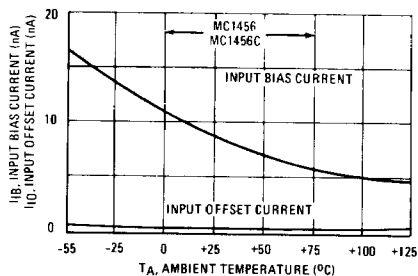


**INTERNALLY COMPENSATED, HIGH PERFORMANCE
 OPERATIONAL AMPLIFIER**

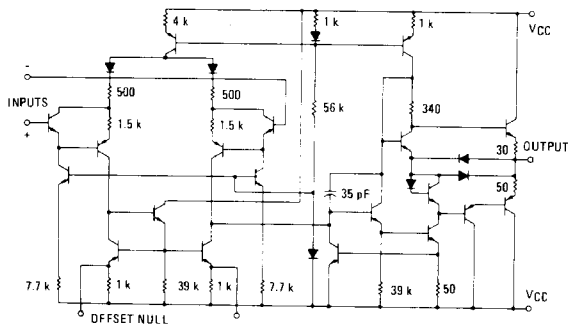
... designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components.

- Low Input Bias Current — 15 nA max
- Low Input Offset Current — 2.0 nA max
- Low Input Offset Voltage — 4.0 mV max
- Fast Slew Rate — 2.5 V/ μ s typ
- Large Power Bandwidth — 40 kHz typ
- Low Power Consumption — 45 mW max
- Offset Voltage Null Capability
- Output Short-Circuit Protection
- Input Over-Voltage Protection

**TYPICAL INPUT BIAS CURRENT AND INPUT
 OFFSET CURRENT versus TEMPERATURE for MC1556**



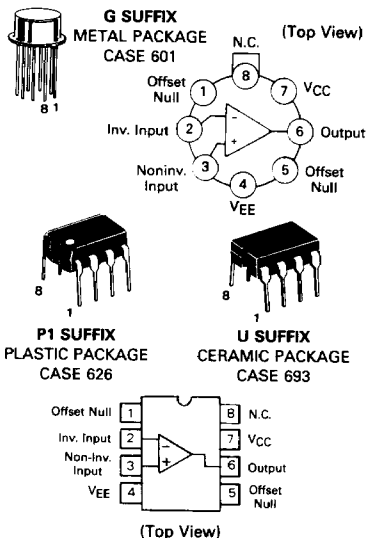
REPRESENTATIVE CIRCUIT SCHEMATIC



**MC1456
 MC1456C
 MC1556**

OPERATIONAL AMPLIFIER

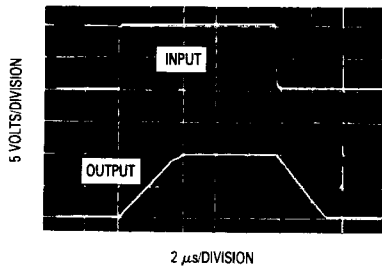
SILICON MONOLITHIC
 INTEGRATED CIRCUIT



ORDERING INFORMATION

Device	Temperature Range	Package
MC1456G,CG MC1456CP1,P1	0°C to +70°C	Metal Can Plastic DIP
MC1556G MC1556U	-55°C to +125°C	Metal Can Ceramic DIP

VOLTAGE-FOLLOWER PULSE RESPONSE



MC1456, MC1456C, MC1556

MAXIMUM RATINGS ($T_A = +25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	MC1556	MC1456 MC1456C	Unit
Power Supply Voltage	V_{CC} V_{EE}	+22 -22	+18 -18	Vdc
Differential Input Voltage Range	V_{IDR}	$\pm V_{CC}$		Volts
Common-Mode Voltage Range	V_{ICR}	$\pm V_{CC}$		Volts
Load Current	I_L	20		mA
Output Short Circuit Duration	t_S	Continuous		
Power Dissipation (Package Limitation) Derate above $T_A = +25^\circ\text{C}$	P_D	680 4.6		mW mW/°C
Operating Temperature Range	T_A	-55 to +125	0 to +70	°C
Storage Temperature Range	T_{stg}	-65 to +150	-65 to +150	°C

ELECTRICAL CHARACTERISTICS ($V_{CC} = +15\text{ Vdc}$, $V_{EE} = -15\text{ Vdc}$, $T_A = +25^\circ\text{C}$ unless otherwise noted).

Characteristic	Fig.	Symbol	MC1556			MC1456			MC1456C			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Bias Current $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to T_{high} (See Note 1)		I_{IB}	—	8.0	15	—	15	30	—	15	90	nAdc
Input Offset Current $T_A = +25^\circ\text{C}$ $T_A = +25^\circ\text{C}$ to T_{high} $T_A = T_{low}$ to $+25^\circ\text{C}$		I_{IO}	—	1.0	2.0	—	5.0	10	—	5.0	30	nAdc
Input Offset Voltage $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to T_{high}		V_{IO}	—	2.0	4.0	—	5.0	10	—	5.0	12	mVdc
Differential Input Impedance (Open-Loop, $f = 20\text{ Hz}$)												
Parallel Input Resistance		r_p	—	5.0	—	—	3.0	—	—	3.0	—	Megohms
Parallel Input Capacitance		c_p	—	6.0	—	—	6.0	—	—	6.0	—	pF
Common-Mode Input Impedance ($f = 20\text{ Hz}$)		z_i	—	250	—	—	250	—	—	250	—	Megohms
Common-Mode Input Voltage Range	1	V_{ICR}	± 12	± 13	—	± 11	± 12	—	± 10.5	± 12	—	Vpk
Equivalent Input Noise Voltage ($A_V = 100$, $R_S = 10\text{ k ohms}$, $f = 1.0\text{ kHz}$, $BW = 1.0\text{ Hz}$)	2	e_n	—	45	—	—	45	—	—	45	—	nV/(Hz) ^{1/2}
Common-Mode Rejection Ratio ($f = 100\text{ Hz}$)	3	CMRR	80	110	—	70	110	—	—	110	—	dB
Open-Loop Voltage Gain, ($V_O = \pm 10\text{ V}$, $R_L = 2.0\text{ k ohms}$) $T_A = +25^\circ\text{C}$ $T_A = T_{low}$ to T_{high}	4,5,6	A_{VOL}	100,000 40,000	200,000 —	— 70,000	100,000 40,000	— —	25,000 —	100,000 —	— —	—	V/V
Power Bandwidth ($A_V = 1$, $R_L = 2.0\text{ k ohms}$, $THD \leq 5\%$, $V_O = 20\text{ Vp-p}$)	9	BWp	—	40	—	—	40	—	—	40	—	kHz
Unity Gain Crossover Frequency (open-loop)	5	BW	—	1.0	—	—	1.0	—	—	1.0	—	MHz
Phase Margin (open-loop, unity gain)	5,7		—	70	—	—	70	—	—	70	—	degrees
Gain Margin	5,7		—	18	—	—	18	—	—	18	—	dB
Slew Rate (Unity Gain)		SR	—	2.5	—	—	2.5	—	—	2.5	—	V/ μs
Output Impedance ($f = 20\text{ Hz}$)		z_o	—	1.0	2.0	—	1.0	2.5	—	1.0	—	kohms
Short-Circuit Output Current	8	I_{OS}	—	-17, +9.0	—	—	-17, +9.0	—	—	-17, +9.0	—	mAde
Output Voltage Swing ($R_L = 2.0\text{ k ohms}$)	10	V_{OR}	± 12	± 13	—	± 11	± 12	—	± 10	± 12	—	Vpk
Power Supply Rejection Ratio $V_{CC} = \text{constant}$, $R_S \leq 10\text{ k ohms}$ $V_{EE} = \text{constant}$, $R_S \leq 10\text{ k ohms}$		PSRR+ PSRR-	—	50 100	100 —	— 75	75 200	— —	— 75	75 —	—	$\mu\text{V/V}$
Power Supply Current		I_{CC} I_{EE}	—	1.0 1.0	1.5 1.5	—	1.3 1.3	3.0 3.0	—	1.3 1.3	4.0 4.0	mAde
DC Quiescent Power Dissipation ($V_O = 0$)	11	P_D	—	30	45	—	40	90	—	40	120	mW

Note 1: T_{low} : 0° for MC1456 and MC1456C
 -55°C for MC1556
 T_{high} : $+70^\circ\text{C}$ for MC1456 and MC1456C
 $+125^\circ\text{C}$ for MC1556

MC1456, MC1456C, MC1556

TYPICAL CHARACTERISTICS

($V_{CC} = +15\text{ Vdc}$, $V_{EE} = -15\text{ Vdc}$, $T_A = +25^\circ\text{C}$ unless otherwise noted).

FIGURE 1 – INPUT COMMON-MODE SWING versus POWER SUPPLY VOLTAGE

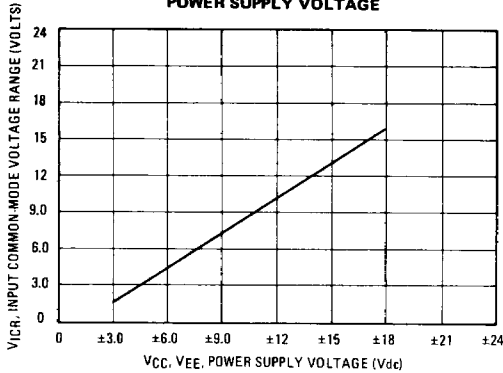


FIGURE 2 – SPECTRAL NOISE DENSITY

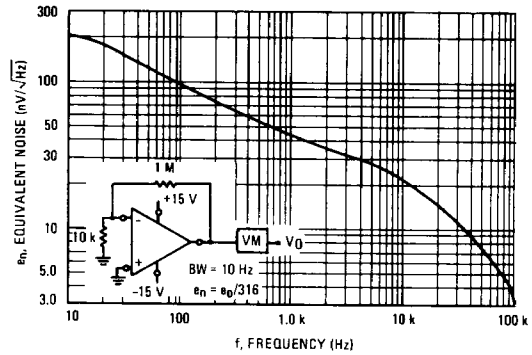


FIGURE 3 – COMMON-MODE REJECTION RATIO versus FREQUENCY

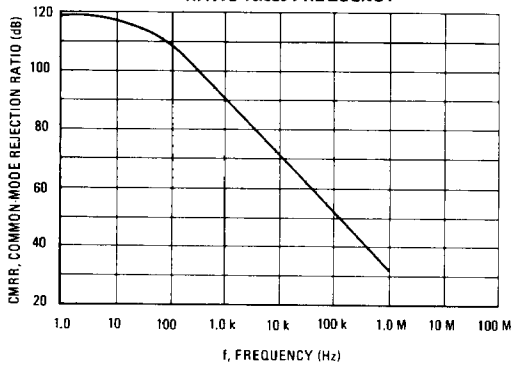


FIGURE 4 – OPEN-LOOP VOLTAGE GAIN versus TEMPERATURE

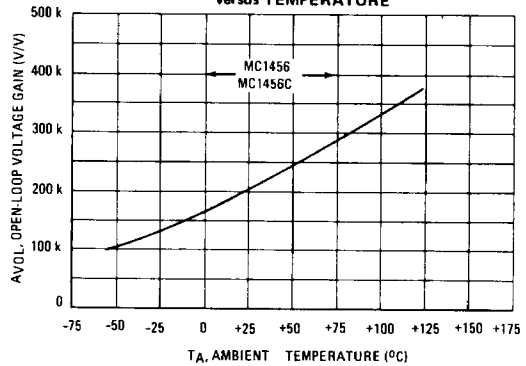


FIGURE 5 – OPEN-LOOP FREQUENCY RESPONSE

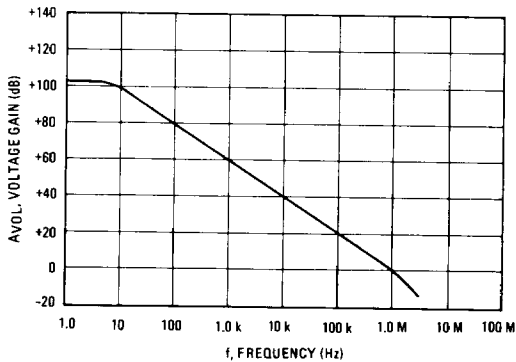
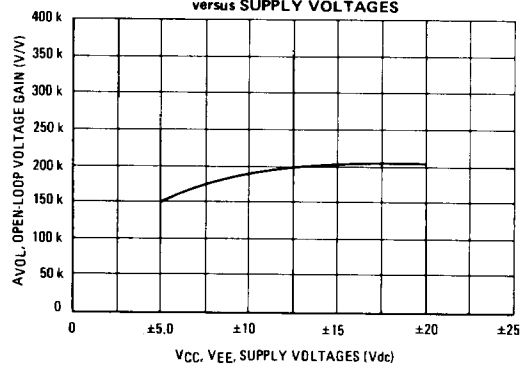


FIGURE 6 – OPEN-LOOP VOLTAGE GAIN versus SUPPLY VOLTAGES



MC1456, MC1456C, MC1556

TYPICAL CHARACTERISTICS (continued)

FIGURE 7 – OPEN-LOOP PHASE SHIFT

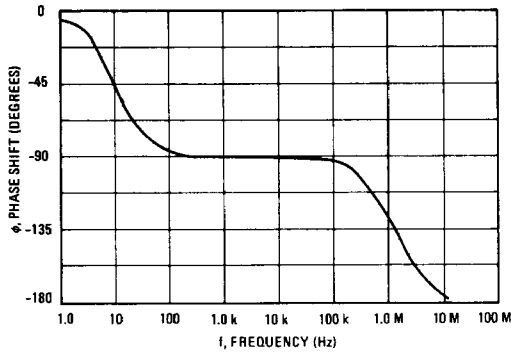


FIGURE 8 – OUTPUT SHORT-CIRCUIT CURRENT
versus TEMPERATURE

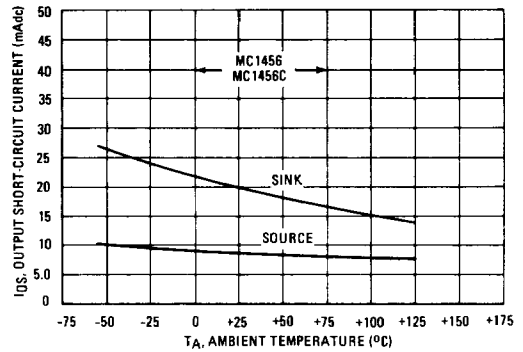


FIGURE 9 – POWER BANDWIDTH

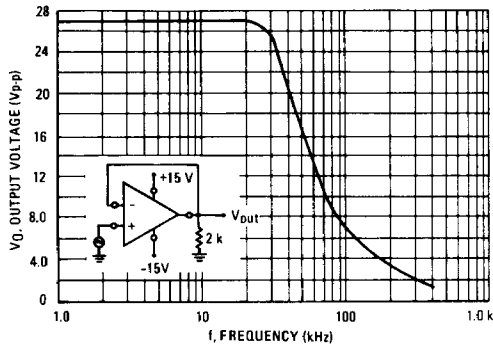


FIGURE 10 – OUTPUT VOLTAGE SWING versus
LOAD RESISTANCE

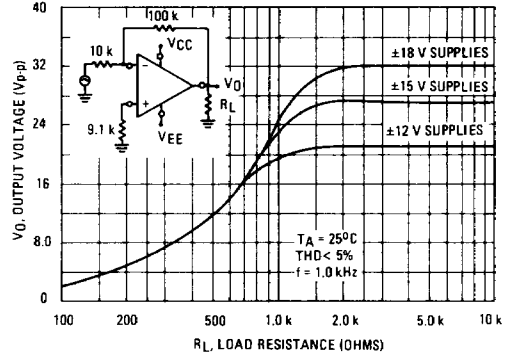
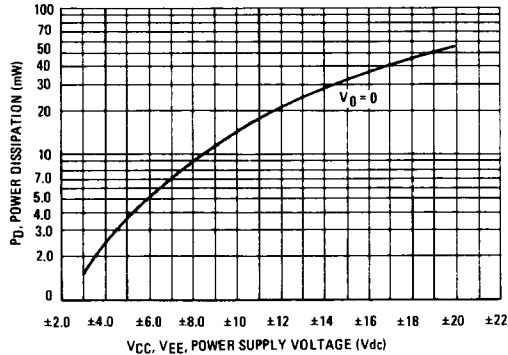


FIGURE 11 – POWER DISSIPATION versus
POWER SUPPLY VOLTAGE



TYPICAL APPLICATIONS

Where values are not given for external components they must be selected by the designer to fit the requirements of the system.

FIGURE 12 — INVERTING FEEDBACK MODEL

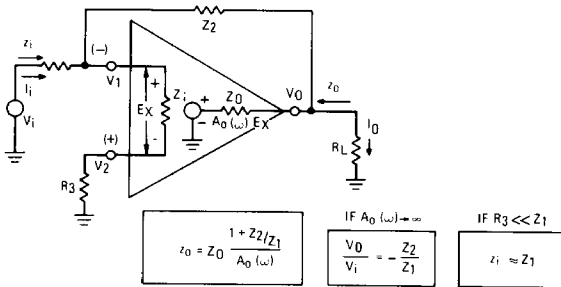


FIGURE 13 — NONINVERTING FEEDBACK MODEL

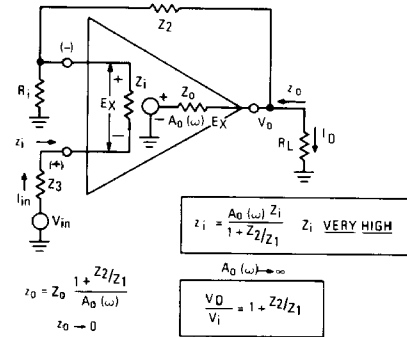


FIGURE 14 — LOW-DRIFT SAMPLE AND HOLD

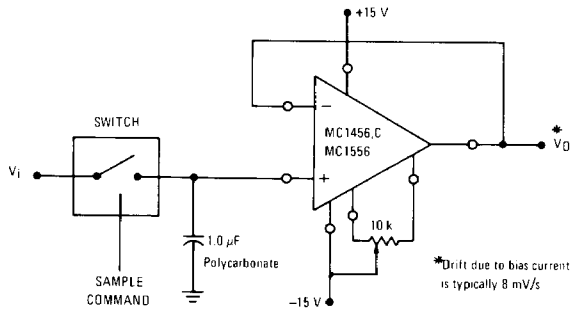
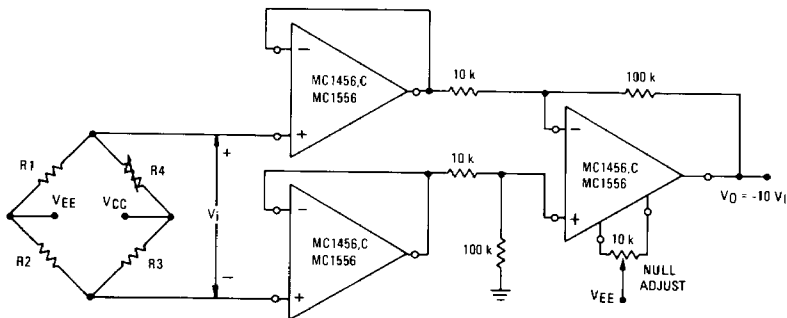


FIGURE 15 — HIGH IMPEDANCE BRIDGE AMPLIFIER



TYPICAL APPLICATIONS (continued)

FIGURE 16 — LOGARITHMIC AMPLIFIER

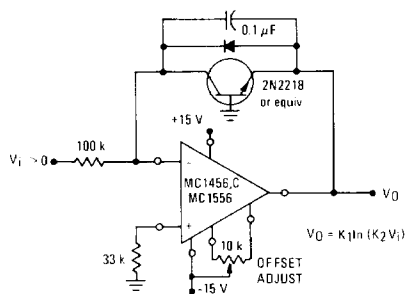


FIGURE 17 — VOLTAGE OFFSET NULL CIRCUIT

