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MOTOROLA

MC1436, C

High Voltage, Internally Compensated Operational Amplifiers

The MC1436, C was designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components.

- Output Voltage Swing:
  ±22 $V_{pk(min)}$ (V_{CC} = +28 V, V_{EE} = –28 V)
- Fast Slew Rate: 2.0 V/μs Typ
- Internally Compensated
- Offset Voltage Null Capability
- Input Overvoltage Protection
- A_{VOL}: 500,000 Typ
- Characteristics Independent of Power Supply Voltages:
  (±5.0 Vdc to ±36 Vdc)

Figure 1. Differential Amplifier with ±20 V Common Mode Input Voltage Range

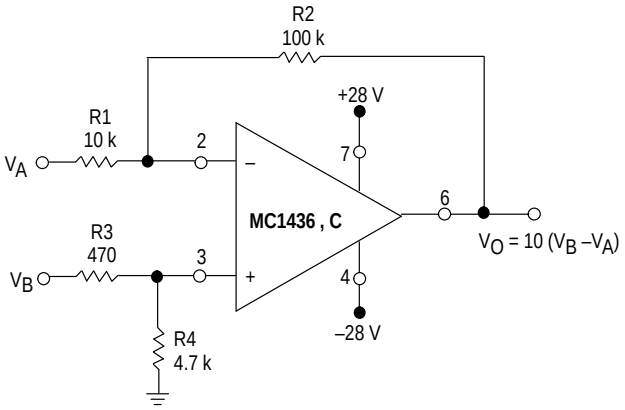
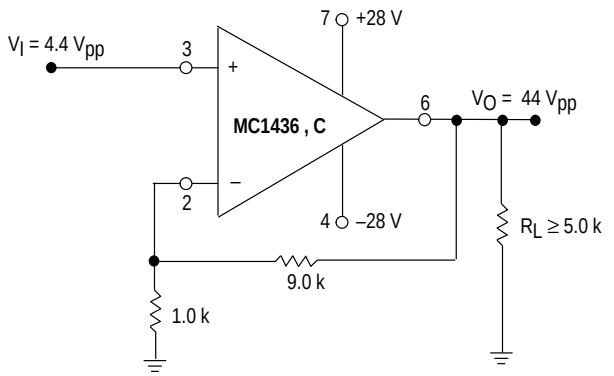
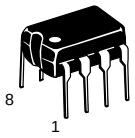


Figure 2. Typical Noninverting X10 Voltage Amplifier



OPERATIONAL AMPLIFIERS

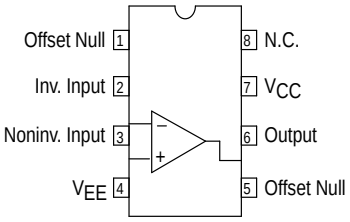
SEMICONDUCTOR TECHNICAL DATA



P1 SUFFIX
PLASTIC PACKAGE
CASE 626

D SUFFIX
PLASTIC PACKAGE
CASE 751
(SO–8)

PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC1436CD,D	T_A = 0° to +70°C	SO–8
MC1436CP1,P1		Plastic DIP

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

Rating	Symbol	MC1436	MC1436C	Unit
Power Supply Voltage	V_{CC} V_{EE}	+34 –34	+30 –30	Vdc
Input Differential Voltage Range	V_{IDR}	Note 2		V
Input Common Mode Voltage Range	V_{ICR}	Note 2		V
Output Short Circuit Duration (V_{CC} = V_{EE} = 28 Vdc, V_O = 0)	t_{SC}	5.0		sec
Power Dissipation (Package Limitation) Derate above T_A = +25°C	P_D	680 4.6		mW mW/°C
Operating Ambient Temperature Range	T_A	0 to +70		°C
Storage Temperature Range	T_{stg}	–65 to +150		°C

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

Characteristic	Symbol	MC1436			MC1436C			Unit
		Min	Typ	Max	Min	Typ	Max	
Input Bias Current	I_{IB}							nAdc
T_A = +25°C		–	15	40	–	25	90	
T_A = T_{low} to T_{high} (See Note 1)		–	–	55	–	–	–	
Input Offset Current	I_{IO}							nAdc
T_A = +25°C		–	5.0	10	–	10	25	
T_A = +25°C to T_{high}		–	–	14	–	–	–	
T_A = T_{low} to +25°C		–	–	14	–	–	–	
Input Offset Voltage	V_{IO}							mVdc
T_A = +25°C		–	5.0	10	–	5.0	12	
T_A = T_{low} to T_{high}		–	–	14	–	–	–	
Differential Input Impedance (Open loop, f ≤ 5.0 Hz)								MΩ
Parallel Input Resistance	rp	–	10	–	–	10	–	pF
Parallel Input Capacitance	Cp	–	2.0	–	–	2.0	–	
Common Mode Input Impedance (f ≤ 5.0 Hz)	z_{ic}	–	250	–	–	250	–	MΩ
Input Common Mode Voltage Range	V_{ICR}	±22	±25	–	±18	±20	–	Vpk
Equivalent Input Noise Voltage (A_V = 100, R_S = 10 kΩ, f = 1.0 kHz, BW = 1.0 Hz)	e_n	–	50	–	–	50	–	$nV/(Hz)^{1/2}$
Common Mode Rejection (DC)	CMR	70	110	–	50	90	–	dB
Large Signal DC Open Loop Voltage Gain	A_{VOL}							V/V
(V_O = ±10 V, R_L = 100 kΩ) T_A = +25°C		70,000	500,000	–	50,000	500,000	–	
T_A = T_{low} to T_{high}		50,000	–	–	–	–	–	
(V_O = ±10 V, R_L = 10 kΩ, T_A = +25°C)		–	200,000	–	–	200,000	–	
Power Bandwidth (Voltage Follower)	BWp							kHz
(A_V = 1, R_L = 5.0 kΩ, THD ≤ 5%, V_O = 40 V_{pp})		–	23	–	–	23	–	
Unity Gain Crossover Frequency (Open loop)	f_c	–	1.0	–	–	1.0	–	MHz
Phase Margin (Open loop, Unity Gain)	ϕ_m	–	50	–	–	50	–	Degrees
Gain Margin	A_M	–	18	–	–	18	–	dB
Slew Rate (Unity Gain)	SR	–	2.0	–	–	2.0	–	V/μs
Output Impedance (f ≤ 5.0 Hz)	z_O	–	1.0	–	–	1.0	–	kΩ
Short Circuit Output Current	I_{SC}	–	±17	–	–	±19	–	mAdc

NOTES: 1. T_{low} = 0°C for MC1436,C T_{high} = +70°C for MC1436,C
2. Either or both input voltages must not exceed the magnitude of V_{CC} or V_{EE} + 3.0 V.

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

Characteristic	Symbol	MC1436			MC1436C			Unit
		Min	Typ	Max	Min	Typ	Max	
Output Voltage Range (R_L = 5.0 kΩ) V_{CC} = +28 Vdc, V_{EE} = –28 Vdc V_{CC} = +36 Vdc, V_{EE} = –36 Vdc	V_O	 ±20 –	 ±22 –	 – –	 ±20 –	 ±22 –	 – –	V_{pk}
Power Supply Rejection V_{EE} = Constant, R_S ≤ 10 kΩ V_{CC} = Constant, R_S ≤ 10 kΩ	 PSR + PSR –	 – –	 35 35	 200 200	 – –	 50 50	 – –	μV/V
Power Supply Current (See Note 2)	I_{CC} I_{EE}	– –	2.6 2.6	5.0 5.0	– –	2.6 2.6	5.0 5.0	mAdc
DC Quiescent Power Consumption (V_O = 0)	P_C	–	146	280	–	146	280	mW

NOTES: 2. V_{CC} = V_{EE} = 5.0 Vdc to 30 Vdc for MC1436
V_{CC} = V_{EE} = 5.0 Vdc to 28 Vdc for MC1436C

Figure 3. Low–Drift Sample and Hold

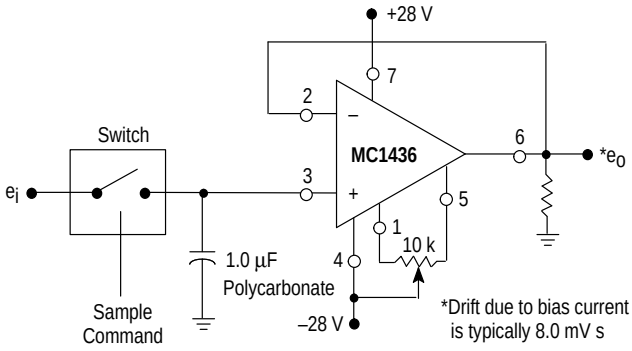


Figure 4. Power Bandwidth

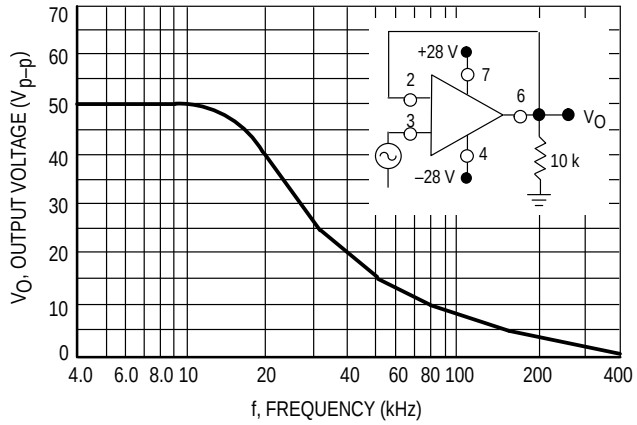


Figure 5. Peak Output Voltage Swing versus Power Supply Voltage

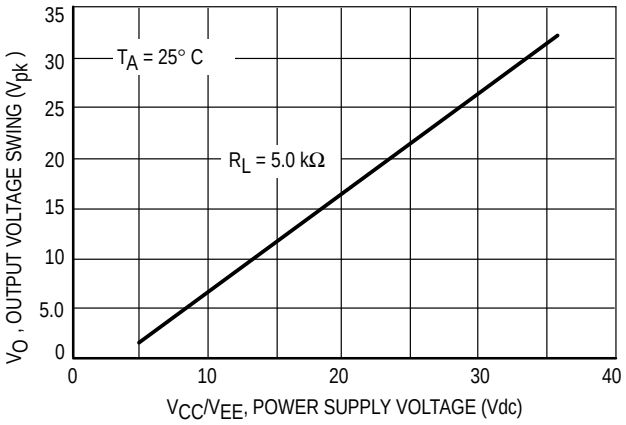


Figure 6. Open Loop Frequency Response

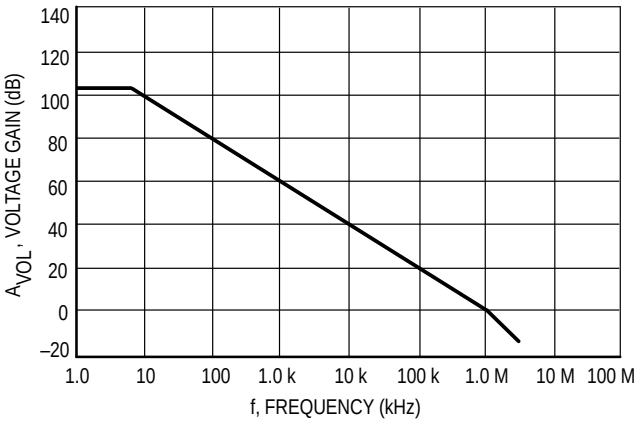


Figure 7. Output Short Circuit Current versus Temperature

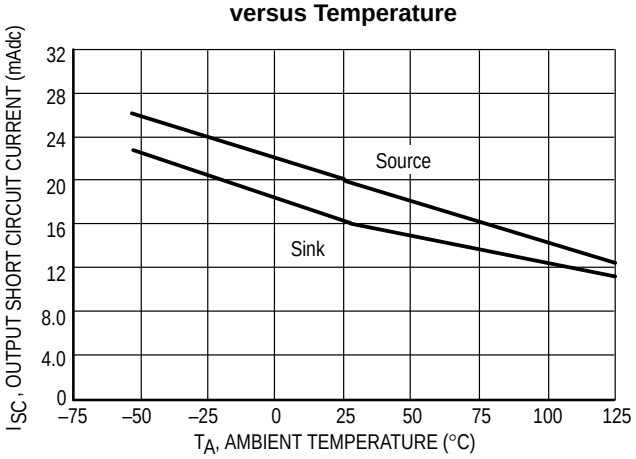


Figure 8. Input Bias Current versus Temperature

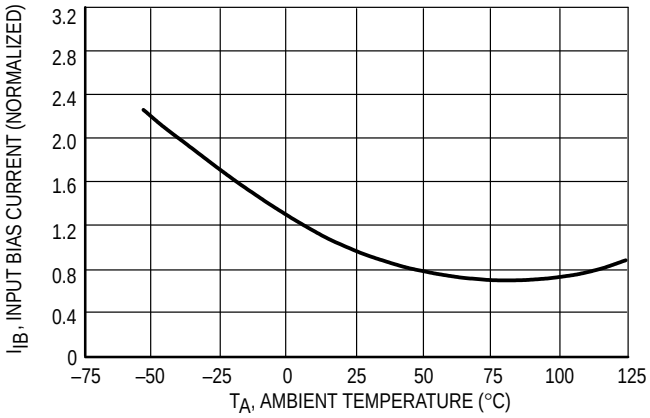


Figure 9. Inverting Feedback Model

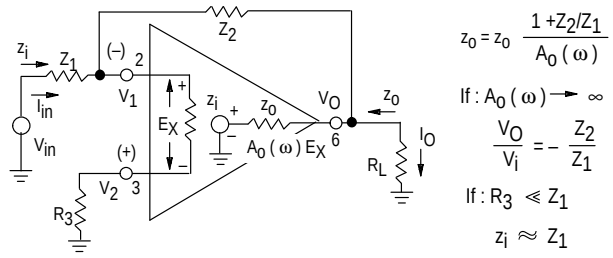


Figure 10. Noninverting Feedback Model

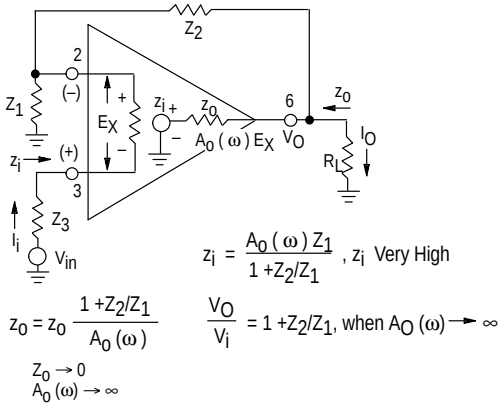


Figure 11. Audio Amplifier

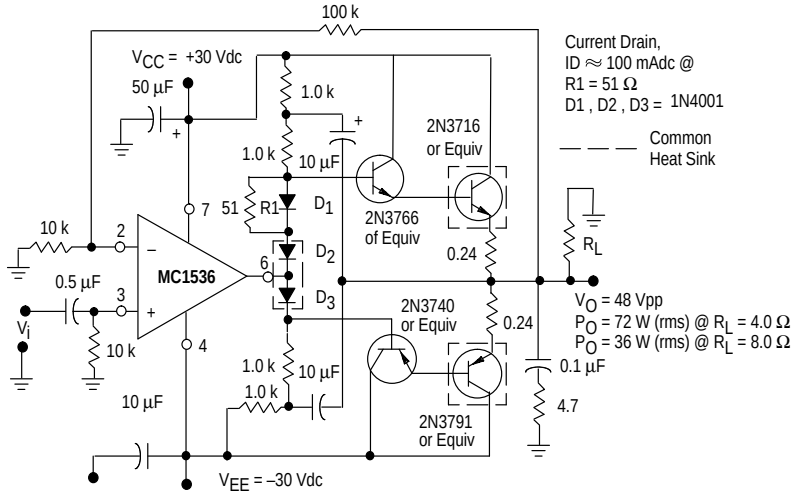
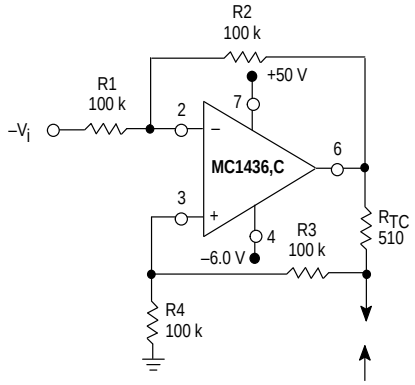


Figure 12. Voltage Controlled Current Source or Transconductance Amplifier with 0 V to 40 V Compliance



$$\frac{I_O}{V_i} = \frac{I}{R_{TC}} = 2.0\ \text{mA/V}$$

$$Z_O = \frac{R1R_{TC}\,(R3 + R4)}{R1\,(R_{TC} + R3) - R2\,R4}$$

Figure 13. Representative Schematic Diagram

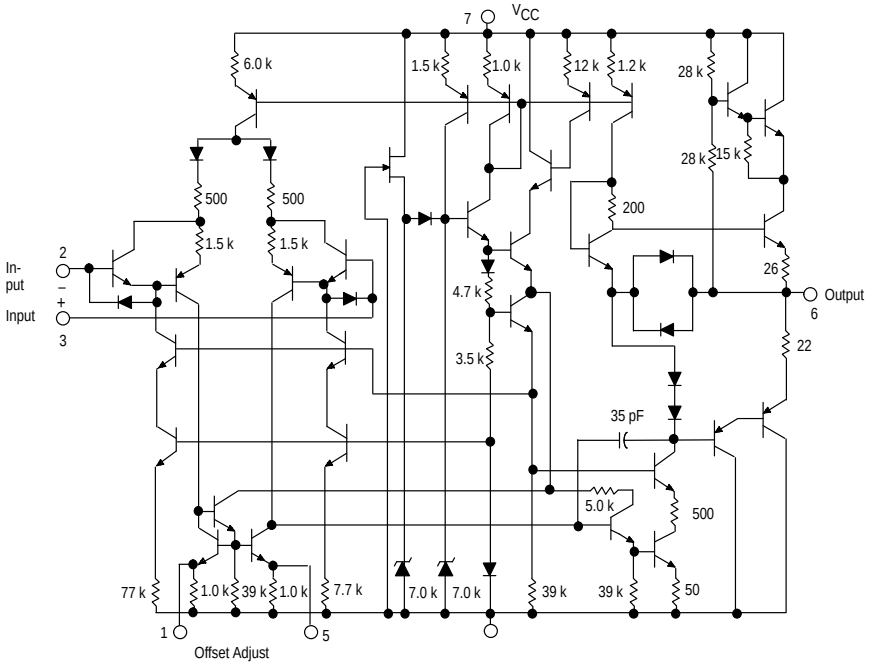
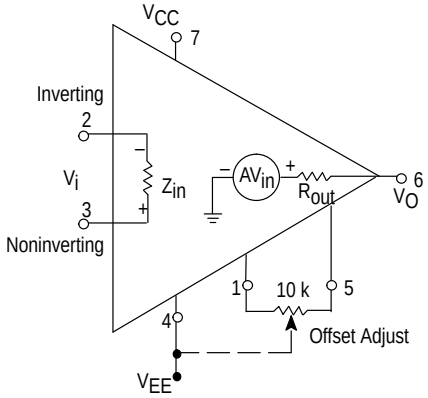
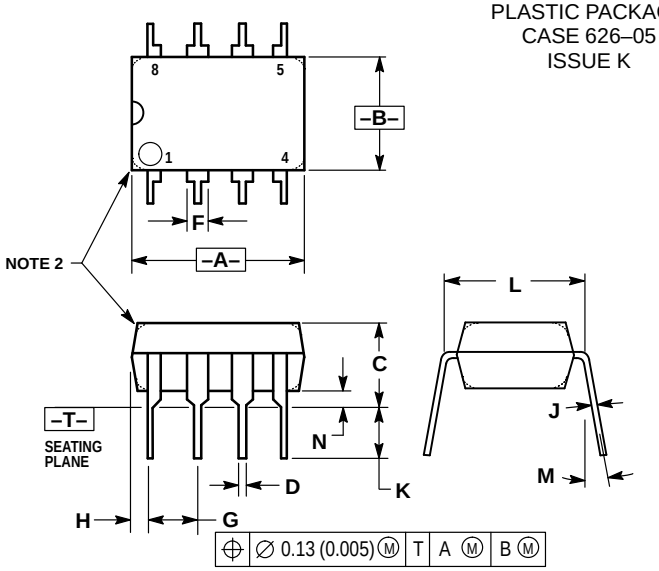


Figure 14. Equivalent Circuit



OUTLINE DIMENSIONS

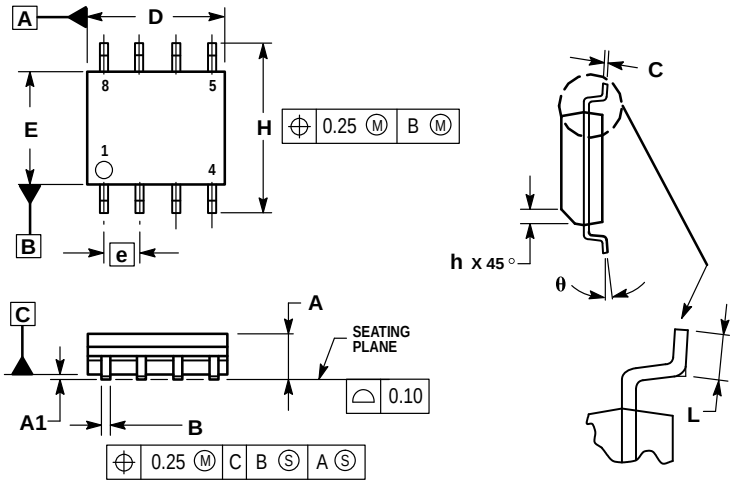
P1 SUFFIX
PLASTIC PACKAGE
CASE 626–05
ISSUE K



NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	—	10°	—	10°
N	0.76	1.01	0.030	0.040

D SUFFIX
PLASTIC PACKAGE
CASE 751–05
(SO–8)
ISSUE R



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS	
DIM	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.18	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
θ	0°	7°

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