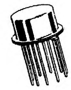
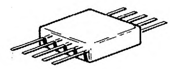
MC1709C

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

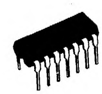


Lead 4 connected to case

CASE 96
(TO-99)
"G" SUFFIX



CASE 72
(TO-91)
"F" SUFFIX



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} = 150 ohms typical

PIN CONNECTIONS

Schematic	A	B	C	D	E	F	G	H
"G" Package	1	2	3	4	5	6	7	8
"F" Package	2	3	4	5	6	7	8	9
"P" Package	3	4	5	6*	9	10	11	12

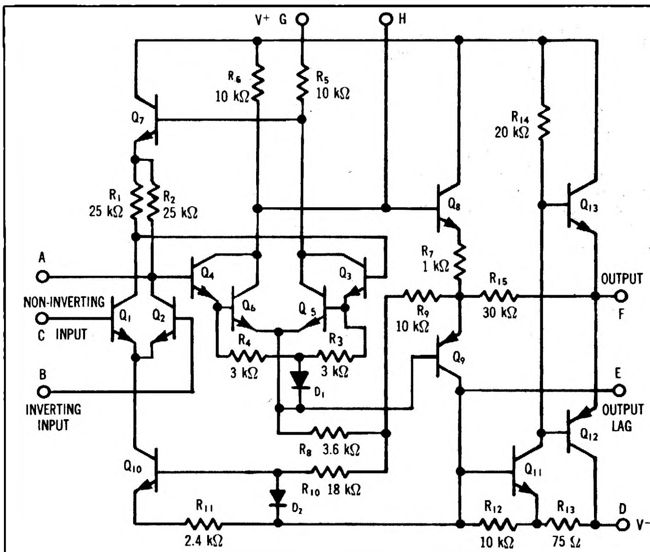
*Pin 7 is electrically connected to substrate and V⁻

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

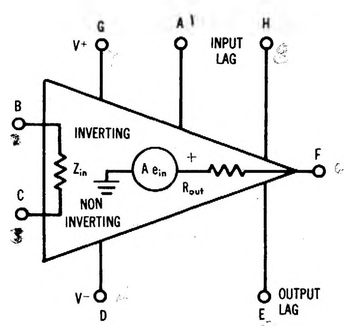
Rating	Symbol	Value	Unit
Power Supply Voltage	V^+ V^-	+18 -18	Vdc Vdc
Differential Input Signal	V_{in}	±5.0	Volts
Common Mode Input Swing	CMV_{in}	$\pm V^+$	Volts
Load Current	I_L	10	mA
Output Short Circuit Duration	t_S	5.0	s
Power Dissipation (Package Limitation) Metal Can Derate above 25°C Flat Package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

* For full temperature range (-55°C to +125°C) and characteristic curves, see MC1709 data sheet.

CIRCUIT SCHEMATIC

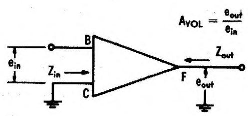
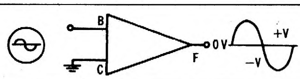
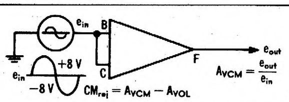
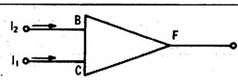
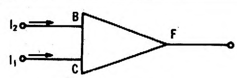
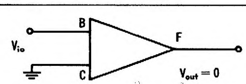
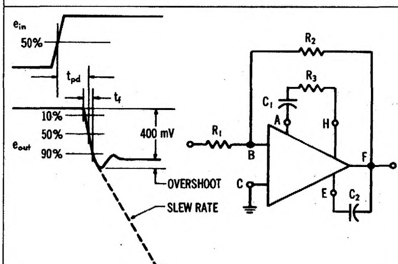
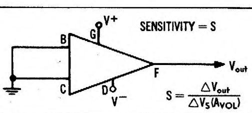


EQUIVALENT CIRCUIT



MC1709C (continued)

ELECTRICAL CHARACTERISTICS (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 = 2 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}	-	150	-	Ω
	Input Impedance (f = 20 Hz)	Z_{in}	50	250	-	kΩ
	Output Voltage Swing (R_L = 10 kΩ) (R_L = 2 kΩ)	V_{out}	 ±12 ±10	 ±14 ±13	 - -	V_{peak}
	Input Common Mode Voltage Swing	CMV_{in}	±8.0	±10	-	V_{peak}
	Common Mode Rejection Ratio	CM_{rej}	65	90	-	dB
	Input Bias Current $\left(I_b = \frac{I_1 + I_2}{2}\right)$, ($T_A$ = +25°C) (T_A = 0°C)	I_b	 - -	 0.3 -	 1.5 2.0	µA
	Input Offset Current ($I_{io} = I_1 - I_2$) ($I_{io} = I_1 - I_2$, T_A = 0°C) ($I_{io} = I_1 - I_2$, T_A = +75°C)	I_{io}	 - - -	 0.1 - -	 0.5 0.75 0.75	µA
	Input Offset Voltage (T_A = 25°C) (T_A = 0°C, +75°C)	V_{io}	 - -	 2.0 -	 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 pF	 t_f t_{pd} dV_{out}/dt ①	 - - -	 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_f t_{pd} dV_{out}/dt ①	- - -	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_f t_{pd} dV_{out}/dt ①	- - -	2.2 1.3 0.25	- - -	µs µs V/µs
	Average Temperature Coefficient of Input Offset Voltage (R_S = 50 Ω, T_A = 0°C to +75°C) ($R_S \leq$ 10 kΩ, T_A = 0°C to +75°C)	TC_{Vio}	 - -	 3.0 6.0	 - -	µV/°C
	DC Power Dissipation (Power Supply = ±15 V, V_{out} = 0)	P_D	-	80	200	mW
	Positive Supply Sensitivity (V^- constant)	S^+	-	25	200	µV/V
	Negative Supply Sensitivity (V^+ constant)	S^-	-	25	200	µV/V

① dV_{out}/dt = Slew Rate

MC1712

. . . designed for use as an operational amplifier utilizing operating characteristics as a function of the external feedback components.

Lead 4 connected to case

CASE 96
(TO-99)
"G" SUFFIX

CASE 72
(TO-91)
"F" SUFFIX

Typical Amplifier Features:

- Open Loop Gain A_{VOL} = 3600 typical
- Low Temperature Drift – ±2.5 μV/°C
- Output Swing – ±5.3 V typical @ +12 V and -6.0 V Supplies
- Low Output Impedance – Z_{out} = 200 ohms typical

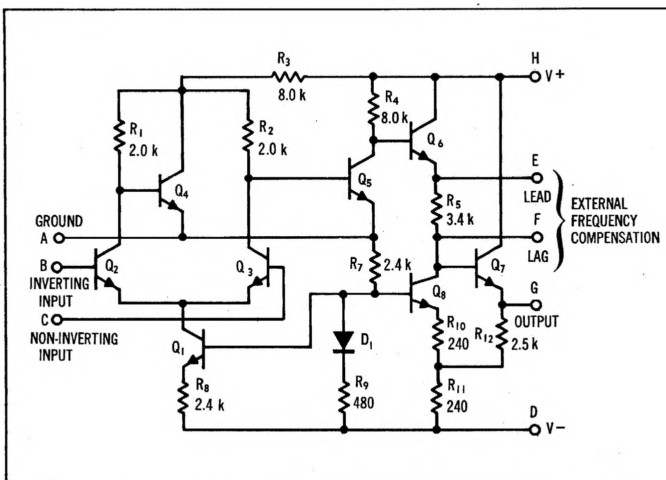
MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage (Total between V^+ and V^- terminals)	$\|V^+\|+\|V^-\|$	21	Vdc
Differential Input Signal	V_{in}	±5.0	Volts
Common Mode Input Swing	CMV_{in}	+1.5 -6.0	Volts
Peak Load Current	I_L	50	mA
Power Dissipation (Package Limitation)	P_D		
Metal Can		680	mW
Derate above T_A = 25°C		4.6	mW/°C
Flat Package		500	mW
Derate above T_A = 25°C		3.3	mW/°C
Operating Temperature Range	T_A	-55 to +125	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

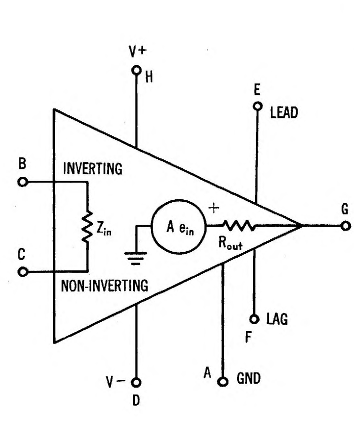
PIN CONNECTIONS

Schematic	A	B	C	D	E	F	G	H
"G" Package	1	2	3	4	5	6	7	8
"F" Package	2	3	4	5	6	7	8	10

CIRCUIT SCHEMATIC

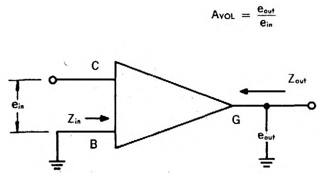
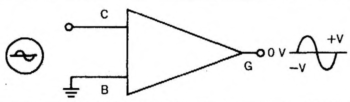
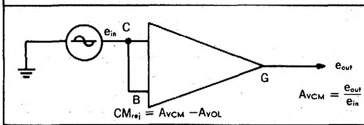
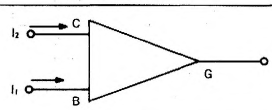
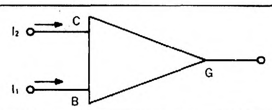
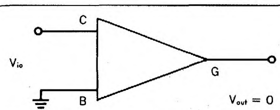
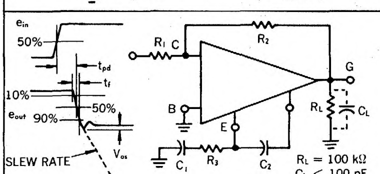
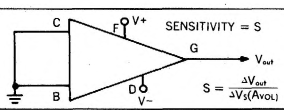


EQUIVALENT CIRCUIT



MC1712 (continued)

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic Definitions ①	Characteristic	Symbol	Min	Typ	Max	Unit
	Open Loop Voltage Gain R_L = 100 kΩ (V^+ = 6.0 Vdc, V^- = -3.0 Vdc, (V_{out} = ± 2.5 V) (V^+ = 12 Vdc, V^- = -6.0 Vdc, V_{out} = ± 5.0 V) (V^+ = 12 Vdc, V^- = -6.0 Vdc, V_{out} = ± 5.0 Vdc, T_A = -55, +125°C) (V^+ = 6.0 Vdc, V^- = -3.0 Vdc, V_{out} = ± 2.5 V, T_A = -55 to +125°C)	A_{VOL}	 600 2500 2000 500	 900 3600 	 1500 6000 7000 1750	V/V
	Output Impedance (V^+ = 6.0 Vdc, V^- = -3.0 Vdc, f = 20 Hz) (V^+ = 12 Vdc, V^- = -6.0 Vdc, f = 20 Hz)	Z_{out}	 - -	 300 200	 700 500	ohms
	Input Impedance (V^+ = 6.0 Vdc, V^- = -3.0 Vdc, f = 20 Hz) (V^+ = 6.0 Vdc, V^- = -3.0 Vdc, f = 20 Hz, T_A = -55°C, +125°C) (V^+ = 12 Vdc, V^- = -6.0 Vdc, f = 20 Hz) (V^+ = 12 Vdc, V^- = -6.0 Vdc, f = 20 Hz, T_A = -55°C, +125°C)	Z_{in}	 22 8.0 16 6.0	 70 - 40 -	 - - - -	k ohms
	Output Voltage Swing (V^+ = 6.0 Vdc, V^- = -3.0 Vdc, R_L = 100 kΩ) (V^+ = 12 Vdc, V^- = -6.0 Vdc, R_L = 100 kΩ) (V^+ = +6.0 Vdc, V^- = -3.0 Vdc, R_L = 10 kΩ) (V^+ = +12 Vdc, V^- = -6.0 Vdc, R_L = 10 kΩ)	V_{out}	 ±2.5 ±5.0 ± 1.5 ± 3.5	 ±2.7 ±5.3 ± 2.0 ± 4.0	 - - 	V_{peak}
	Input Common Mode Voltage Swing (V^+ = 6.0 Vdc, V^- = -3.0 Vdc) (V^+ = 12 Vdc, V^- = -6.0 Vdc)	CMV_{in}	 +0.5 -1.5 +0.5 -4.0	 - - - -	 - - - -	V_{peak}
	Common Mode Rejection Ratio (V^+ = 6.0 Vdc, V^- = -3.0 Vdc, f ≤ 1.0 kHz) (V^+ = 12 Vdc, V^- = -6.0 Vdc, f ≤ 1.0 kHz)	CM_{rej}	 80 80	 100 100	 - -	dB
	Input Bias Current T_A = 25°C $I_b = \frac{I_1 + I_2}{2}$, ($V^+$ = 6.0 Vdc, V^- = -3.0 Vdc) (V^+ = 12 Vdc, V^- = -6.0 Vdc) T_A = -55°C (V^+ = 6.0 Vdc, V^- = -3.0 Vdc) (V^+ = 12 Vdc, V^- = -6.0 Vdc)	I_b	 - - - -	 1.2 2.0 2.5 4.0	 3.5 5.0 7.5 10	µA
	Input Offset Current ($I_{io} = I_1 - I_2$) (V^+ = 6.0 Vdc, V^- = -3.0 Vdc) (V^+ = 6.0 Vdc, V^- = -3.0 Vdc, T_A = -55 to +125°C) (V^+ = 12 Vdc, V^- = -6.0 Vdc) (V^+ = 12 Vdc, V^- = -6.0 Vdc, T_A = -55 to +125°C)	I_{io}	 - - - -	 0.1 - 0.2 -	 0.5 1.5 0.5 1.5	µA
	Input Offset Voltage R_S = 2.0 kΩ (V^+ = 6.0 Vdc, V^- = -3.0 Vdc) (V^+ = 6.0 Vdc, V^- = -3.0 Vdc, T_A = -55°C, +125°C) (V^+ = 12 Vdc, V^- = -6.0 Vdc) (V^+ = 12 Vdc, V^- = -6.0 Vdc, T_A = -55°C, +125°C)	V_{io}	 - - - -	 1.3 - 1.1 -	 3.0 4.0 2.0 3.0	mV
	Step Response V^+ = 12 Vdc, V^- = -6.0 Vdc Gain = 100, V_{in} = 1.0 mV, R_1 = 1.0 kΩ, R_2 = 100 kΩ, C_2 = 50 pF, R_3 = ∞, C_1 = open V^+ = 12 Vdc, V^- = -6.0 Vdc Gain = 1.0, V_{in} = 10 mV, R_1 = 10 kΩ, R_2 = 10 kΩ, C_1 = 0.01 µF, R_3 = 20Ω, C_2 = open	V_{os} t_f t_{pd} dV_{out}/dt② V_{os} t_f t_{pd} dV_{out}/dt②	- - - - - - - -	20 10 10 12 10 25 16 1.5	40 30 - - 50 120 - -	% ns ns V/µs % ns ns V/µs
	Average Temperature Coefficient of Input Offset Voltage R_S = 50 Ω (T_A = +25 to +125°C) (T_A = -55 to +25°C)	TC_{Vio}	 - -	 2.5 2.0	 - -	µV/°C
	Average Temperature Coefficient Input Offset Current (T_A = +25°C to +125°C) (T_A = -55 to +25°C)	TC_{Iio}	 - -	 0.05 1.5	 - -	nA/°C
	DC Power Dissipation (V_{out} = 0, V^+ = 6.0 Vdc, V^- = -3.0 Vdc) (V_{out} = 0, V^+ = 12 Vdc, V^- = -6.0 Vdc)	P_D	 - -	 17 70	 30 120	mW
	Positive Supply Sensitivity (V^- constant = -6.0 Vdc, V^+ = 12 Vdc to 6.0 Vdc)	S^+	-	60	200	µV/V
	Negative Supply Sensitivity (V^+ constant = 12 Vdc, V^- = -6.0 Vdc to -3.0 Vdc)	S^-	-	60	200	µV/V

① All definitions imply linear operation. ② dV_{out}/dt = Slew Rate

TYPICAL OUTPUT CHARACTERISTICS

V+ = 12 Vdc, V− = −6.0 Vdc, T_A = 25°C

FIGURE 1 — OPEN LOOP GAIN versus POWER SUPPLY VARIATIONS

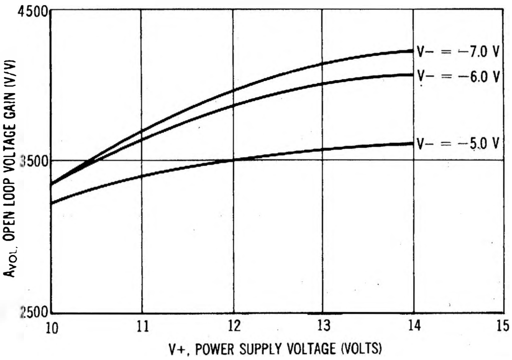


FIGURE 2 — OPEN LOOP VOLTAGE GAIN versus FREQUENCY

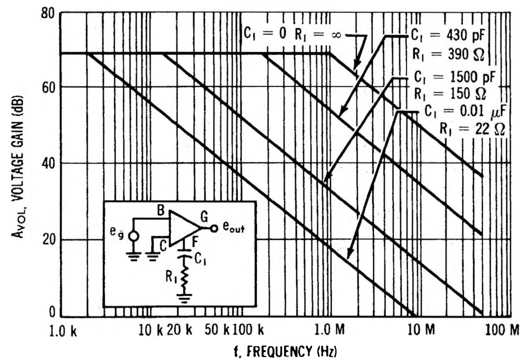


FIGURE 3 — VOLTAGE GAIN versus FREQUENCY

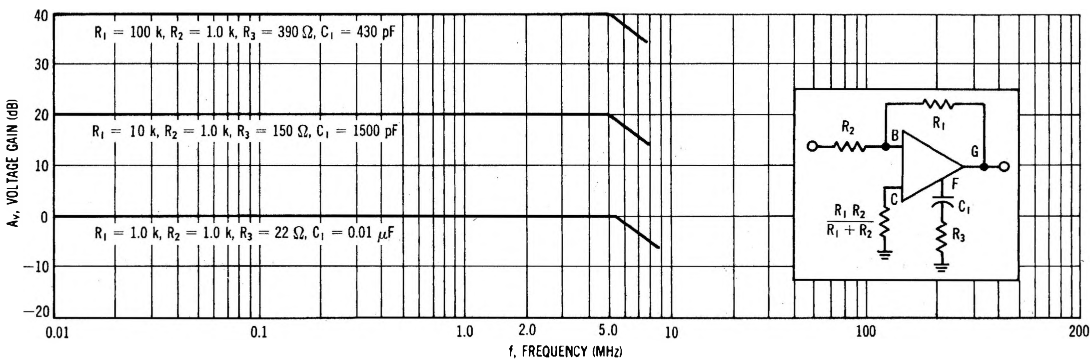


FIGURE 4 — MAXIMUM OUTPUT SWING versus FREQUENCY

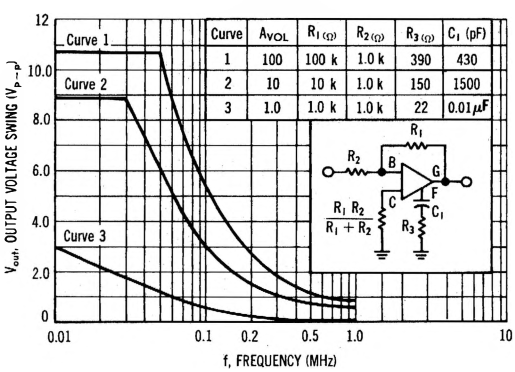


FIGURE 5 — OUTPUT VOLTAGE SWING versus LOAD RESISTANCE

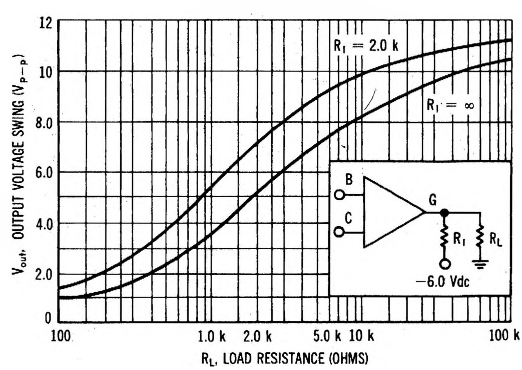


FIGURE 6 — INPUT BIAS CURRENT versus TEMPERATURE

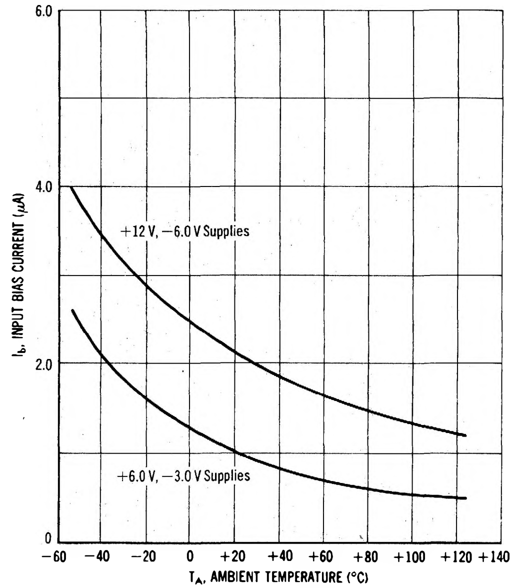


FIGURE 7 — INPUT OFFSET CURRENT versus TEMPERATURE

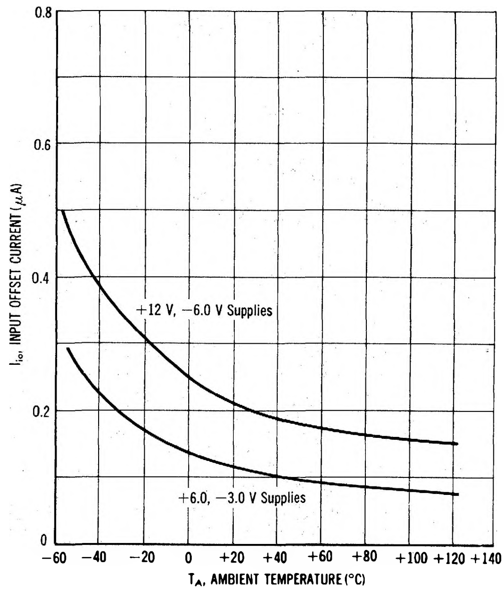


FIGURE 8 — INPUT OFFSET VOLTAGE versus TEMPERATURE

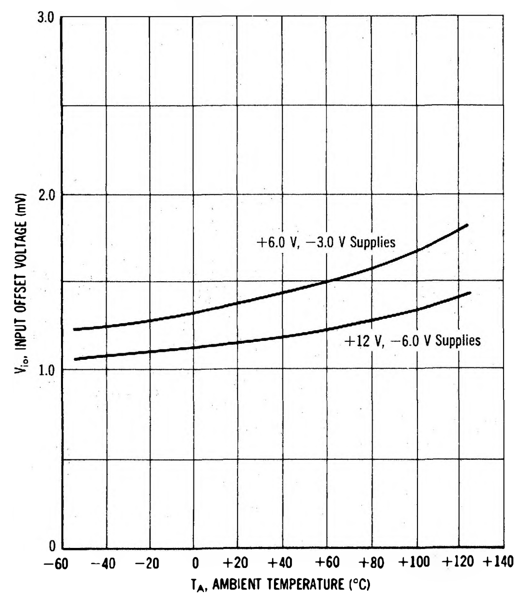


FIGURE 9 — OUTPUT NOISE VOLTAGE versus SOURCE IMPEDANCE