2

ORDERING INFORMATION

Device	Temperature Range	Package
MC1436CD	0°C to +70°C	SO-8
MC1436D	0°C to +70°C	SO-8
MC1436P1	0°C to +70°C	Plastic DIP
MC1436CP1	0°C to +70°C	Plastic DIP
MC1436G	0°C to +70°C	Metal Can
MC1436U	0°C to +70°C	Ceramic DIP
MC1436CG	0°C to +70°C	Metal Can
MC1436CU	0°C to +70°C	Ceramic DIP
MC1536G	−55°C to +125°C	Metal Can
MC1536U	−55°C to +125°C	Ceramic DIP

MC1436
MC1436C
MC1536

HIGH VOLTAGE, INTERNALLY COMPENSATED 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 (MC1536)
- Output Voltage Swing –
  ±30 $V_{pk(min)}$ (V_{CC} = +36 V, V_{EE} = -36 V) (MC1536)
  ±22 $V_{pk(min)}$ (V_{CC} = +28 V, V_{EE} = -28 V)
- Input Bias Current – 20 nA max (MC1536)
- Input Offset Current – 3.0 nA max (MC1536)
- Fast Slew Rate – 2.0 V/μs typ
- Internally Compensated
- Offset Voltage Null Capability
- Input Over-Voltage Protection
- A_{VOL} – 500,000 typ
- Characteristics Independent of Power Supply Voltages – (±5.0 Vdc to ±36 Vdc)

OPERATIONAL AMPLIFIER

SILICON MONOLITHIC INTEGRATED CIRCUIT

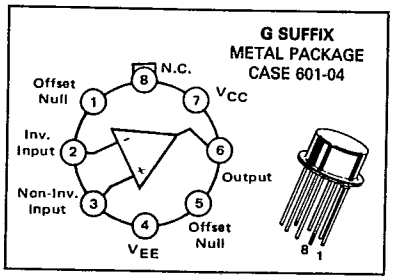
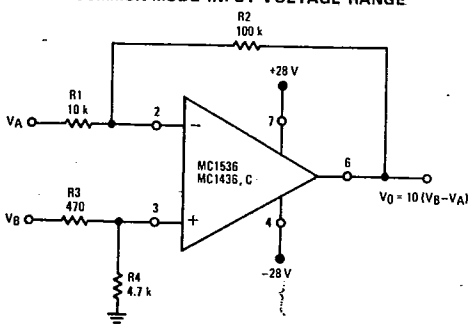
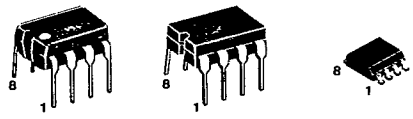


FIGURE 1 – DIFFERENTIAL AMPLIFIER WITH ± 20 V COMMON-MODE INPUT VOLTAGE RANGE





P1 SUFFIX
PLASTIC PACKAGE
CASE 626-05

U SUFFIX
CERAMIC PACKAGE
CASE 693-02

D SUFFIX
PLASTIC PACKAGE
CASE 751-02
SO-8

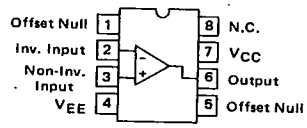


FIGURE 2 — TYPICAL NONINVERTING X10 VOLTAGE AMPLIFIER

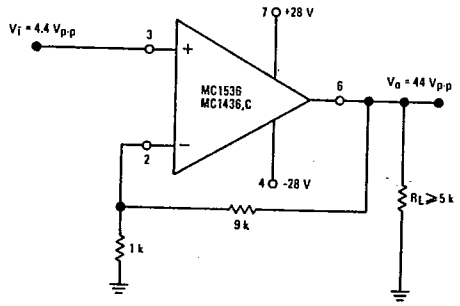
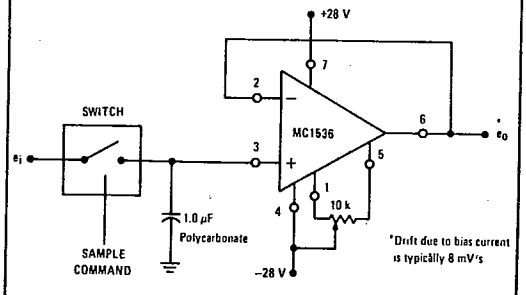


FIGURE 3 — LOW-DRIFT SAMPLE AND HOLD



MC1436, MC1436C, MC1536

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

Rating	Symbol	MC1536	MC1436	MC1436C	Unit
Power Supply Voltage	V_{CC} V_{EE}	+40 -40	+34 -34	+30 -30	Vdc
Input Differential Voltage Range	V_{IDR}	Note 3			Volts
Input Common-Mode Voltage Range	V_{ICR}	Note 3			Volts
Output Short Circuit Duration (V_{CC} = V_{EE} = 28 Vdc, V_o = 0)	t_S	5.0			s
Power Dissipation (Package Limitation) Derate above T_A = +25°C	P_D	680 4.6			mW mW/°C
Operating Ambient Temperature Range	T_A	-55 to +125	0 to +70		°C
Storage Temperature Range	T_{stg}	-65 to +150			°C

ELECTRICAL CHARACTERISTICS (V_{CC} = +28 Vdc, V_{EE} = -28 Vdc, T_A = +25°C unless otherwise noted)

Characteristics	Symbol	MC1536 Min	MC1536 Typ	MC1536 Max	MC1436 Min	MC1436 Typ	MC1436 Max	MC1436C Min	MC1436C Typ	MC1436C Max	Unit
Input Bias Current	I_{IB}										nAdc
T_A = +25°C		–	8.0	20	–	15	40	–	25	90	
T_A = T_{low} to T_{high} (See Note 1)		–	–	35	–	–	55	–	–	–	
Input Offset Current	I_{IO}										nAdc
T_A = +25°C		–	1.0	3.0	–	5.0	10	–	10	25	
T_A = +25°C to T_{high}		–	–	4.5	–	–	14	–	–	–	
T_A = T_{low} to +25°C		–	–	7.0	–	–	14	–	–	–	
Input Offset Voltage	V_{IO}										mVdc
T_A = +25°C		–	2.0	5.0	–	5.0	10	–	5.0	12	
T_A = T_{low} to T_{high}		–	–	7.0	–	–	14	–	–	–	
Differential Input Impedance (Open-Loop, f ≤ 5.0 Hz)											
Parallel Input Resistance	r_P	–	10	–	–	10	–	–	10	–	Meg ohms
Parallel Input Capacitance	C_P	–	2.0	–	–	2.0	–	–	2.0	–	pF
Common-Mode Input Impedance (f ≤ 5.0 Hz)	z_{ic}	–	250	–	–	250		–	250	–	Meg ohms
Input Common-Mode Voltage Range	V_{ICR}	±24	±25		±22	±25	–	±18	±20	–	V_{pk}
Equivalent Input Noise Voltage	e_n										nV/(Hz)½
(A_V = 100, R_s = 10 k ohms, f = 1.0 kHz, BW = 1.0 Hz)		–	50	–	–	50	–	–	50	–	
Common-Mode Rejection Ratio (dc)	CMRR	80	110	–	70	110	–	50	90	–	dB
Large Signal dc Open Loop Voltage Gain	A_{VOL}										V/V
(V_o = ± 10 V, R_L = 100 k ohms) T_A = +25°C		100,000	500,000	–	70,000	500,000	–	50,000	500,000	–	
(V_o = ± 10 V, R_L = 100 k ohms) T_A = T_{low} to T_{high}		50,000	–	–	50,000	–	–	–	–	–	
(V_o = ±10 V, R_L = 10 k ohms, T_A = +25°C)			200,000			200,000			200,000		
Power Bandwidth (Voltage Follower)	BWp										kHz
(A_V = 1, R_L = 5.0 k ohms, THD ≤ 5%, V_o = 40 Vp-p)		–	23	–	–	23	–	–	23	–	
Unity Gain Crossover Frequency (open-loop)	f_c	–	1.0	–	–	1.0	–	–	1.0		MHz
Phase Margin (open-loop, unity gain)	ϕ_m	–	50		–	50	–	–	50		degrees
Gain Margin	A_M	–	18	–	–	18	–	–	18	–	dB
Slew Rate (Unity Gain)	SR	–	2.0	–	–	2.0		–	2.0	–	V/µs
Output Impedance (f ≤ 5.0 Hz)	z_o	–	1.0		–	1.0	–		1.0		k ohms
Short-Circuit Output Current	I_{OS}	–	±17	–	–	±17			±19	–	mAdc
Output Voltage Range (R_L = 5.0 k ohms)	V_{OR}										V_{pk}
V_{CC} = +28 Vdc, V_{EE} = -28 Vdc		±22	±23	–	±20	±22	–	±20	±22	–	
V_{CC} = +36 Vdc, V_{EE} = -36 Vdc		±30	±32	–	–	–	–		–	–	
Power Supply Sensitivity (dc)											µV/V
V_{EE} = constant, R_s ≤ 10 k ohms	PSS+	–	15	100	–	35	200	–	50		
V_{CC} = constant, R_s ≤ 10 k ohms	PSS-	–	15	100	–	35	200	–	50		
Power Supply Current (See Note 2)	I_{CC}	–	2.2	4.0	–	2.6	5.0	–	2.6	5.0	mAdc
	I_{EE}	–	2.2	4.0	–	2.6	5.0	–	2.6	5.0	
DC Quiescent Power Consumption	P_C										mW
(V_o = 0)		–	124	224	–	146	280	–	146	280	

Note 1: T_{low} = 0°C for MC1436,C; -55°C for MC1536
T_{high} = +70°C for MC1436,C; +125°C for MC1536

Note 2: V_{CC} = V_{EE} = 5.0 Vdc to 36 Vdc for MC1536
V_{CC} = V_{EE} = 5.0 Vdc to 30 Vdc for MC1436
V_{CC} = V_{EE} = 5.0 Vdc to 28 Vdc for MC1436C

Note 3: Either or both input voltages must not exceed the magnitude of V_{CC} or V_{EE} +3.0 volts.

2

FIGURE 4 – POWER BANDWIDTH

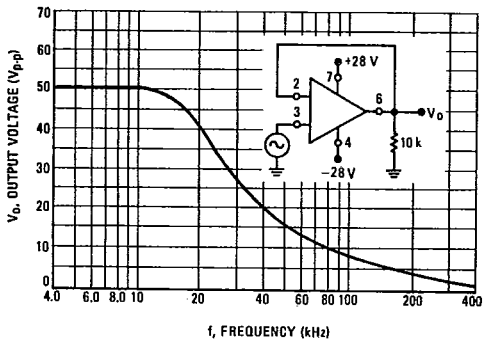


FIGURE 5 – PEAK OUTPUT VOLTAGE SWING, versus POWER SUPPLY VOLTAGE

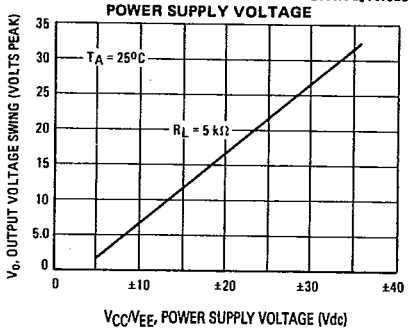


FIGURE 6 – OPEN-LOOP FREQUENCY RESPONSE

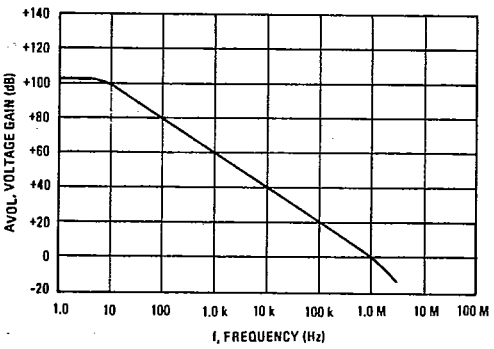


FIGURE 7 – OUTPUT SHORT-CIRCUIT CURRENT versus TEMPERATURE

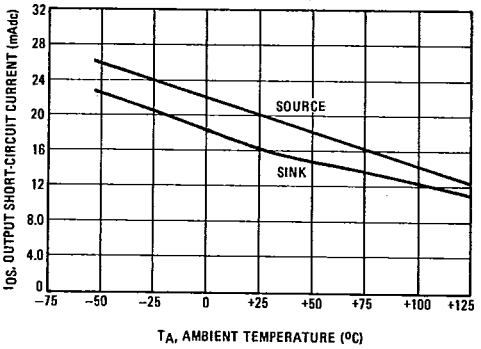


FIGURE 8 – INPUT BIAS CURRENT versus TEMPERATURE

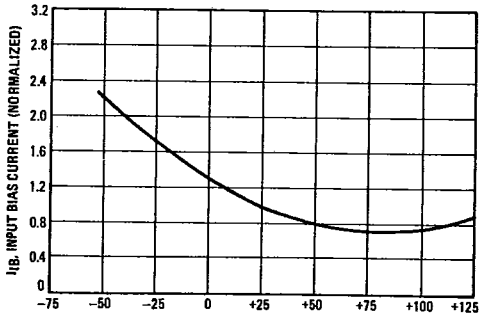


FIGURE 9 – INVERTING FEEDBACK MODEL

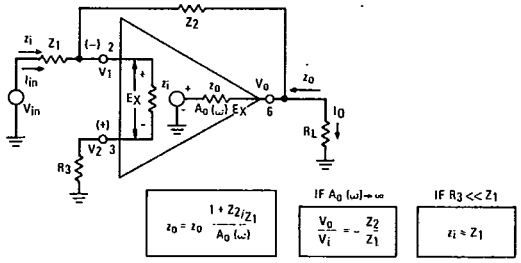


FIGURE 10 – NON-INVERTING FEEDBACK MODEL

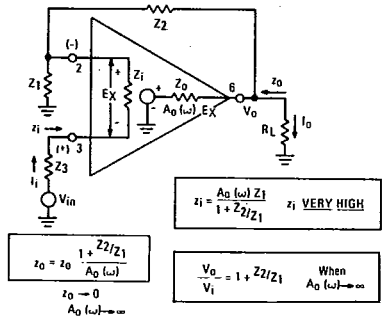


FIGURE 11 – AUDIO AMPLIFIER

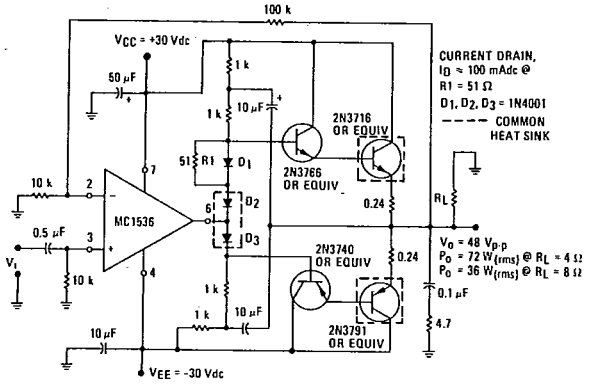


FIGURE 12 – VOLTAGE CONTROLLED CURRENT SOURCE or TRANSCONDUCTANCE AMPLIFIER WITH 0 TO 40 V COMPLIANCE

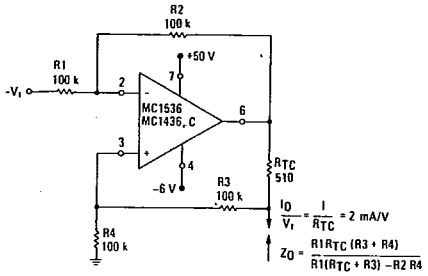


FIGURE 13 – REPRESENTATIVE CIRCUIT SCHEMATIC

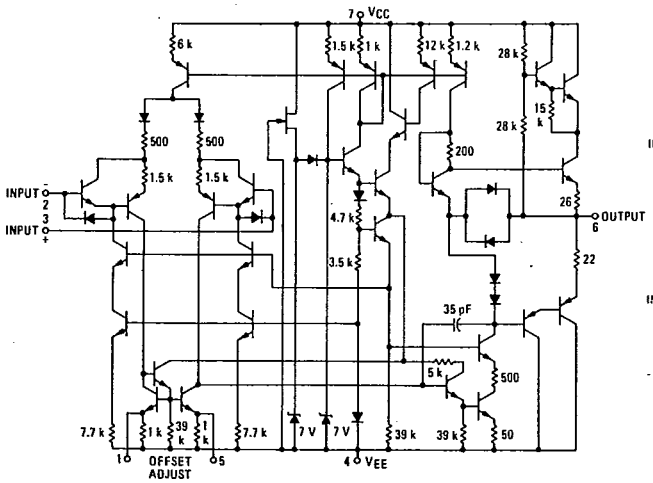


FIGURE 14 – EQUIVALENT CIRCUIT