

μA777 ✓

PRECISION OPERATIONAL AMPLIFIER

FAIRCHILD LINEAR INTEGRATED CIRCUITS

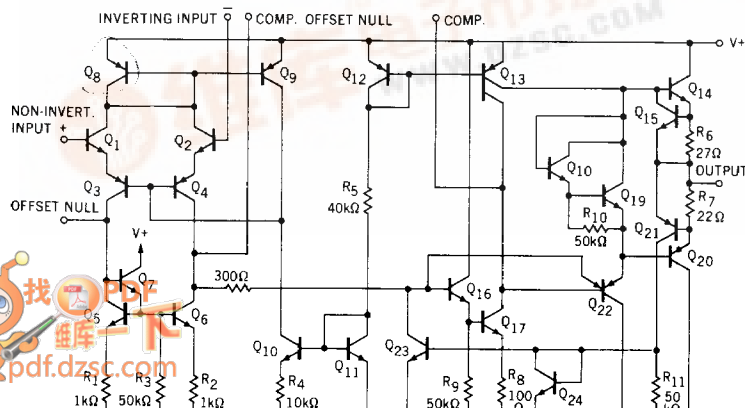
GENERAL DESCRIPTION — The $\mu A777C$ is a monolithic Precision Operational Amplifier constructed using a low-noise Fairchild Planar* epitaxial process. It is an excellent choice when performance versus cost trade-offs are possible between super beta or FET input operational amplifiers and low-cost general purpose operational amplifiers. Low offset and bias currents improve system accuracy when used in applications such as long-term integrators, sample and hold circuits and high-source impedance summing amplifiers. Even though the input bias current is extremely low, the $\mu A777C$ maintains full ± 30 V differential voltage range. The internal construction utilizes isothermal layout and special electrical design to maintain system performance despite variations in temperature or output load. High common mode input voltage range, latch-up protection, short-circuit protection and simple frequency compensation make the device versatile and easily used.

- **LOW OFFSET VOLTAGE AND OFFSET CURRENT**
- **LOW OFFSET VOLTAGE AND CURRENT DRIFT**
- **LOW INPUT BIAS CURRENT**
- **LOW INPUT NOISE VOLTAGE**
- **LARGE COMMON MODE AND DIFFERENTIAL VOLTAGE RANGES**

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	± 22 V
Internal Power Dissipation	
Metal Can	500 mW
DIP	670 mW
Mini DIP	310 mW
Differential Input Voltage	± 30 V
Input Voltage (Note 1)	± 15 V
Storage Temperature Range	
Metal Can and Hermetic DIP	-65°C to $+150^{\circ}\text{C}$
Mini DIP	-55°C to $+125^{\circ}\text{C}$
Operating Temperature Range	0°C to 70°C
Pin Temperature	
Metal Can and Hermetic DIP (Soldering, 60 s)	300°C
Mini DIP (Soldering, 10 s)	260°C
Output Short Circuit Duration (Note 2)	Indefinite

EQUIVALENT CIRCUIT



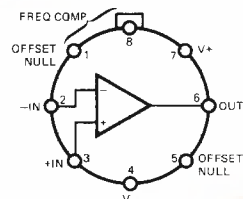
CONNECTION DIAGRAMS

8-PIN METAL CAN

(TOP VIEW)

PACKAGE OUTLINE 5S

PACKAGE CODE H



NOTE: Pin 4 connected to case

ORDER INFORMATION

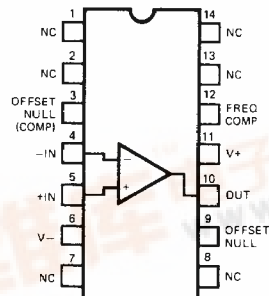
TYPE	PART NO.
$\mu A777C$	$\mu A777HC$

14-PIN DIP

(TOP VIEW)

PACKAGE OUTLINE 6A 9A

PACKAGE CODE D P



ORDER INFORMATION

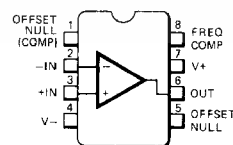
TYPE	PART NO.
$\mu A777C$	$\mu A777DC$
$\mu A777C$	$\mu A777PC$

8-PIN MINI DIP

(TOP VIEW)

PACKAGE OUTLINE 9T

PACKAGE CODE T



ORDER INFORMATION

TYPE	PART NO.
------	----------

FAIRCHILD • μ A777

μ A777

ELECTRICAL CHARACTERISTICS: $V_S = \pm 15$ V, $T_A = 25^\circ\text{C}$, $C_C = 30$ pF unless otherwise specified.

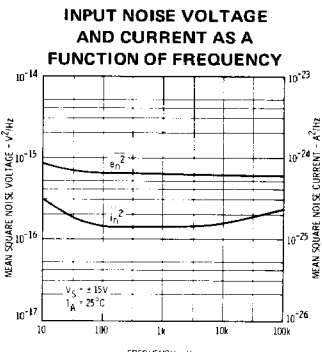
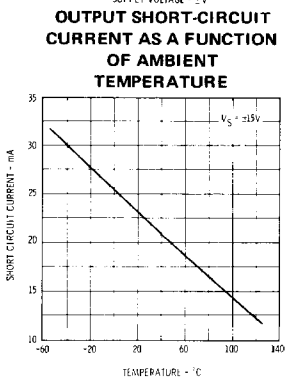
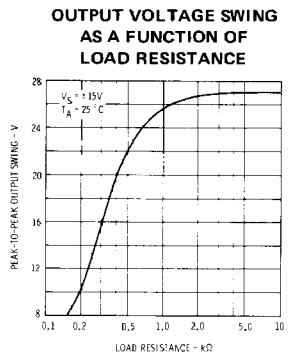
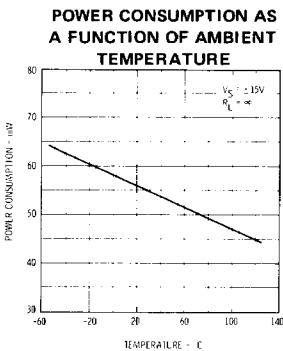
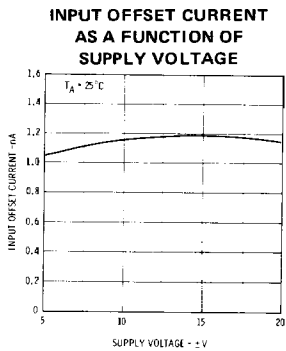
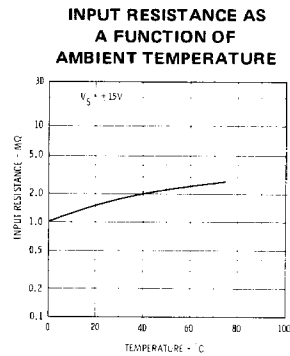
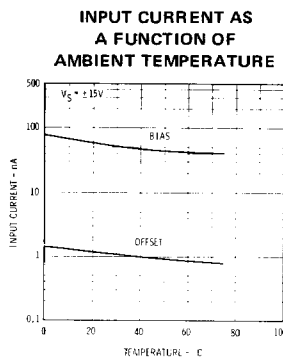
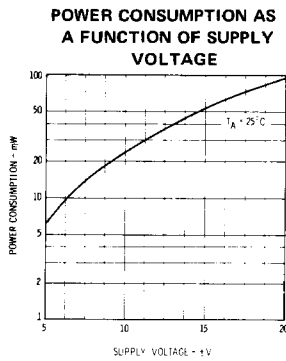
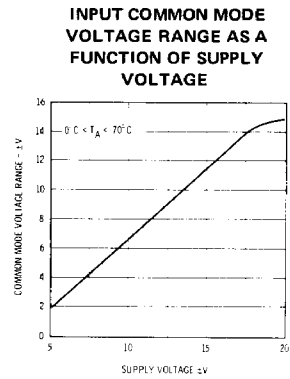
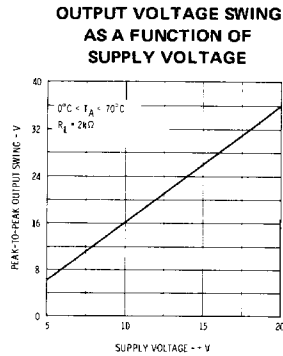
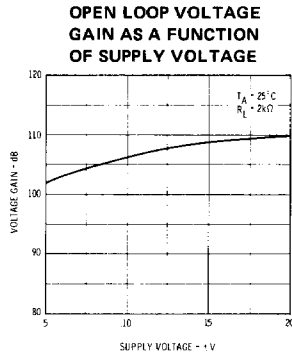
CHARACTERISTICS		CONDITIONS	MIN	TYP	MAX	UNITS	
Input Offset Voltage		$R_S \leq 50\text{ k}\Omega$		0.7	5.0	mV	
Input Offset Current				0.7	20.0	nA	
Input Bias Current				25	100	nA	
Input Resistance			1.0	2.0		M Ω	
Input Capacitance				3.0		pF	
Offset Voltage Adjustment Range				± 25		mV	
Large Signal Voltage Gain		$R_L \geq 2\text{ k}\Omega$, $V_{OUT} = \pm 10\text{ V}$	25,000	250,000		V/V	
Output Resistance				100		Ω	
Output Short Circuit Current				± 25		mA	
Supply Current				1.9	2.8	mA	
Power Consumption				60	85	mW	
Transient Response (Voltage Follower, Gain of 1)	Rise Time	$V_{IN} = 20\text{ mV}$, $C_C = 30\text{ pF}$, $R_L = 2\text{ k}\Omega$, $C_L \leq 100\text{ pF}$		0.3		μs	
	Overshoot			5.0		%	
Slew Rate (Voltage Follower, Gain of 1)		$R_L \geq 2\text{ k}\Omega$		0.5		V/ μs	
Transient Response (Voltage Follower, Gain of 10)	Rise Time	$V_{IN} = 20\text{ mV}$, $C_C = 3.5\text{ pF}$, $R_L = 2\text{ k}\Omega$, $C_L \leq 100\text{ pF}$		0.2		μs	
	Overshoot			5.0		%	
Slew Rate (Voltage Follower, Gain of 10)		$R_L \leq 2\text{ k}\Omega$, $C_C = 3.5\text{ pF}$		5.5		V/ μs	
The following specifications apply for $0^\circ\text{C} \leq T_A \leq +70^\circ\text{C}$							
Input Offset Voltage		$R_S \leq 50\text{ k}\Omega$		0.8	5.0	mV	
Average Input Offset Voltage Drift		$R_S \leq 50\text{ k}\Omega$		4.0	30	$\mu\text{V}/^\circ\text{C}$	
Input Offset Current					40	nA	
Average Input Offset Current Drift		$25^\circ\text{C} \leq T_A \leq +70^\circ\text{C}$		0.01	0.3	nA/ $^\circ\text{C}$	
		$0^\circ\text{C} \leq T_A \leq +25^\circ\text{C}$		0.02	0.6	nA/ $^\circ\text{C}$	
Input Bias Current				200	nA		
Input Voltage Range		± 12	± 13		V		
Common Mode Rejection Ratio		$R_S \leq 50\text{ k}\Omega$	70	95		dB	
Supply Voltage Rejection Ratio		$R_S \leq 50\text{ k}\Omega$		15	150	$\mu\text{V}/\text{V}$	
Large Signal Voltage Gain		$R_L \geq 2\text{ k}\Omega$, $V_{OUT} = \pm 10\text{ V}$	15,000			V/V	
Output Voltage Swing		$R_L \geq 10\text{ k}\Omega$	± 12	± 14		V	
		$R_L \geq 2\text{ k}\Omega$	± 10	± 13		V	
Power Consumption				60	100	mW	

NOTES:

- Rating applies to ambient temperatures up to 70°C . Above 70°C ambient derate linearly at 6.3 mW/ $^\circ\text{C}$ Metal Can, 8.3 mW/ $^\circ\text{C}$ for the DIP, and 5.6 mW/ $^\circ\text{C}$ for the Mini DIP.
- For supply voltages less than ± 15 V, the absolute maximum input voltage is equal to the supply voltage.
- Short circuit may be to ground or either supply. Rating applies to $+125^\circ\text{C}$ Case Temperature or $+75^\circ\text{C}$ Ambient Temperature.

FAIRCHILD • $\mu A777$

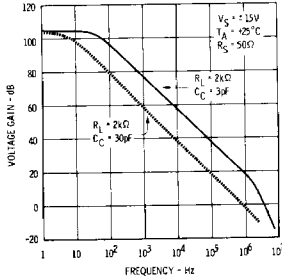
TYPICAL PERFORMANCE CURVES



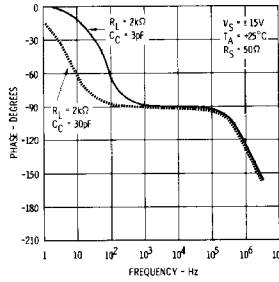
FAIRCHILD • $\mu A777$

TYPICAL PERFORMANCE CURVES

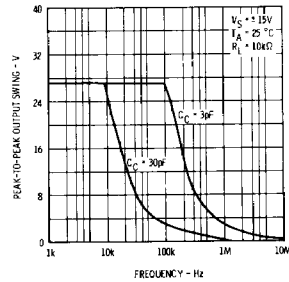
**OPEN LOOP VOLTAGE GAIN
AS A FUNCTION OF
FREQUENCY**



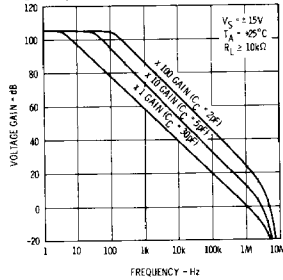
**OPEN LOOP PHASE
RESPONSE AS A
FUNCTION OF FREQUENCY**



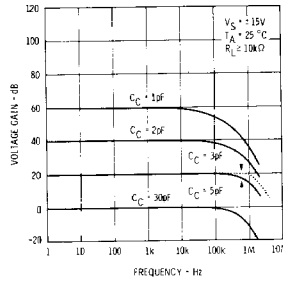
**OUTPUT VOLTAGE SWING
AS A FUNCTION OF
FREQUENCY**



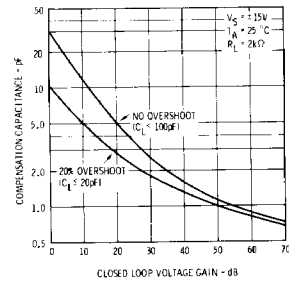
**OPEN LOOP VOLTAGE GAIN
AS A FUNCTION OF
FREQUENCY FOR VARIOUS
GAIN/COMPENSATION OPTIONS**



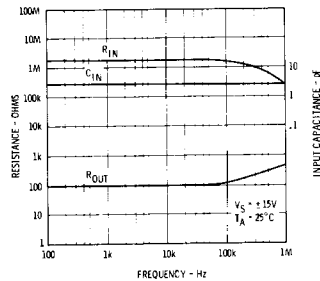
**FREQUENCY RESPONSE
FOR VARIOUS
CLOSED-LOOP GAINS**



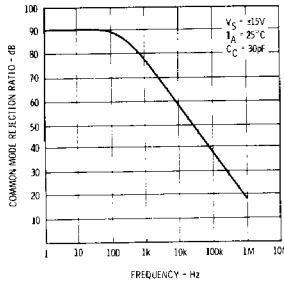
**COMPENSATION
CAPACITANCE AS A
FUNCTION OF CLOSED
LOOP VOLTAGE GAIN**



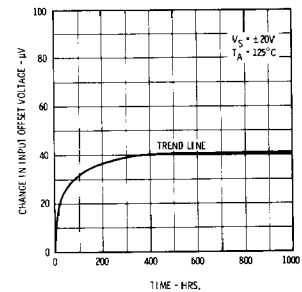
**INPUT RESISTANCE,
OUTPUT RESISTANCE,
AND INPUT CAPACITANCE
AS A FUNCTION OF FREQUENCY**



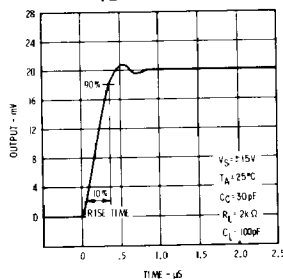
**COMMON MODE REJECTION
RATIO AS A FUNCTION OF
FREQUENCY**



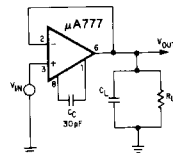
**INPUT OFFSET VOLTAGE
DRIFT AS A FUNCTION
OF TIME**



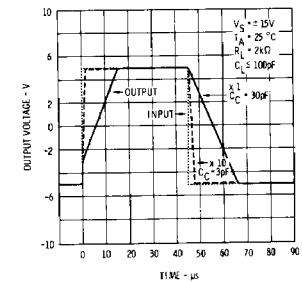
**VOLTAGE FOLLOWER
TRANSIENT RESPONSE
(GAIN OF 1)**



**TRANSIENT RESPONSE
TEST CIRCUIT**



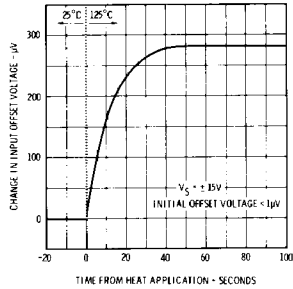
**VOLTAGE FOLLOWER
LARGE SIGNAL
PULSE RESPONSE**



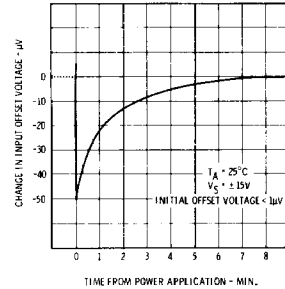
FAIRCHILD • $\mu A777$

TYPICAL PERFORMANCE CURVES

THERMAL RESPONSE OF INPUT OFFSET VOLTAGE TO STEP CHANGE OF CASE TEMPERATURE

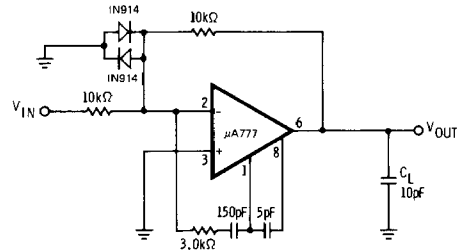
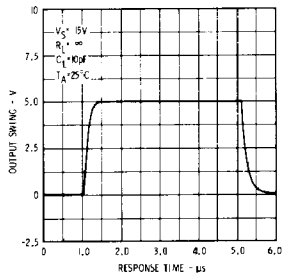


STABILIZATION TIME OF INPUT OFFSET VOLTAGE FROM POWER TURN-ON

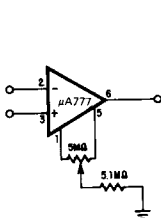


FEED FORWARD COMPENSATION

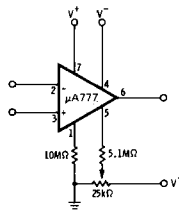
LARGE SIGNAL FEEDFORWARD TRANSIENT RESPONSE



VOLTAGE OFFSET NULL CIRCUIT

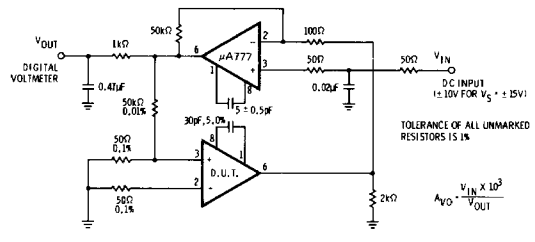


SUGGESTED



ALTERNATE

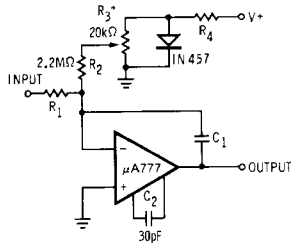
GAIN TEST CIRCUIT



FAIRCHILD • $\mu A777$

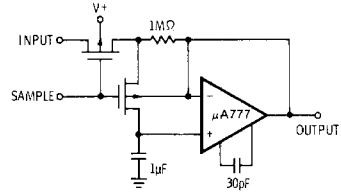
TYPICAL APPLICATIONS

BIAS COMPENSATED LONG TIME INTEGRATOR

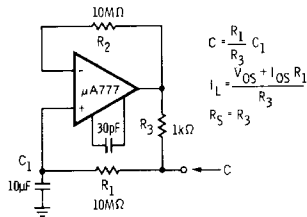


* Adjust R_3 for minimum integrator drift

SAMPLE AND HOLD



CAPACITANCE MULTIPLIER

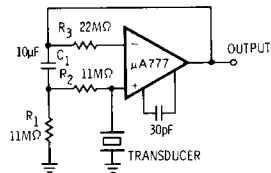


$$C = \frac{R_1}{R_3} C_1$$

$$I_L = \frac{V_{OS} + I_{OS} R_1}{R_3}$$

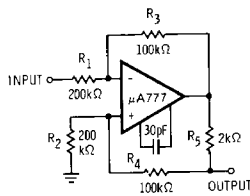
$$R_5 = R_3$$

AMPLIFIER FOR CAPACITANCE TRANSDUCERS



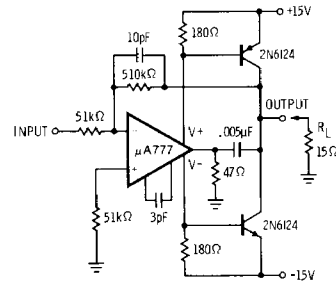
Low Frequency Cutoff $R_1 \times C_1$

BILATERAL CURRENT SOURCE

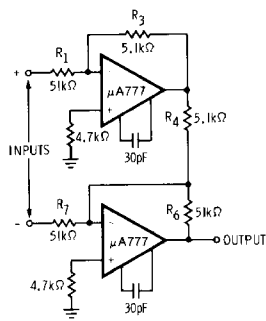


$$I_{OUT} = \frac{R_3 V_{IN}}{R_1 R_5} ; R_1 = R_2 ; R_3 = R_4 + R_5$$

HIGH SLEW RATE POWER AMPLIFIER



± 100 V COMMON MODE RANGE INSTRUMENTATION AMPLIFIER



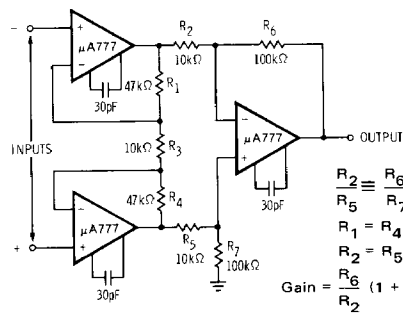
$$\frac{R_1}{R_7} \cong \frac{R_3}{R_4} \text{ for best CMRR}$$

$$R_3 = R_4$$

$$R_1 = R_6 = 10R_3$$

$$\text{Gain} = \frac{R_7}{R_5}$$

INSTRUMENTATION AMPLIFIER WITH HIGH COMMON MODE REJECTION



$$\frac{R_2}{R_5} \cong \frac{R_6}{R_7} \text{ for best CMRR}$$

$$R_1 = R_4$$

$$R_2 = R_5$$

$$\text{Gain} = \frac{R_6}{R_2} \left(1 + \frac{2R_1}{R_3} \right)$$