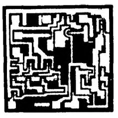
MC1533
MC1433

OPERATIONAL AMPLIFIERS

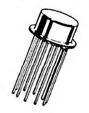
MONOLITHIC OPERATIONAL AMPLIFIER



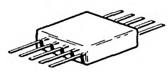
. . . designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components.

- High-Performance Open Loop Gain Characteristics
  A_{VOL} = 60,000 typical
- Low Temperature Drift – ±5 μV/°C
- Large Output Voltage Swing –
  ±13 V typical @ ±15 V Supply
- Low Output Impedance – Z_{out} = 100 ohms typical

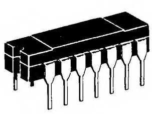
OPERATIONAL AMPLIFIER MONOLITHIC SILICON INTEGRATED CIRCUIT



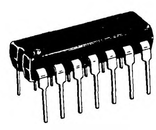
G SUFFIX
METAL PACKAGE
CASE 602B



F SUFFIX
CERAMIC PACKAGE
CASE 606
TO-91



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116



P SUFFIX
PLASTIC PACKAGE
CASE 605
TO-116
(MC1433P Only)

FIGURE 1 – CIRCUIT SCHEMATIC

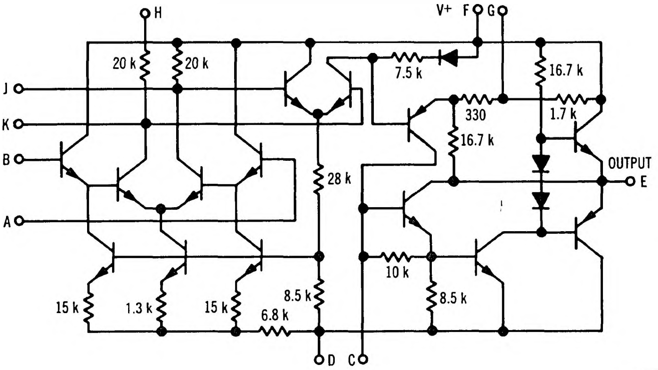
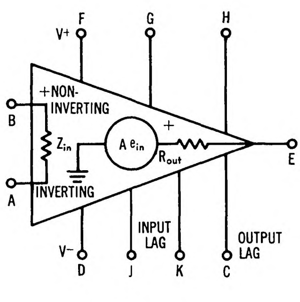


FIGURE 2 – EQUIVALENT CIRCUIT



PIN CONNECTIONS

Schematic	A	B	C	D	E	F	G	H	J	K
"G" Package	1	2	3	4	5	6	7	8	9	10
"F" Package	10	1	2	3	4	5	6	7	8	9
"L" & "P" Packages	4	5	6	7	11	12	13	14	2	3

See Packaging Information Section for outline dimensions.

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

Characteristic	Symbol	MC1533 Min	MC1533 Typ	MC1533 Max	MC1433 Min	MC1433 Typ	MC1433 Max	Unit
Open Loop Voltage Gain	A_{VOL}							–
(T_A = +25°C)		40,000	60,000	–	30,000	60,000	–	
(T_A = T_{low} ① to T_{high} ①)		35,000	50,000	–	20,000	50,000	–	
Output Impedance (f = 20 Hz)	Z_{out}	–	100	150	–	100	150	Ω
Input Impedance (f = 20 Hz)	Z_{in}	500	1000	–	300	600	–	kΩ
Output Voltage Swing	V_o							V_{peak}
(R_L = 10 kΩ)		±12	±13	–	±12	±13	–	
(R_L = 2 kΩ)		±11	±12	–	±10	±12	–	
Input Common Mode Voltage Swing	CMV_{in}	+9.0	+10	–	+8.0	+9.0	–	V_{peak}
		-8.0	-9.0	–	-8.0	-9.0	–	
Common Mode Rejection Ratio	CM_{rej}	90	100	–	80	100	–	dB
Input Bias Current	I_b							μA
(T_A = +25°C)		–	0.5	1.0	–	0.5	2.0	
(T_A = T_{low})		–	–	3.0	–	–	4.0	
Input Offset Current	$\|I_{io}\|$							μA
(T_A = +25°C)		–	0.03	0.15	–	0.1	0.50	
(T_A = T_{low})		–	–	0.5	–	–	0.75	
(T_A = T_{high})		–	–	0.2	–	–	0.75	
Input Offset Voltage ②	$\|V_{io}\|$							mV
(T_A = +25°C)		–	1.0	5.0	–	1.0	7.5	
(T_A = T_{low}, T_{high})		–	–	6.0	–	–	10	
Step Response (C_2 = 10 pF)								
Gain = 100, 10% overshoot,	t_f	–	0.25	–	–	0.25	–	μs
R_1 = 10 kΩ, R_2 = 1.0 MΩ,	t_{pd}	–	0.1	–	–	0.1	–	μs
R_3 = 100 Ω, C_1 = 0.01 μF	dV_{out}/dt ③	–	6.2	–	–	6.2	–	V/μs
Gain = 10, no overshoot,	t_f	–	0.3	–	–	0.3	–	μs
R_1 = 10 kΩ, R_2 = 100 kΩ,	t_{pd}	–	0.1	–	–	0.1	–	μs
R_3 = 10 Ω, C_1 = 0.1 μF	dV_{out}/dt ③	–	2.9	–	–	2.9	–	V/μs
Gain = 1, 5% overshoot,	t_f	–	0.2	–	–	0.2	–	μs
R_1 = 10 kΩ, R_2 = 10 kΩ,	t_{pd}	–	0.1	–	–	0.1	–	μs
R_3 = 10 Ω, C_1 = 1.0 μF	dV_{out}/dt ③	–	2.0	–	–	2.0	–	V/μs
Average Temperature Coefficient of Input Offset Voltage	$\|TC_{Vio}\|$							μV/°C
(T_A = T_{low} to +25°C)		–	8.0	–	–	10	–	
(T_A = +25°C to T_{high})		–	5.0	–	–	8.0	–	
Average Temperature Coefficient of Input Offset Current	$\|TC_{Iio}\|$							nA/°C
(T_A = T_{low} to T_{high})		–	0.1	–	–	0.1	–	
(T_A = +25°C to T_{high})		–	0.05	–	–	0.05	–	
DC Power Dissipation (Power Supply = ±15 V, V_o = 0)	P_D	–	125	170	–	125	240	mW
Positive Supply Sensitivity (V^- constant)	S^+	–	50	150	–	50	200	μV/V
Negative Supply Sensitivity (V^+ constant)	S^-	–	50	150	–	50	200	μV/V

① T_{high} = +75°C for MC1433, +125°C for MC1533; T_{low} = 0 for MC1433, -55°C for MC1533

② Input offset voltage (V_{io}) may be adjusted to zero.

③ dV_{out}/dt = Slew Rate

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

Rating	Symbol	Value	Unit
Power Supply Voltage MC1533,MC1433 MC1533,MC1433	V^+ V^-	+20,+18 -20,-18	Vdc Vdc
Differential Input Signal	V_{in}	±10	Volts
Common Mode Input Swing	CMV_{in}	$\pm V^+$	Volts
Load Current	I_L	10	mA
Output Short Circuit Duration	t_S	1.0	s
Power Dissipation (Package Limitation) Metal Package Derate above T_A = +25°C Flat Package Derate above T_A = +25°C Dual In-Line Ceramic Package Derate above T_A = +25°C Dual In-Line Plastic Package Derate above T_A = +25°C	P_D	 680 4.6 500 3.3 625 5.0 400 3.3	 mW mW/°C mW mW/°C mW mW/°C mW mW/°C
Operating Temperature Range MC1533 MC1433	T_A	 -55 to +125 0 to +75	°C
Storage Temperature Range Metal and Ceramic Packages Plastic Package	T_{stg}	 -65 to +150 -65 to +125	°C

TYPICAL CHARACTERISTICS

FIGURE 3 – TEST CIRCUIT

V^+ = +15 Vdc, V^- = -15 Vdc, T_A = +25°C

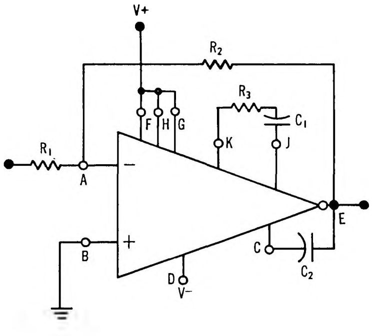


Fig. No.	Curve No.	Test Conditions				
		R_1 (Ω)	R_2 (Ω)	R_3 (Ω)	C_1 (μF)	C_2 (pF)
4	1	10 k	10 k	10	1.0	10
	2	10 k	100 k	10	0.1	10
	3	10 k	1.0 M	100	0.01	10
	3	1.0 k	1.0 M	390	0.002	10
5	1	10 k	10 k	10	1.0	10
	2	10 k	100 k	10	0.1	10
	3	10 k	1.0 M	100	0.01	10
	4	1.0 k	1.0 M	390	0.002	10
6	1	0	∞	10	1.0	10
	2	0	∞	10	0.1	10
	3	0	∞	100	0.01	10
	4	0	∞	390	0.002	10

TYPICAL CHARACTERISTICS (continued)

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

FIGURE 4 – LARGE-SIGNAL SWING versus FREQUENCY

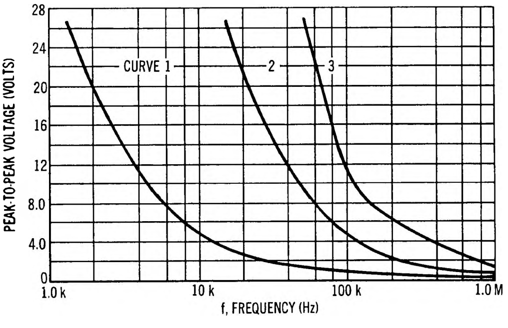


FIGURE 5 – VOLTAGE GAIN versus FREQUENCY

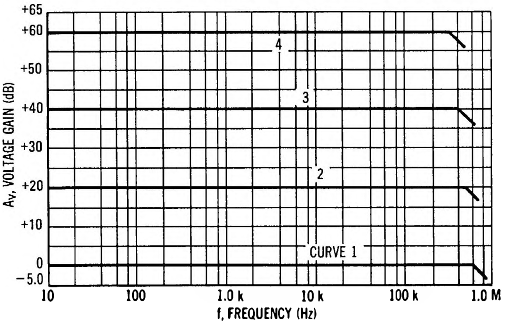


FIGURE 6 – OFFSET ADJUST CIRCUIT

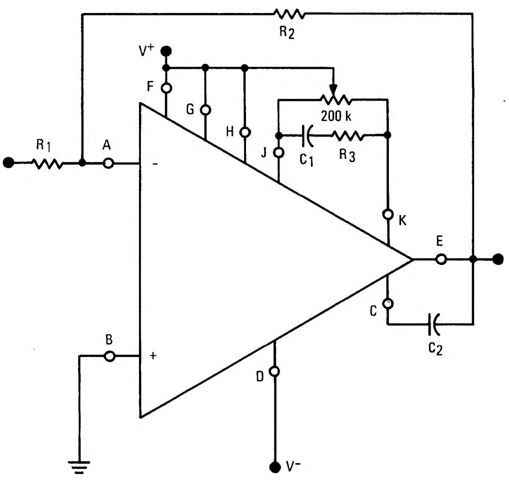
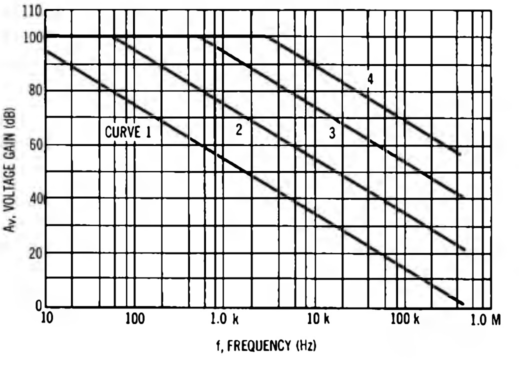


FIGURE 7 – OPEN LOOP VOLTAGE GAIN versus FREQUENCY (HIGH GAIN CONFIGURATION)



PIN CONNECTIONS

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TYPICAL CHARACTERISTICS (continued)

FIGURE 8 – POWER DISSIPATION versus POWER SUPPLY VOLTAGE

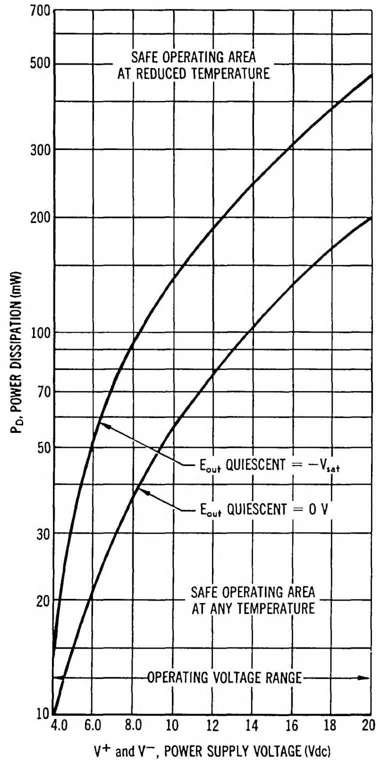

FIGURE 9 – VOLTAGE GAIN versus POWER SUPPLY VOLTAGE

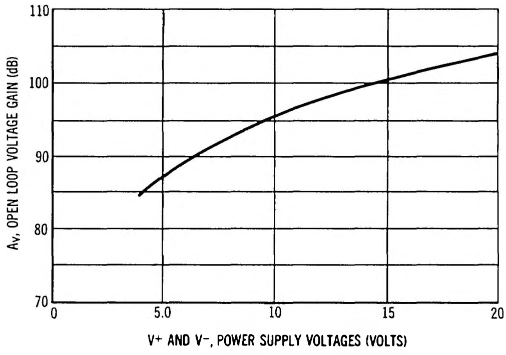

FIGURE 10 – COMMON MODE SWING versus POWER SUPPLY VOLTAGE

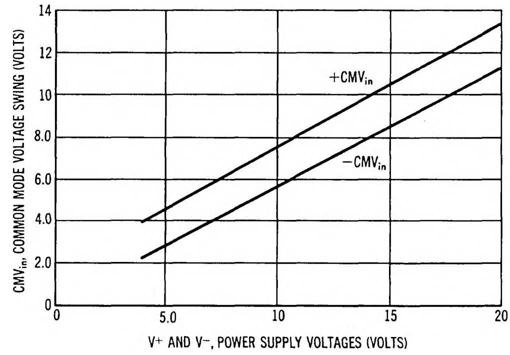

FIGURE 11 – INPUT NOISE VOLTAGE versus SOURCE RESISTANCE