MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

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)

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

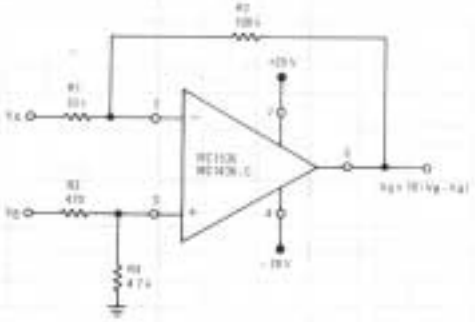
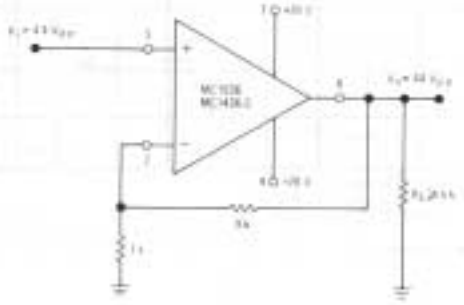


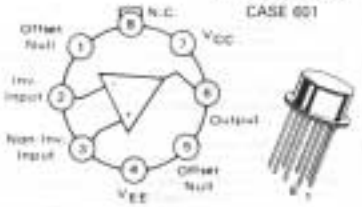
FIGURE 2 — TYPICAL NONINVERTING X10 VOLTAGE AMPLIFIER



OPERATIONAL AMPLIFIER

SILICON MONOLITHIC INTEGRATED CIRCUIT

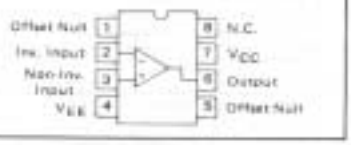
G SUFFIX
METAL PACKAGE
CASE 601



P1 SUFFIX
PLASTIC PACKAGE
CASE 626

U SUFFIX
CERAMIC PACKAGE
CASE 693

D SUFFIX
PLASTIC PACKAGE
CASE 751
(SO-8)



ORDERING INFORMATION

Device	Temperature Range	Package
MC1436CD,D MC1436P1,CP1 MC1436CG,G MC1436CU,U	0°C to +70°C	SO-8 Plastic DIP Metal Can Ceramic DIP
MC1536G MC1536U	−55°C to +125°C	Metal Can Ceramic DIP

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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			MC1436			MC1436C			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_{IB}	–	6.0 –	30 35	–	15 –	40 55	–	25 –	60 –	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 4.5 7.0	– – –	5.0 – –	10 14 14	– – –	10 – –	25 – –	nAdc
Input Offset Voltage T_A = +25°C T_A = T_{low} to T_{high}	V_{IO}		2.0	5.0 7.0	–	5.0	10 14	–	5.0	12 –	mVdc
Differential Input Impedance (Open Loop, f ≤ 5.0 Hz) Parallel Input Resistance Parallel Input Capacitance	r_p C_p		10 2.0		–	10 2.0	–	–	10 2.0	–	Meg ohms pF
Common-Mode Input Impedance (f ≤ 5.0 Hz)	r_{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 (A_V = 100, R_S = 10 k ohms, f = 1.0 kHz, BW = 1.0 Hz)	e_n		90			50	–		50	–	nV/√Hz
Common-Mode Rejection Ratio (dc)	CMRR	80	110		70	110		50	90		dB
Large Signal dc Open Loop Voltage Gain (V_O = ± 10 V, R_L = 100 k ohms) $\begin{cases} T_A = +25°C \\ T_A = T_{low} \text{ to } T_{high} \end{cases}$ (V_O = ±10 V, R_L = 10k 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	500,000 200,000		V/V
Power Bandwidth (Voltage Follower) (A_V = 1, R_L = 5.0 k ohms, THD = 5%, V_O = 20 Vp-p)	BW_P		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_M		90			90			90		degrees
Gain Margin	A_M		16			16			16		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			±15		mAdc
Output Voltage Range (R_L = 5.0 k ohms) V_{CC} = +28 Vdc, V_{EE} = -28 Vdc V_{CC} = +36 Vdc, V_{EE} = -36 Vdc	V_{OR}	±23 ±30	±23 ±32		±20	±27 –		±20	±22		V_{pk}
Power Supply Sensitivity (dc) V_{EE} = constant, R_S ≤ 10 k ohms V_{CC} = constant, R_S ≤ 10 k ohms	PSS+ PSS-		15 15	100 100		35 35	330 200		50 50		μV/V
Power Supply Current (See Note 2)	I_{CC} I_{EE}		2.3 2.3	4.0 4.0		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		129	224		146	280		146	280	mW

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 36 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.