

MC1536G MC1436G MC1436CG

OPERATIONAL AMPLIFIER

HIGH VOLTAGE, INTERNALLY COMPENSATED MONOLITHIC OPERATIONAL AMPLIFIER

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

- Maximum Supply Voltage – ± 40 Vdc (MC1536G)
- Output Voltage Swing –
 ± 30 V_{pk}(min) ($V^+ = +36$ V, $V^- = -36$ V) (MC1536G)
 ± 22 V_{pk}(min) ($V^+ = +28$ V, $V^- = -28$ V)
- Input Bias Current – 20 nA max (MC1536G)
- Input Offset Current – 3.0 nA max (MC1536G)
- Fast Slew Rate – 2.0 V/ μ s typ
- Internally Compensated
- Offset Voltage Null Capability
- Input Over-Voltage Protection
- A_{VOL} – 500,000 typ
- Characteristics Independent of Power Supply Voltages –
 $(\pm 5.0$ Vdc to ± 36 Vdc)

OPERATIONAL AMPLIFIER INTEGRATED CIRCUIT

EPITAXIAL PASSIVATED

METAL PACKAGE
CASE 601
TO-99



(bottom view)



FIGURE 1 – DIFFERENTIAL AMPLIFIER WITH ± 20 V
COMMON-MODE INPUT VOLTAGE RANGE

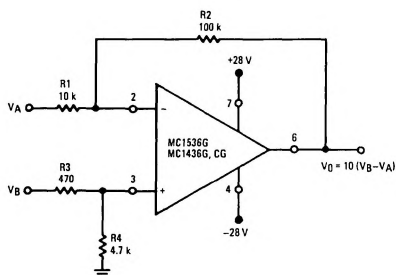


FIGURE 2 – VOLTAGE CONTROLLED CURRENT
SOURCE or TRANSCONDUCTANCE AMPLIFIER
WITH 0 TO 40 V COMPLIANCE

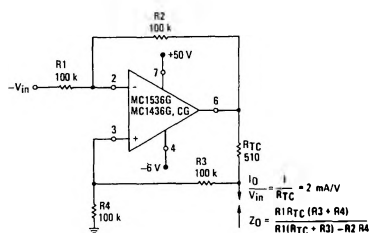


FIGURE 3 – TYPICAL NON-INVERTING X10
VOLTAGE AMPLIFIER

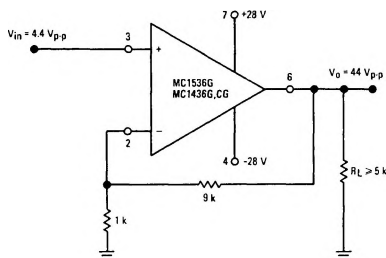
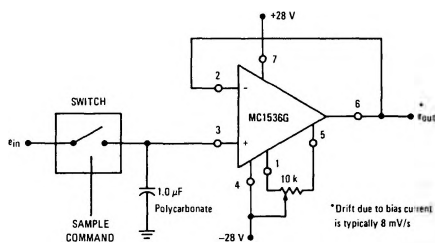


FIGURE 4 – LOW-DRIFT SAMPLE AND HOLD



MC1536G, MC1436G, MC1436CG (continued)

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

Rating	Symbol	MC1536G	MC1436G	MC1436CG	Unit
Power Supply Voltage	V ⁺ V ⁻	+40 -40	+34 -34	+30 -30	Vdc
Differential Input Signal	V _{in}	±(V ⁺ + V ⁻ -3)			Volts
Common-Mode Input Swing	CMV _{in}	+V ⁺ , -(V ⁻ -3)			Volts
Output Short Circuit Duration (V ⁺ = V ⁻ = 28 Vdc, V _O = 0)	T _{SC}	5.0			s
Power Dissipation (Package Limitation) Derate above T _A = +25°C	P _D	680 4.6			mW mW/°C
Operating Temperature Range	T _A	-55 to +150			°C
Storage Temperature Range	T _{stg}	-65 to +150			°C

ELECTRICAL CHARACTERISTICS (V⁺ = +28 Vdc, V⁻ = -28 Vdc, T_A = +25°C unless otherwise noted)

Characteristics	Symbol	MC1536G			MC1436G			MC1436CG			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Bias Current T _A = +25°C T _A = T _{low} to T _{high} (See Note 1)	I _b	—	8.0	20	—	15	40	—	25	90	nAdc
Input Offset Current T _A = +25°C T _A = +25°C to T _{high} T _A = T _{low} to +25°C	I _{io}	—	1.0	3.0	—	5.0	10	—	10	25	nAdc
Input Offset Voltage T _A = +25°C T _A = T _{low} to T _{high}	V _{io}	—	2.0	5.0	—	5.0	10	—	5.0	12	mVdc
Differential Input Impedance (Open-Loop, f ≤ 5.0 Hz)	R _p	—	10	—	—	10	—	—	10	—	Meg ohms
Parallel Input Resistance	C _p	—	2.0	—	—	2.0	—	—	2.0	—	pF
Common-Mode Input Impedance (f ≤ 5.0 Hz)	Z _(in)	—	250	—	—	250	—	—	250	—	Meg ohms
Common-Mode Input Voltage Swing	CMV _{in}	±24	±25	—	±22	±25	—	±18	±20	—	V _{pk}
Equivalent Input Noise Voltage (A _V = 100, R _s = 10 k ohms, f = 1.0 kHz, BW = 1.0 Hz)	e _n	—	50	—	—	50	—	—	50	—	nV/(Hz) ^{1/2}
Common-Mode Rejection Ratio (dc)	CM _{rej}	80	110	—	70	110	—	50	90	—	dB
Large Signal dc Open Loop Voltage Gain (V _O = ±10 V, R _L = 100 k ohms) { T _A = +25°C T _A = T _{low} to T _{high} (V _O = ±10 V, R _L = 10 k ohms, T _A = +25°C)	A _{VOL}	100,000 50,000 —	500,000 — 200,000	— — —	70,000 50,000 —	500,000 — 200,000	— — —	50,000 — 200,000	500,000 — —	— — —	V/V
Power Bandwidth (Voltage Follower) (A _V = 1, R _L = 5.0 k ohms, THD ≤ 5%, V _O = 40 Vp-p)	P _{BW}	—	23	—	—	23	—	—	23	—	kHz
Unity Gain Crossover Frequency (open-loop)	f _c	—	1.0	—	—	1.0	—	—	1.0	—	MHz
Phase Margin (open-loop, unity gain)	φ	—	50	—	—	50	—	—	50	—	degrees
Gain Margin	A _{GM}	—	18	—	—	18	—	—	18	—	dB
Slew Rate (Unity Gain)	dV _{out} /dt	—	2.0	—	—	2.0	—	—	2.0	—	V/μs
Output Impedance (f ≤ 5.0 Hz)	Z _{out}	—	1.0	—	—	1.0	—	—	1.0	—	k ohms
Short-Circuit Output Current	I _{SC}	—	±17	—	—	±17	—	—	±19	—	mAdc
Output Voltage Swing (R _L = 5.0 k ohms) V ⁺ = +28 Vdc, V ⁻ = -28 Vdc V ⁺ = +36 Vdc, V ⁻ = -36 Vdc	V _O	±22 ±30	±23 ±32	— —	±20 —	±22 —	— —	±20 —	±22 —	— —	V _{pk}
Power Supply Sensitivity (dc) V ⁻ = constant, R _s ≤ 10 k ohms V ⁺ = constant, R _s ≤ 10 k ohms	S ⁺ S ⁻	— —	15 15	100 100	— —	35 35	200 200	— —	50 50	— —	μV/V
Power Supply Current (See Note 2)	I _D ⁺ I _D ⁻	— —	2.2 2.2	4.0 4.0	— —	2.6 2.6	5.0 5.0	— —	2.6 2.6	5.0 5.0	mAdc
DC Quiescent Power Dissipation (V _O = 0)	P _D	—	124	224	—	146	280	—	146	280	mW

Note 1: T_{low} = 0°C for MC1436G.CG
-55°C for MC1536G
T_{high} = +75°C for MC1436G.CG
+15°C for MC1536G

Note 2: V⁺ = |V⁻| = 5.0 Vdc to 36 Vdc for MC1536G
V⁺ = |V⁻| = 5.0 Vdc to 30 Vdc for MC1436G
V⁺ = |V⁻| = 5.0 Vdc to 28 Vdc for MC1436CG

FIGURE 5 – POWER BANDWIDTH

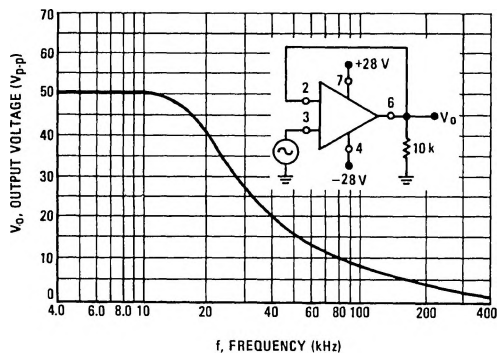


FIGURE 6 – PEAK OUTPUT VOLTAGE SWING versus POWER SUPPLY VOLTAGE

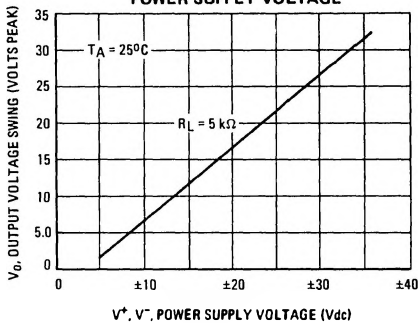


FIGURE 7 – OPEN-LOOP FREQUENCY RESPONSE

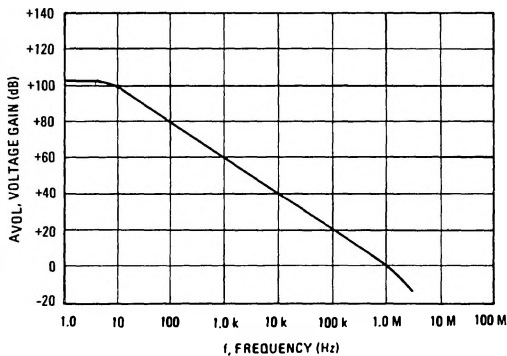


FIGURE 8 – OUTPUT SHORT-CIRCUIT CURRENT versus TEMPERATURE

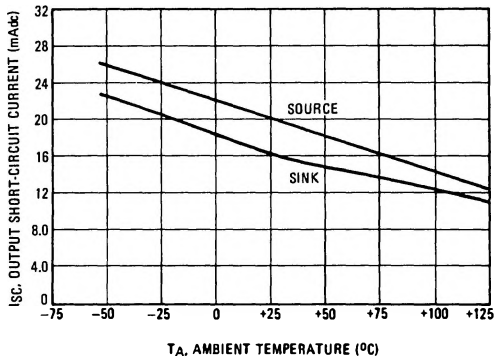


FIGURE 9 – INPUT BIAS CURRENT versus TEMPERATURE

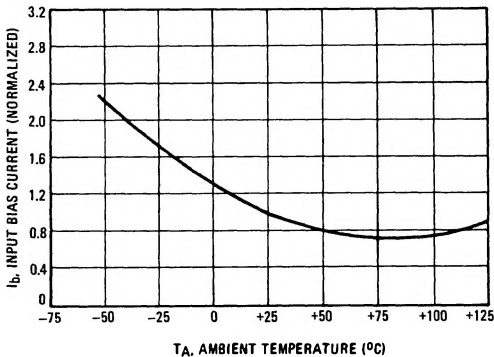


FIGURE 10 – INVERTING FEEDBACK MODEL

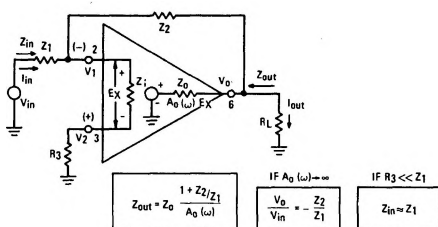


FIGURE 11 – NON-INVERTING FEEDBACK MODEL

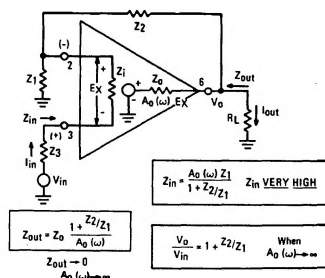


FIGURE 12 – AUDIO AMPLIFIER

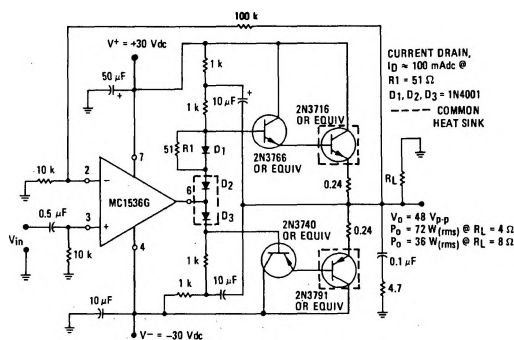


FIGURE 13 – CIRCUIT SCHEMATIC

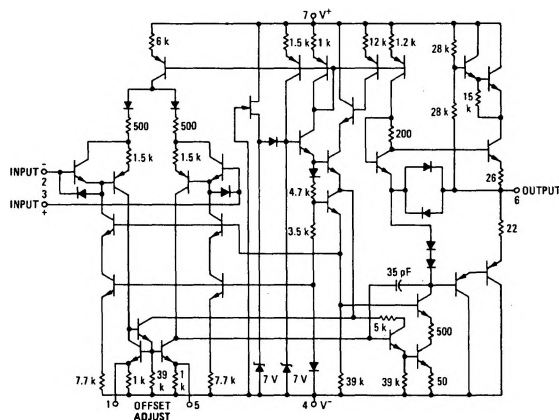


FIGURE 14 – EQUIVALENT CIRCUIT

