0	5.2
5	1	1	10 k	10 k	1.5 k	5.0 k	200	0.10
	2	10	10 k	100 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

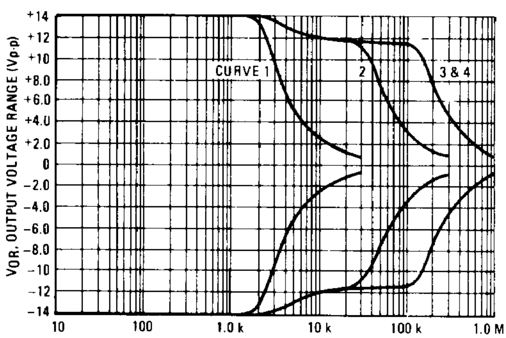


FIGURE 5 – VOLTAGE GAIN versus FREQUENCY

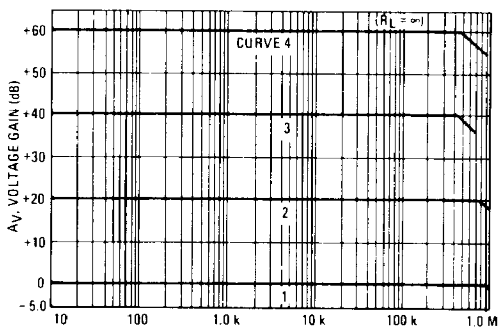


FIGURE 6 – OPEN LOOP VOLTAGE GAIN versus FREQUENCY

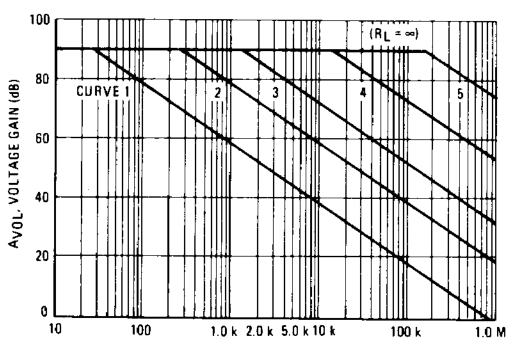
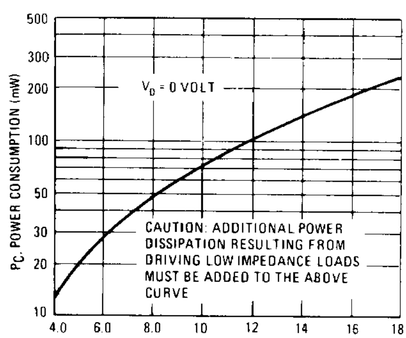


FIGURE 7 – TOTAL POWER CONSUMPTION versus POWER SUPPLY VOLTAGE



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TYPICAL CHARACTERISTICS (continued)

FIGURE 8 – VOLTAGE GAIN versus POWER SUPPLY VOLTAGE

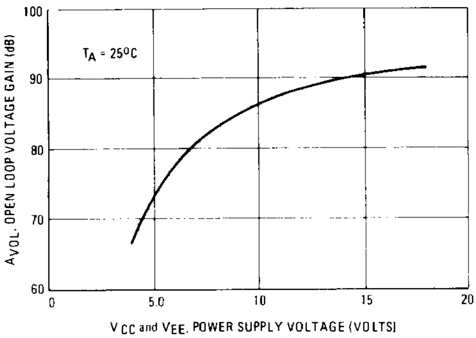


FIGURE 9 – COMMON INPUT SWING versus POWER SUPPLY VOLTAGE

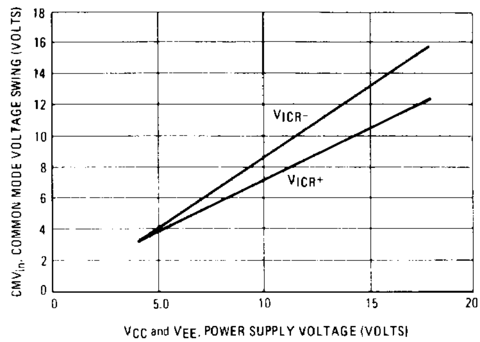


FIGURE 10 – INPUT OFFSET VOLTAGE versus TEMPERATURE

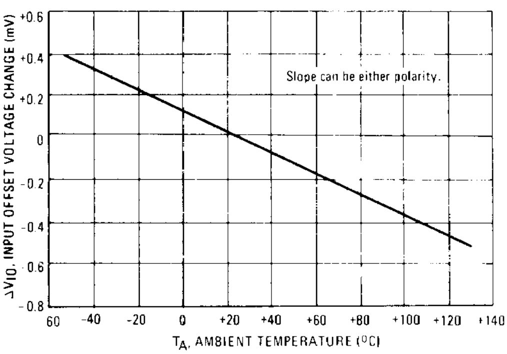


FIGURE 11 – OUTPUT NOISE VOLTAGE versus SOURCE RESISTANCE

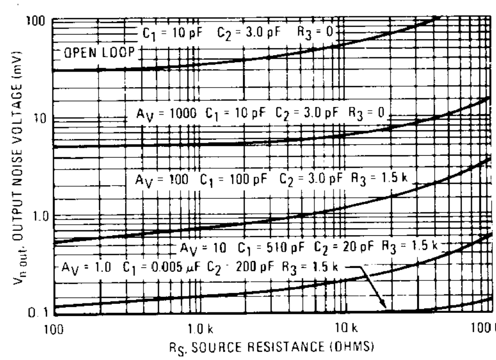
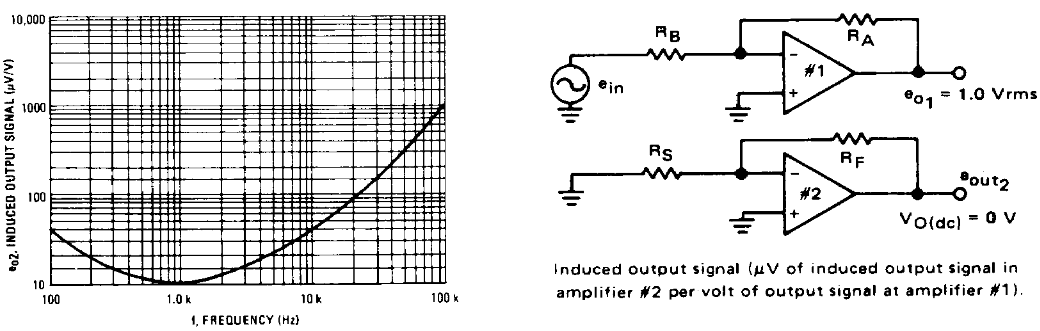


FIGURE 12 – INDUCED OUTPUT SIGNAL (CHANNEL SEPARATION) versus FREQUENCY



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