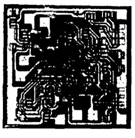
OPERATIONAL AMPLIFIERS

MC1520
MC1420

MONOLITHIC DIFFERENTIAL OUTPUT OPERATIONAL AMPLIFIER



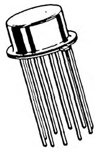
. . . designed for use in general-purpose or wide-band differential amplifier applications, especially those requiring differential outputs.

Typical Characteristics

- Differential Input and Differential Output
- Wide Closed-Loop Bandwidth; 10 MHz
- Differential Gain; 70 dB
- High Input Impedance; 2.0 megohms:
- Low Output Impedance; 50 ohms

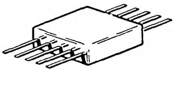
OPERATIONAL AMPLIFIER

MONOLITHIC SILICON
INTEGRATED
CIRCUIT



Pin 3 connected to case

G SUFFIX
METAL PACKAGE
CASE 602A



F SUFFIX
CERAMIC PACKAGE
CASE 606
TO-91

MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+ V^-	+8.0 -8.0	Vdc
Differential Input Signal	V_{in}	±8.0	Vdc
Load Current	I_{L1}, I_{L2}	15	mA
Power Dissipation (Package Limitation) Metal Package Derate above T_A = +25°C Flat Package Derate above T_A = +25°C	P_D	 680 4.6 500 3.3	 mW mW/°C mW mW/°C
Operating Temperature Range MC1520 MC1420	T_A	-55 to +125 0 to + 75	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

CIRCUIT SCHEMATICS

FIGURE 1 – CIRCUIT SCHEMATIC

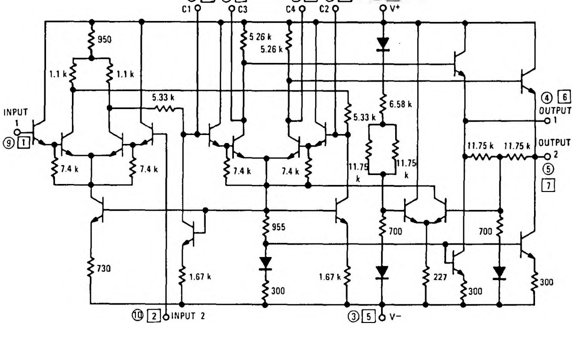
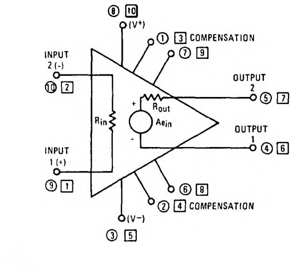


FIGURE 2 – EQUIVALENT CIRCUIT



○ contains pin number for metal can package
□ contains pin number for flat package

See Packaging Information Section for outline dimensions.

SINGLE-ENDED ELECTRICAL CHARACTERISTICS

(V^+ = +6.0 Vdc, V^-=-6.0 Vdc, T_A = +25°C unless otherwise noted)

Characteristic	Symbol	MC1520 Min	MC1520 Typ	MC1520 Max	MC1420 Min	MC1420 Typ	MC1420 Max	Unit
Open Loop Voltage Gain (T_{low} ② $\leq T_A \leq T_{high}$ ②)	A_{VOL}	1000 60	1500 64	– –	750 –	1500 64	– –	V/V dB
Output Impedance (f = 20 Hz)	Z_{out}	–	50	100	–	50	–	ohms
Input Impedance (f = 20 Hz)	Z_{in}	0.5	2.0	–	–	2.0	–	megohms
Output Voltage Swing (R_L = 7.0 kΩ[Figure8])	V_o	±3.5	±4.0	–	±3.0	±4.0	–	V_{peak}
Input Common-Mode Voltage Swing	CMV_{in}	±2.0	±3.0	–	–	±3.0	–	V_{peak}
Common-Mode Rejection Ratio	CM_{rej}	75	90	–	60	90	–	dB
Input Bias Current $\left(\left[I_b = \frac{I_1 + I_2}{2}\right], T_A = +25^oC\right)$	I_b	–	0.8	2.0	–	2.0	40	µA
Input Offset Current ($I_{io} = I_1 - I_2$) ($I_{io} = I_1 - I_2$, $T_A = T_{low}$) ($I_{io} = I_1 - I_2$, $T_A = T_{high}$)	$\|I_{io}\|$	– – –	30 – –	100 200 200	– – –	30 – –	200 – –	nA
Input Offset Voltage (T_A = +25°C)	$\|V_{io}\|$	–	5.0	10	–	5.0	15	mV
Step Response Gain = 1.0, 10% Overshoot R_1 = 10 kΩ R_2 = 10 kΩ R_3 = 5.0 kΩ C_s = 39 pF	t_f t_{pd} dV_{out}/dt ①	– – –	80 70 5.0	– – –	– – –	80 70 5.0	– – –	ns ns V/µs
Gain = 10, 10% Overshoot R_1 = 10 kΩ R_2 = 100 kΩ R_3 = 10 kΩ C_s = 10 pF	t_f t_{pd} dV_{out}/dt ①	– – –	80 70 15	– – –	– – –	80 70 15	– – –	ns ns V/µs
Gain = 100, No Overshoot R_1 = 1.0 kΩ R_2 = 100 kΩ R_3 = 1.0 kΩ C_s = 1.0 pF	t_f t_{pd} dV_{out}/dt ①	– – –	80 70 30	– – –	– – –	80 70 30	– – –	ns ns V/µs
Open Loop, No Overshoot R_1 = 50 Ω R_2 = ∞ R_3 = 50 Ω C_s = 0	t_f t_{pd} dV_{out}/dt ①	– – –	180 70 35	– – –	– – –	180 70 35	– – –	ns ns V/µs
Bandwidth: (Open Loop[Figure 4]) (Closed Loop[Unity Gain]) (Figure 5)	–	– –	2.0 10	– –	– –	2.0 10	– –	MHz
Input Noise Voltage (Open Loop) (5.0 Hz – 5.0 MHz)	$V_{n(in)}$	–	11	15	–	11	–	µV(rms)
Average Temperature Coefficient of Input Offset Voltage (R_S = 50 Ω, $T_A = T_{low}$ to T_{high})	$\|TCV_{io}\|$	–	2.0	–	–	2.0	–	µV/°C
DC Power Dissipation (V_o = 0)	P_D	–	120	240	–	120	240	mW
Power Supply Sensitivity ($V^{\pm}$ Constant)	$S^{\pm}$	–	250	450	–	250	–	µV/V

① dV_{out}/dt = Slew Rate ② T_{low} = 0°C for MC1420, -55°C for MC1520 T_{high} = +75°C for MC1420 +125°C for MC1520

MC1520, MC1420 (continued)

DIFFERENTIAL ELECTRICAL CHARACTERISTICS

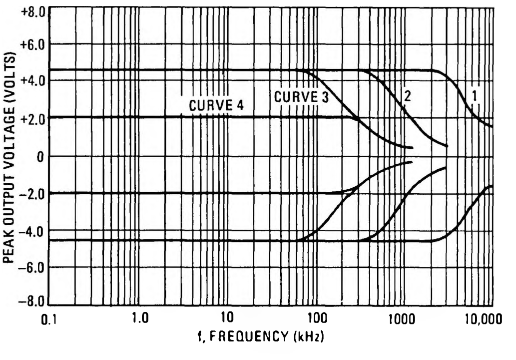
(V^+ = +6.0 Vdc, V^- = -6.0 Vdc, T_A = +25°C unless otherwise noted)

Characteristic	Symbol	MC1520 Min	MC1520 Typ	MC1520 Max	MC1420 Min	MC1420 Typ	MC1420 Max	Unit
Gain (Open Loop)	A_{VOL}	2000 66	3000 70	– –	1500 64	3000 70	– –	V/V dB
Input Impedance (f = 20 Hz)	Z_{in}	0.5	2.0	–	–	2.0	–	megohms
Output Impedance (f = 20 Hz)	Z_{out}	–	100	200	–	100	–	ohms
Common-Mode Output Voltage	V_o (CM)	-0.5	0	+0.5	–	0	–	Vdc
Output Voltage Swing (R_L = 7.0 kΩ)	V_o	±7.0	±8.0	–	±6.0	±8.0	–	V_{peak}

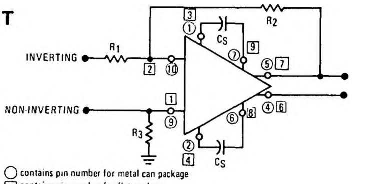
TYPICAL CHARACTERISTICS

(V^+ = +6.0 Vdc, V^- = -6.0 Vdc, T_A = +25°C, unless otherwise noted.)

FIGURE 3 – LARGE SIGNAL SWING versus FREQUENCY



TEST CIRCUIT



◯ contains pin number for metal can package
☐ contains pin number for flat package

FIGURE NO.	CURVE NO.	MODE	VOLTAGE GAIN	TEST CONDITIONS R_1 (Ω)	R_2 (Ω)	R_3 (Ω)	C_S (pF)	NOISE OUTPUT mV (rms)
3	1	INVERTING	100	1.0 k	100 k	1.0 k	1.0	2.0
	2	INVERTING	10	10 k	100 k	10 k	10	0.55
	3	INVERTING	1.0	10 k	10 k	5.0 k	39	0.17
	4	NON-INVERTING	1.0	∞	10 k	10 k	39	0.17
4	1	NON-INVERTING	A_{VOL}	0	∞	50	1.0	1.0
	2	NON-INVERTING	A_{VOL}	0	∞	50	10	2.0
	3	NON-INVERTING	A_{VOL}	0	∞	50	39	5.2
5	1	NON-INVERTING	100	100	10 k	100	1.0	2.0
	2	NON-INVERTING	10	1.0 k	9.1 k	910	10	0.55
	3	NON-INVERTING	1.0	∞	10 k	10 k	39	0.17

FIGURE 4 – OPEN LOOP VOLTAGE GAIN

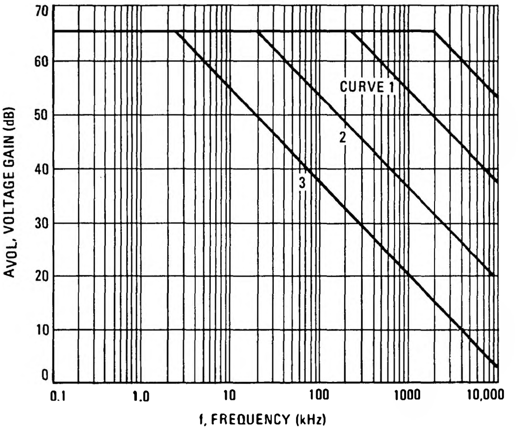
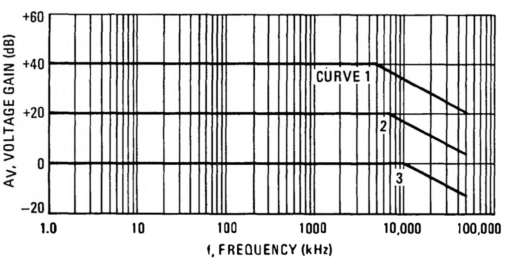


FIGURE 5 – CLOSED LOOP VOLTAGE GAIN versus FREQUENCY



TYPICAL OUTPUT CHARACTERISTICS

(V^+ = +6.0 Vdc, V^- = -6.0 Vdc, unless otherwise noted.)

FIGURE 6 – POWER DISSIPATION versus POWER SUPPLY VOLTAGE

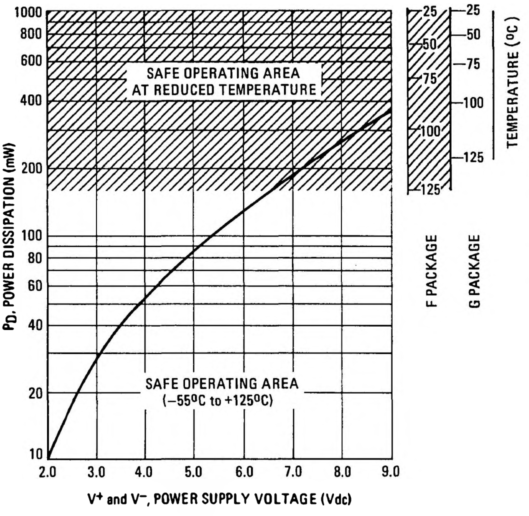


FIGURE 7 – OPEN LOOP VOLTAGE GAIN versus SUPPLY VOLTAGE

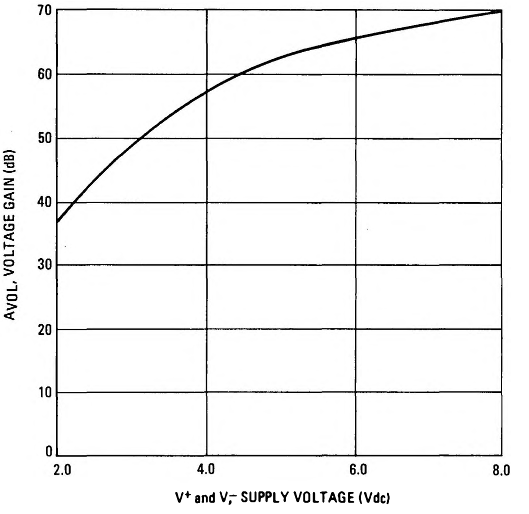


FIGURE 8 – SINGLE ENDED OUTPUT VOLTAGE versus LOAD RESISTANCE

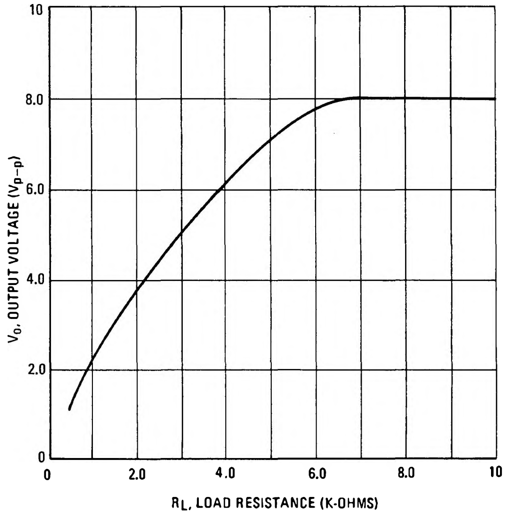


FIGURE 9 – OUTPUT NOISE VOLTAGE versus SOURCE RESISTANCE