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A Schlumberger Company

μA747 Dual Operational Amplifier

Linear Division Operational Amplifiers

Description

The μA747 contains a pair of high performance monolithic operational amplifiers constructed using the Fairchild Planar Epitaxial process. They are intended for a wide range of analog applications where board space or weight are important. High common mode voltage range and absence of latch up make the μA747 ideal for use as a voltage follower. The high gain and wide range of operating voltage provide superior performance in integrator, summing amplifier, and general feedback applications. The μA747 is short circuit protected and requires no external components for frequency compensation. The internal 6 dB/octave roll-off insures stability in closed loop applications. For single amplifier performance, *see μA741 data sheet.*

- **No Frequency Compensation Required**
- **Short Circuit Protection**
- **Offset Voltage Null Capability**
- **Large Common Mode And Differential Voltage Ranges**
- **Low Power Consumption**
- **No Latch Up**

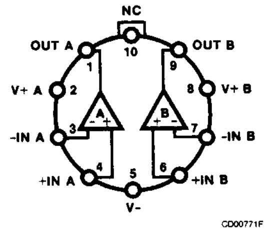
Absolute Maximum Ratings

Storage Temperature Range	
Metal Can and Ceramic DIP	-65°C to +175°C
Molded DIP and SO-14	-65°C to +150°C
Operating Temperature Range	
Extended (μA747AM, μA747M)	-55°C to +125°C
Commercial (μA747EC, μA747C)	0°C to +70°C
Lead Temperature	
Metal Can and Ceramic DIP (soldering, 60 s)	300°C
Molded DIP and SO-14 (soldering, 10 s)	265°C
Internal Power Dissipation[1, 2]	
10L-Metal Can	1.07 W
14L-Ceramic DIP	1.36 W
14L-Molded DIP	1.04 W
SO-14	0.93 W
Supply Voltage	
μA747A, μA747	±22 V
μA747E, μA747C	±18 V
Differential Input Voltage	±30 V
Input Voltage[3]	±15 V
Voltage Between Offset Null and V–	±0.5 V
Output Short Circuit Duration[4]	Indefinite

Notes

1. $T_{J\,Max}$ = 150°C for the Molded DIP and SO-14, and 175°C for the Metal Can Ceramic DIP.
2. Ratings apply to ambient temperature at 25°C. Above this temperature, derate the 10L-Metal Can at 7.1 mW/°C, the 14L-Ceramic DIP at 9.1 mW/°C, the 14L-Molded DIP at 8.3 mW/°C, and the SO-14 at 7.5 mW/°C.
3. For supply voltages less than ±15 V, the absolute maximum input voltage is equal to the supply voltage.

Connection Diagram
10-Lead Metal Package
(Top View)

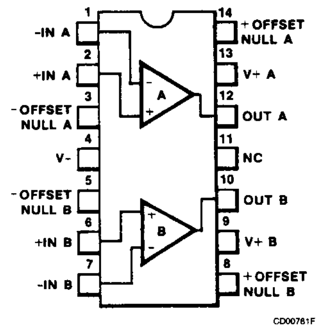


Lead 5 connected to case.

Order Information

Device Code	Package Code	Package Description
μA747HM	5X	Metal
μA747HC	5X	Metal
μA747AHM	5X	Metal
μA747EHC	5X	Metal

Connection Diagram
14-Lead DIP and SO-14 Package
(Top View)

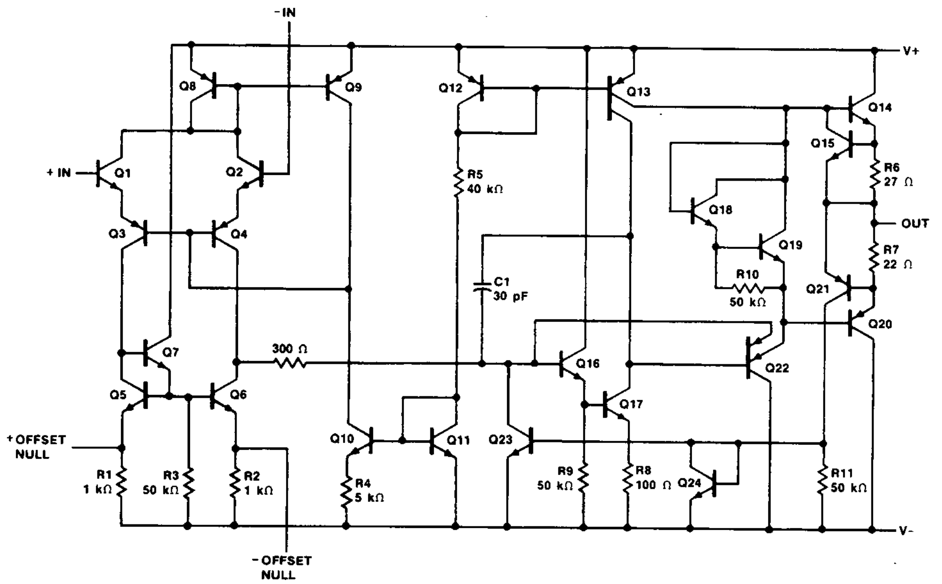


Order Information

Device Code	Package Code	Package Description
μA747DM	6A	Ceramic DIP
μA747DC	6A	Ceramic DIP
μA747PC	9A	Molded DIP
μA747SC	KD	Molded Surface Mount
μA747ADM	6A	Ceramic DIP
μA747EDC	6A	Ceramic DIP

4. Short circuit may be to ground or either supply. Rating applies to 125°C case temperature or 75°C ambient temperature.

Equivalent Circuit (1/2 of circuit)



V+A is internally connected to V+B.

μA747 and μA747C
Electrical Characteristics $T_A = 25°C$, $V_{CC} = \pm 15$ V, unless otherwise specified.

Symbol	Characteristic	Condition	μA747 Min	μA747 Typ	μA747 Max	μA747C Min	μA747C Typ	μA747C Max	Unit
V_{IO}	Input Offset Voltage	$R_S \leq 10$ kΩ		1.0	5.0		1.0	6.0	mV
$V_{IO\ adj}$	Input Offset Voltage Adjustment Range			±15			±15		mV
I_{IO}	Input Offset Current			20	200		20	200	nA
I_{IB}	Input Bias Current			80	500		80	500	nA
Z_I	Input Impedance		0.3	2.0		0.3	2.0		MΩ
I_{CC}	Supply Current			3.4	5.6		3.9	5.6	mA
P_c	Power Consumption			100	170		100	170	mW
PSRR	Power Supply Rejection Ratio			30	150				μV/V
		$V_{CC} = \pm 5.0$ V to ± 18 V					30	150	
I_{OS}	Output Short Circuit Current			25			25		mA
A_{VS}	Large Signal Voltage Gain	$R_L \geq 2.0$ kΩ, $V_O = \pm 10$ V	50	200		25	200		V/mV
TR	Transient Response: Rise time	$V_I = 50$ mV, $R_L = 2.0$ kΩ, $C_L = 100$ pF, $A_V = 1.0$		0.3			0.3		μs
	Transient Response: Overshoot			5.0			5.0		%
BW	Bandwidth			1.0			1.0		MHz
SR	Slew Rate	$R_L = 2.0$ kΩ, $A_V = 1.0$		0.5			0.5		V/μs
CS	Channel Separation			120			120		dB

The following specifications apply over the range of $-55°C \leq T_A \leq +125°C$ for μA747, $0°C \leq T_A \leq 70°C$ for μA747C

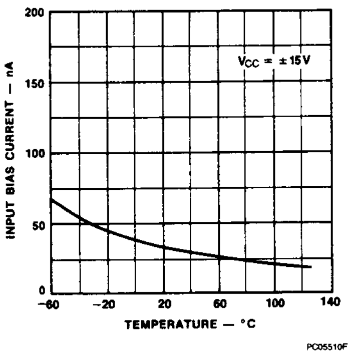
Symbol	Characteristic	Condition	μA747 Min	μA747 Typ	μA747 Max	μA747C Min	μA747C Typ	μA747C Max	Unit
V_{IO}	Input Offset Voltage	$R_S \leq 10$ kΩ		1.0	6.0		1.0	7.5	mV
I_{IO}	Input Offset Current	$0°C \leq T_A \leq 70°C$					7.0	300	nA
		$T_A = +125°C$		7.0	200				
		$T_A = -55°C$		85	500				
I_{IB}	Input Bias Current	$0°C \leq T_A \leq 70°C$					30	800	nA
		$T_A = +125°C$		0.03	0.5				μA
		$T_A = -55°C$		0.3	1.5				
I_{CC}	Supply Current	$0°C \leq T_A \leq 70°C$					4.0	6.6	mA
		$T_A = +125°C$		3.0	5.0				
		$T_A = -55°C$		4.0	6.6				
P_c	Power Consumption	$0°C \leq T_A \leq 70°C$					120	200	mW
		$T_A = +125°C$		90	150				
		$T_A = -55°C$		120	200				
CMR	Common Mode Rejection	$R_S \leq 10$ kΩ	70	90		70	90		dB
V_{IR}	Input Voltage Range		±12	±13		±12	±13		V
PSRR	Power Supply Rejection Ratio			30	150				μV/V
		$V_{CC} = \pm 5.0$ V to ± 18 V					30	150	
A_{VS}	Large Signal Voltage Gain	$R_L \geq 2.0$ kΩ, $V_O = \pm 10$ V	25			15			V/mV
V_{OP}	Output Voltage Swing	$R_L = 10$ kΩ	±12	±14		±12	±14		V
		$R_L = 2.0$ kΩ	±10	±13		±10	±13		

μA747A and μA747E
Electrical Characteristics $T_A = 25°C$, $\pm 5.0\ V \leqslant V_{CC} \leqslant \pm 20\ V$, unless otherwise specified.

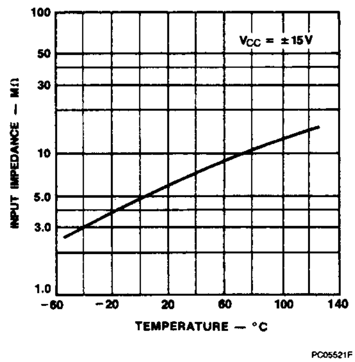
Symbol	Characteristic		Condition			Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage		$R_S \leqslant 50\ \Omega$				0.8	3.0	mV
$V_{IO\ adj}$	Input Offset Voltage Adjustment Range		$V_{CC} = \pm 20\ V$			10			mV
I_{IO}	Input Offset Current						3.0	30	nA
I_{IB}	Input Bias Current						30	80	nA
Z_I	Input Impedance		$V_{CC} = \pm 20\ V$			1.0	6.0		MΩ
P_c	Power Consumption		$V_{CC} = \pm 20\ V$				160	300	mW
CMR	Common Mode Rejection		$V_{CC} = \pm 20\ V$, $V_I = \pm 15\ V$, $R_S = 50\ \Omega$			80	95		dB
PSRR	Power Supply Rejection Ratio		$V_{CC} = +10\ V, -20\ V$ to $V_{CC} = +20\ V, -10\ V$, $R_S = 50\ \Omega$				15	50	μV/V
I_{OS}	Output Short Circuit Current		μA747A			10	25	40	mA
			μA747E			10	25	35	
A_{VS}	Large Signal Voltage Gain		$V_{CC} = \pm 20\ V$, $R_L \geqslant 2.0\ k\Omega$, $V_O = \pm 15\ V$			50			V/mV
TR	Transient Response	Rise time	$V_I = 50\ mV$, $R_L = 2.0\ k\Omega$, $C_L = 100\ pF$ $A_V = 1.0$				0.25	0.8	μs
		Overshoot					6.0	20	%
BW	Bandwidth					0.437	1.5		MHz
SR	Slew Rate		$V_I = \pm 10\ V$, $A_V = 1$			0.3	0.7		V/μs
The following specifications apply over the range of $-55°C \leqslant T_A \leqslant +125°C$ for μA747A, $0°C \leqslant T_A \leqslant +70°C$ for μA747E.									
V_{IO}	Input Offset Voltage							4.0	mV
$\Delta V_{IO}/\Delta T$	Input Offset Voltage Temperature Sensitivity							15	μV/°C
I_{IO}	Input Offset Current							70	nA
I_{IB}	Input Bias Current							210	nA
$\Delta I_{IO}/\Delta T$	Input Offset Current Temperature Sensitivity		μA747E	$T_A = 25°C$ to $70°C$				0.2	nA/°C
				$T_A = 0°C$ to $25°C$				0.5	
			μA747A	$T_A = 25°C$ to $125°C$				0.2	
				$T_A = -55°C$ to $+25°C$				0.5	
Z_I	Input Impedance		$V_{CC} = \pm 20\ V$			0.5			MΩ
P_c	Power Consumption		$V_{CC} = \pm 20\ V$	μA747A	−55°C			330	mW
					+125°C			270	
				μA747E				330	
I_{OS}	Output Short Circuit Current					10		40	mA
A_{VS}	Large Signal Voltage Gain		$V_{CC} = \pm 20\ V$, $R_L \geqslant 2.0\ k\Omega$, $V_O = \pm 15\ V$			32			V/mV
			$V_{CC} = \pm 5\ V$, $R_L \geqslant 2.0\ k\Omega$, $V_O = \pm 2.0\ V$			10			
V_{OP}	Output Voltage Swing		$V_{CC} = \pm 20\ V$		$R_L = 10\ k\Omega$	±16			V
					$R_L = 2.0\ k\Omega$	±15			
CS	Channel Separation		$V_{CC} = \pm 20\ V$			100			dB

Typical Performance Curves for μA747A and μA747

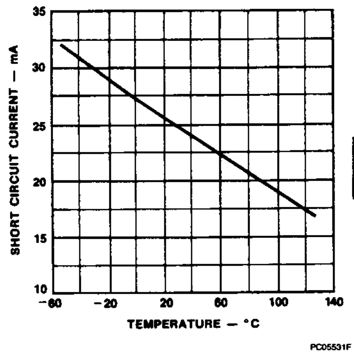
Input Bias Current vs Temperature



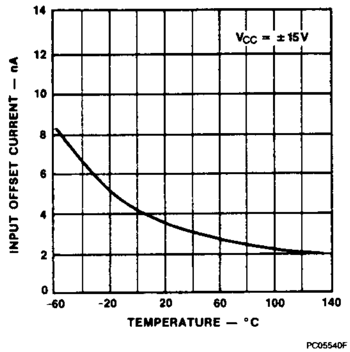
Input Impedance vs Temperature



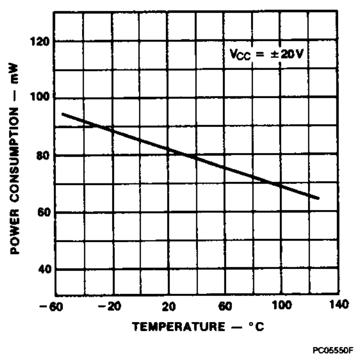
Short Circuit Current vs Temperature



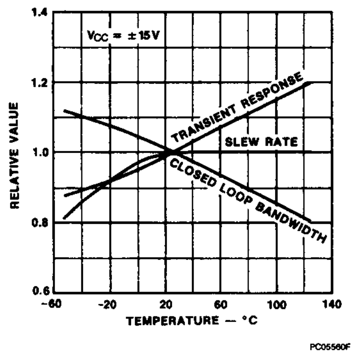
Input Offset Current vs Temperature



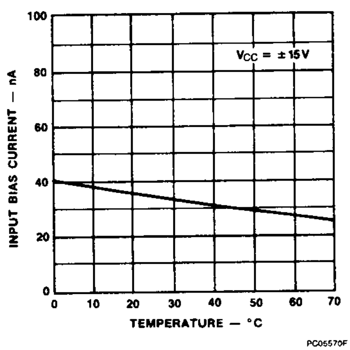
Power Consumption vs Temperature



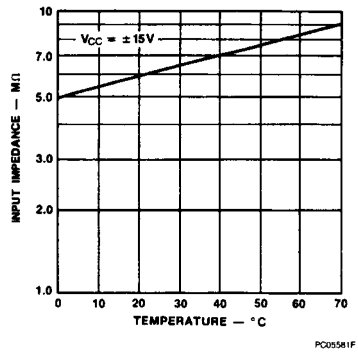
Frequency Characteristics vs Temperature



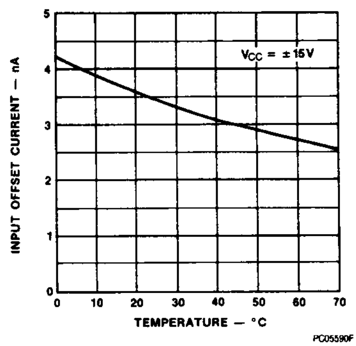
Input Bias Current vs Temperature For μA747C/E



Input Impedance vs Temperature For μA747C/E



Input Offset Current vs Temperature For μA747C/E



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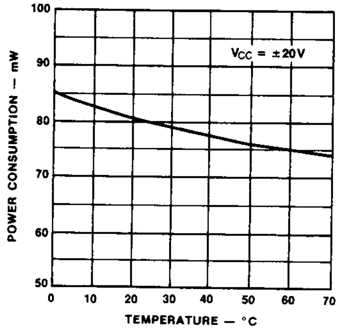
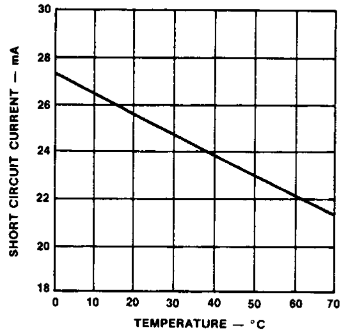
Typical Performance Curves (Cont.)

Power Consumption vs Temperature For μA747C/E



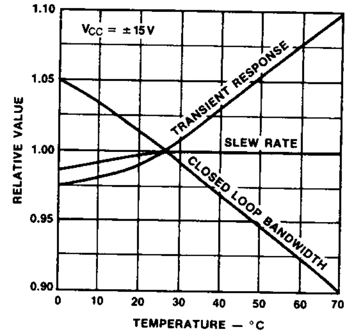
PC05600F

Short Circuit Current vs Temperature For μA747C/E



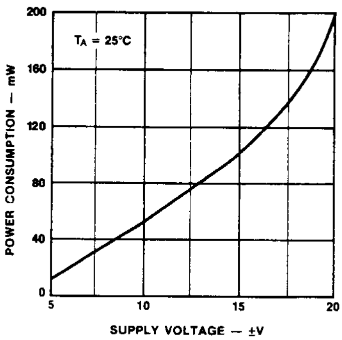
PC05611F

Frequency Characteristics vs Temperature For μA747C/E



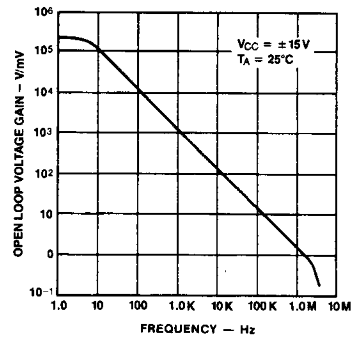
PC05620F

Power Consumption vs Supply Voltage



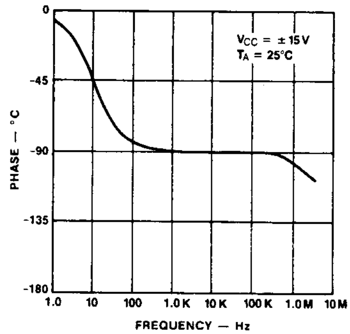
PC05631F

Open Loop Frequency Response



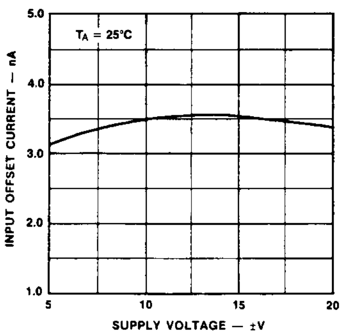
PC05641F

Open Loop Phase Response vs Frequency



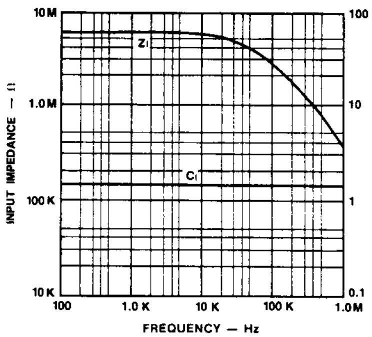
PC05651F

Input Offset Current vs Supply Voltage



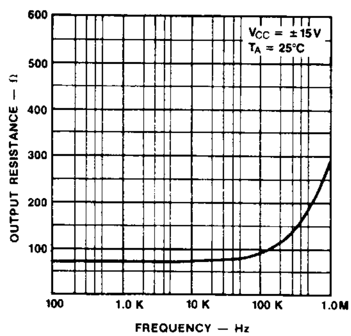
PC05661F

Input Impedance and Input Capacitance vs Frequency



PC05671F

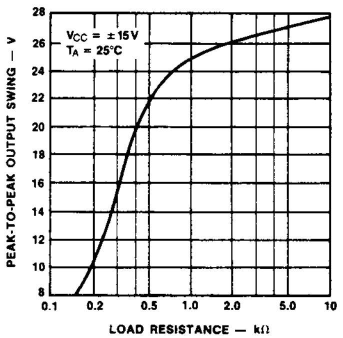
Output Resistance vs Frequency



PC05681F

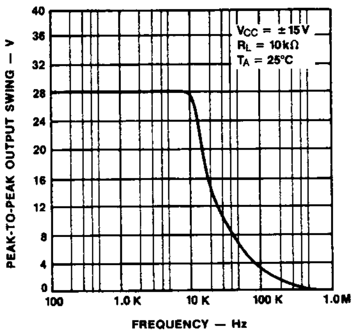
Typical Performance Curves (Cont.)

Output Voltage Swing vs Load Resistance



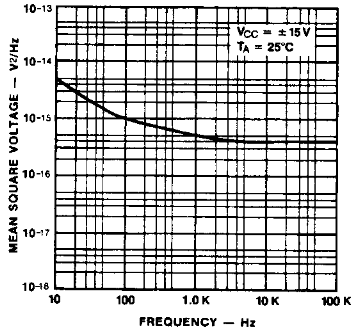
PC05690F

Output Voltage Swing vs Frequency



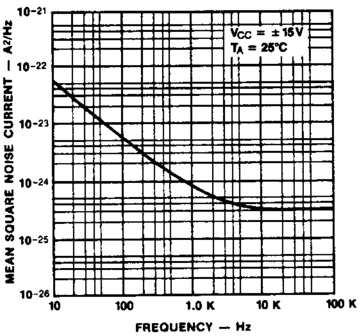
PC05701F

Input Noise Voltage Density vs Frequency



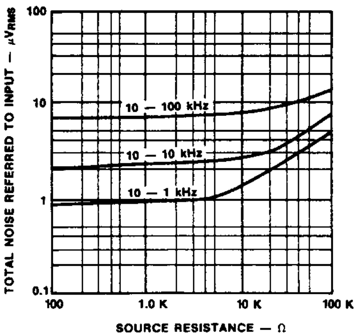
PC05711F

Input Noise Current Density vs Frequency



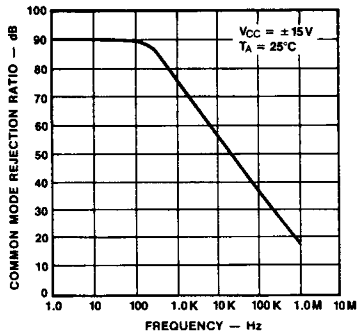
PC05721F

Broadband Noise for Various Bandwidths



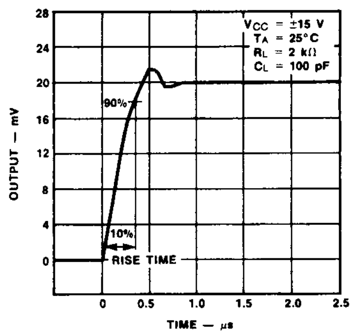
PC05731F

Common Mode Rejection Ratio vs and Frequency μA747/C



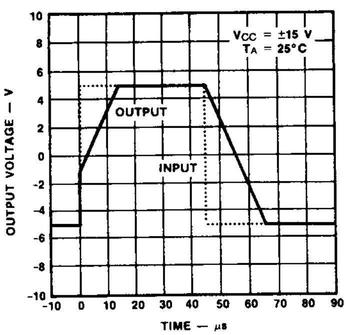
PC05741F

Transient Response For μA747/C



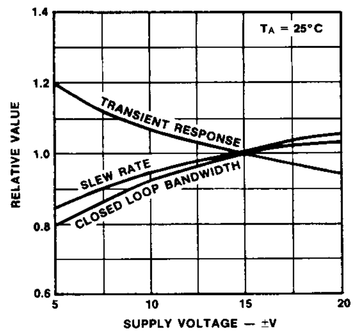
PC05751F

Voltage Follower Large Signal Pulse Response For μA747/C



PC05760F

Frequency Characteristics vs Supply Voltage For μA747/C



PC05770F

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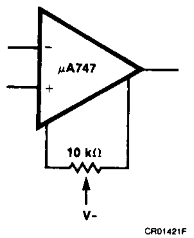
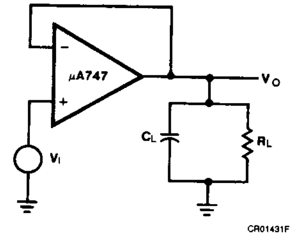
Test Circuits

Voltage Offset Null Circuit

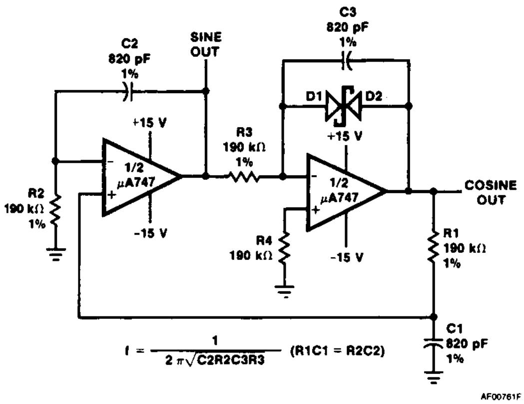


Transient Response Test Circuit

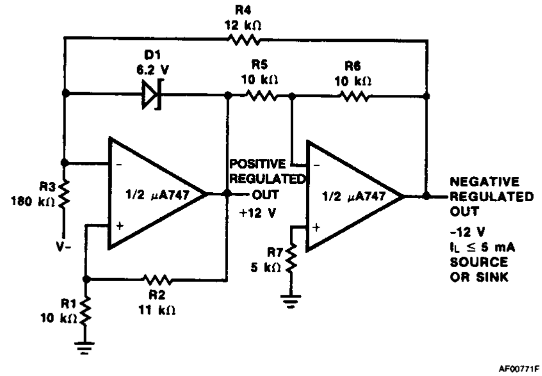


Typical Applications

Quadrature Oscillator



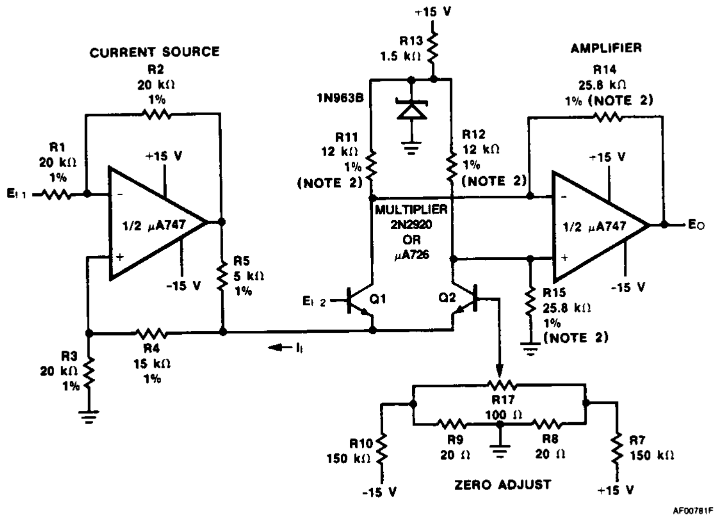
Tracking Positive and Negative Voltage References



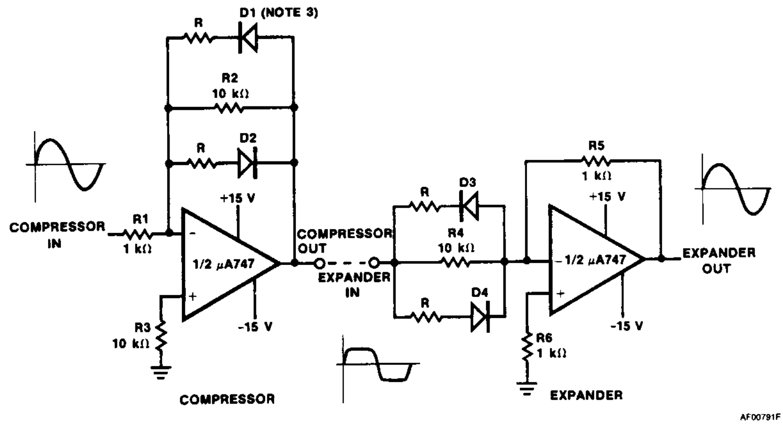
$$\text{Positive Output} = V_{D1} \times \frac{R1 + R2}{R2}$$

$$\text{Negative Output} = -\text{Positive Output} \times \frac{R6}{R5}$$

Analog Multiplier



Compressor/Expander Amplifiers (Note 1)



Notes

1. Maximum Compression Expansion Ratio = R/R (10 kΩ > R ≥ 0)
2. Matched to 0.1% $E_O = 100\ E_{I1} \times E_{I2}$
3. Diodes D1 through D4 are matched FD666 or Equivalent