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μA748 Operational Amplifier

Description

The μA748 is a high performance monolithic operational amplifier constructed using the Fairchild Planar Epitaxial process. It is intended for a wide range of analog applications where tailoring of frequency characteristics is desirable. High common mode voltage range and absence of latch up make the μA748 ideal for use as a voltage follower. The high gain and wide range of operating voltages provide superior performance in integrator, summing amplifier, and general feedback applications. The μA748 is short circuit protected and has the same lead configuration as the popular μA741 operational amplifier. Unity gain frequency compensation is achieved by means of a single 30 pF capacitor.

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

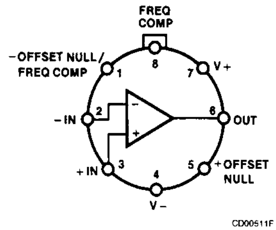
Absolute Maximum Ratings

Storage Temperature Range	
Metal Can and Ceramic DIP	-65°C to +175°C
Molded DIP and SO-8	-65°C to +150°C
Operating Temperature Range	
Extended (μA748M)	-55°C to +125°C
Commercial (μA748C)	0°C to +70°C
Lead Temperature	
Metal Can and Ceramic DIP (soldering, 60 s)	300°C
Molded DIP and SO-8 (soldering, 10 s)	265°C
Internal Power Dissipation[1, 2]	
8L-Metal Can	1.00 W
8L-Molded DIP	0.93 W
8L-Ceramic DIP	1.30 W
SO-8	0.81 W
Supply Voltage	±22 V
Differential Input Voltage	±30 V
Input Voltage[3]	±15 V
Output Short Circuit Duration[4]	Indefinite

Notes

1. $T_{J\ Max}$ = 150°C for the Molded DIP and SO-8, and 175°C for the Metal Can and Ceramic DIP
2. Ratings apply to ambient temperature at 25°C. Above this temperature, derate the 8L-Metal Can at 6.7 mW/°C, the 8L-Molded DIP at 7.5 mW/°C, the 8L-Ceramic DIP at 8.7 mW/°C, and the SO-8 at 6.5 mW/°C.
3. For supply voltages less than ±15 V, the absolute maximum input voltage is equal to the supply voltage.
4. Short circuit may be to ground or either supply. Rating applies to 125°C case temperature or +75°C ambient temperature.

Connection Diagram
8-Lead Metal Package
(Top View)

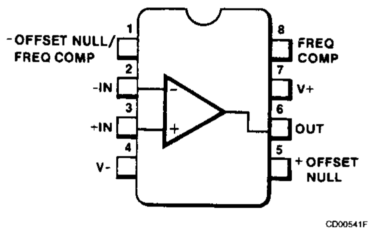


Lead 4 connected to case.

Order Information

Device Code	Package Code	Package Description
μA748HM	5W	Metal
μA748HC	5W	Metal

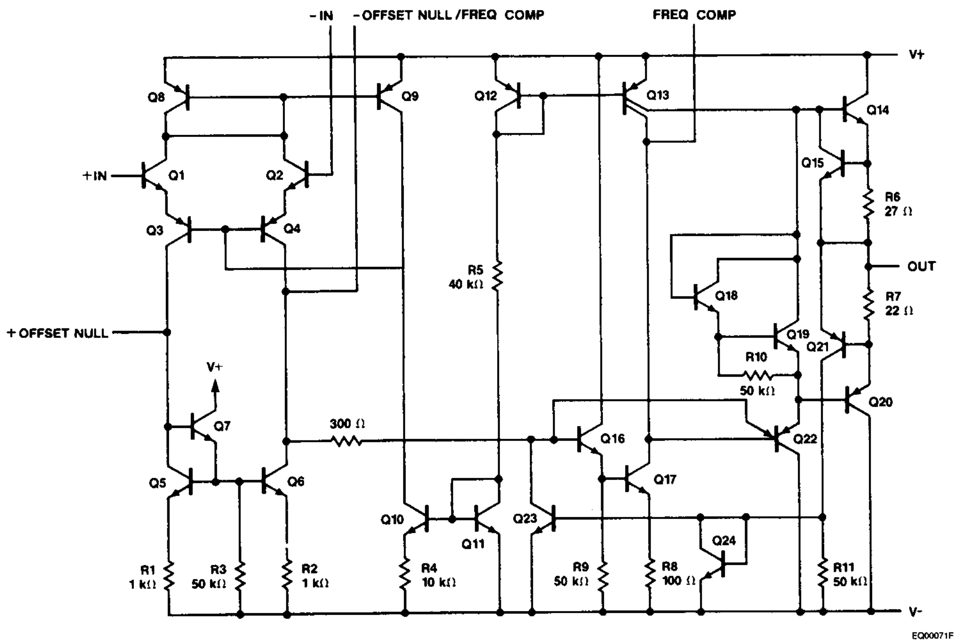
Connection Diagram
8-Lead DIP and SO-8 Package
(Top View)



Order Information

Device Code	Package Code	Package Description
μA748RC	6T	Ceramic DIP
μA748SC	KC	Molded Surface Mount
μA748TC	9T	Molded DIP

Equivalent Circuit



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μA748
Electrical Characteristics $T_A = 25°C$, $V_{CC} = \pm 15$ V, $C_C = 30$ pF, unless otherwise specified.

Symbol	Characteristic		Condition	Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage		$R_S \leq 10$ kΩ		1.0	5.0	mV
$V_{IO\ adj}$	Input Offset Voltage Adjustment Range				±15		mV
I_{IO}	Input Offset Current				20	200	nA
I_{IB}	Input Bias Current				80	500	nA
Z_I	Input Impedance			0.3	2.0		MΩ
I_{CC}	Supply Current				1.9	2.8	mA
P_c	Power Consumption				60	85	mW
I_{OS}	Output Short Circuit Current				25		mA
A_{VS}	Large Signal Voltage Gain		$R_L \geq 2.0$ kΩ, $V_O = \pm 10$ V	50	150		V/mV
TR	Transient Response	Rise time	$V_I = 20$ mV, $C_C = 30$ pF, $R_L = 2.0$ kΩ, $C_L = 100$ pF, $A_V = 1.0$		0.3		μs
		Overshoot			5.0		%
SR	Slew Rate		$R_L = 2.0$ kΩ, $A_V = 1.0$		0.5		V/μs
			$R_L = 2.0$ kΩ, $C_C = 3.5$ pF, $A_V = 10$		5.5		
The following specifications apply for $-55°C \leq T_A \leq 125°C$							
V_{IO}	Input Offset Voltage		$R_S \leq 10$ kΩ		1.0	6.0	mV
I_{IO}	Input Offset Current		$T_A = T_{A\ Max}$		10	200	nA
			$T_A = T_{A\ Min}$		50	500	
I_{IB}	Input Bias Current		$T_A = T_{A\ Max}$		0.03	0.5	μA
			$T_A = T_{A\ Min}$		0.3	1.5	
I_{CC}	Supply Current		$T_A = T_{A\ Max}$		1.5	2.5	mA
			$T_A = T_{A\ Min}$		2.0	3.3	
P_c	Power Consumption		$T_A = T_{A\ Max}$		45	75	mW
			$T_A = T_{A\ Min}$		60	100	
CMR	Common Mode Rejection		$R_S \leq 10$ kΩ	70	90		dB
V_{IR}	Input Voltage Range			±12	±13		V
PSRR	Power Supply Rejection Ratio		$R_S \leq 10$ kΩ		30	150	μV/V
A_{VS}	Large Signal Voltage Gain		$R_L \geq 2.0$ kΩ, $V_O = \pm 10$ V	25			V/mV
V_{OP}	Output Swing		$R_L = 10$ kΩ	±12	±14		V
			$R_L = 2.0$ kΩ	±10	±13		

μA748C

Electrical Characteristics $T_A = 25°C$, $V_{CC} = \pm 15$ V, $C_C = 30$ pF, unless otherwise specified.

Symbol	Characteristic		Condition	Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage		$R_S \leq 10$ kΩ		2.0	6.0	mV
I_{IO}	Input Offset Current				20	200	nA
I_{IB}	Input Bias Current				80	500	nA
Z_I	Input Impedance			0.3	2.0		MΩ
I_{CC}	Supply Current				1.9	2.8	mA
P_c	Power Consumption				60	85	mW
I_{OS}	Output Short Circuit Current				25		mA
A_{VS}	Large Signal Voltage Gain		$R_L \geq 2.0$ kΩ, $V_O = \pm 10$ V	20	150		V/mV
TR	Transient Response	Rise time	$V_I = 20$ mV, $C_C = 30$ pF, $R_L = 2.0$ kΩ, $C_L = 100$ pF, $A_V = 1.0$		0.3		μs
		Overshoot			5.0		%
SR	Slew Rate		$R_L = 2.0$ kΩ, $A_V = 1.0$		0.5		V/μs
The following specifications apply for $0°C \leq T_A \leq 70°C$							
V_{IO}	Input Offset Voltage		$R_S \leq 10$ kΩ		2.0	7.5	mV
I_{IO}	Input Offset Current		$T_A = T_{A\ Max}$			300	nA
			$T_A = T_{A\ Min}$			800	μA
I_{CC}	Supply Current		$T_A = T_{A\ Max}$		1.5	2.5	mA
			$T_A = T_{A\ Min}$		2.0	3.3	
P_c	Power Consumption		$T_A = T_{A\ Max}$		45	75	mW
			$T_A = T_{A\ Min}$		60	100	
CMR	Common Mode Rejection		$R_S \leq 10$ kΩ	70	90		dB
V_{IR}	Input Voltage Range			±12	±13		V
PSRR	Power Supply Rejection Ratio		$R_S \leq 10$ kΩ		30	150	μV/V
A_{VS}	Large Signal Voltage Gain		$R_L \geq 2.0$ kΩ, $V_O = \pm 10$ V	15			V/mV
V_{OP}	Output Voltage Swing		$R_L = 10$ kΩ	±12	±14		V
			$R_L = 2.0$ kΩ	±10	±13		

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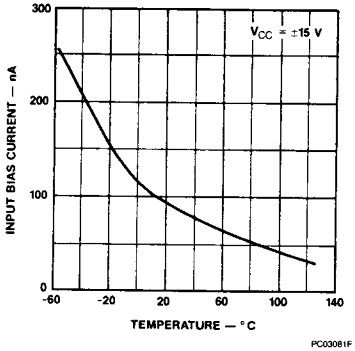
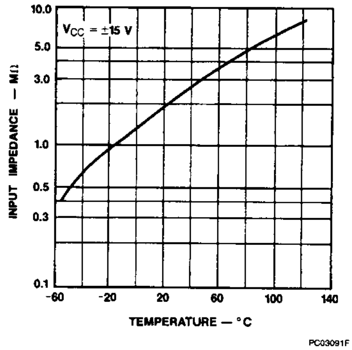
Typical Performance Curves for μA748

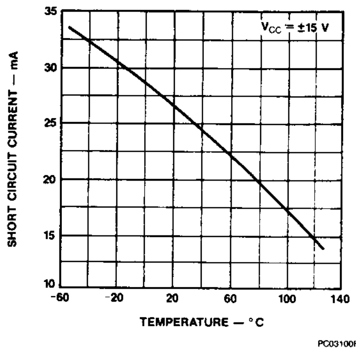
Input Bias Current vs Temperature



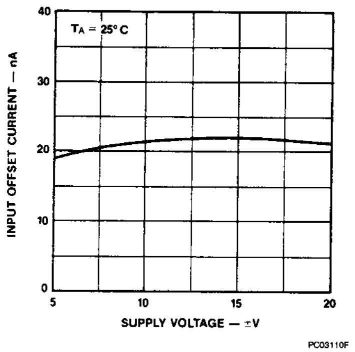
Input Impedance vs Temperature



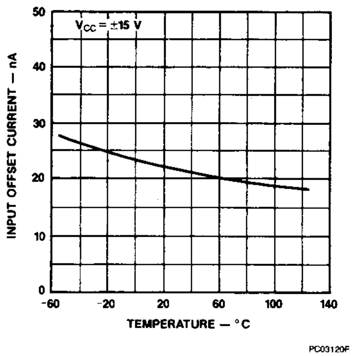
Short Circuit Current vs Temperature



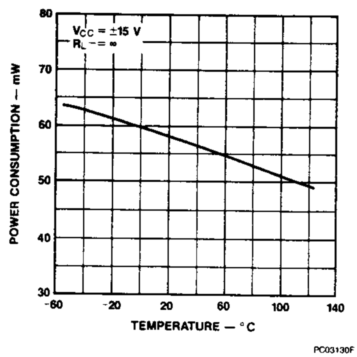
Input Offset Current vs Supply Voltage



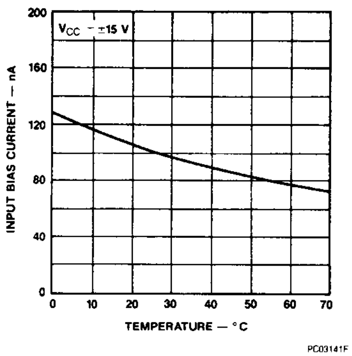
Input Offset Current vs Temperature



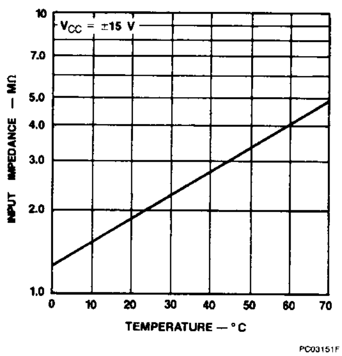
Power Consumption vs Temperature



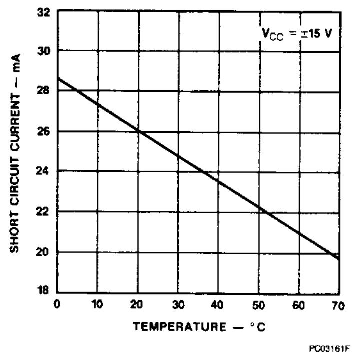
Input Bias Current vs Temperature for μA748C



Input Impedance vs Temperature for μA748C

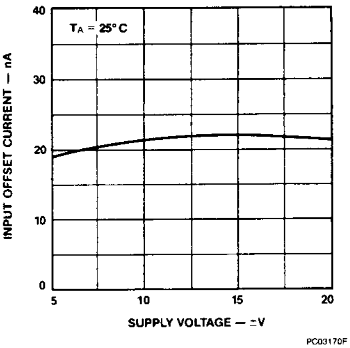


Short Circuit Current vs Temperature for μA748C

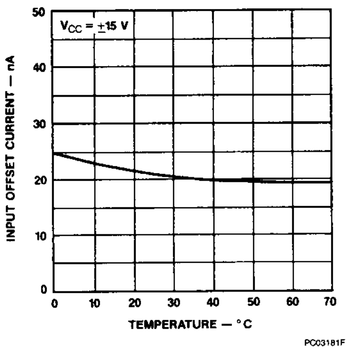


Typical Performance Curves for μA748 and μA748C (Cont.)

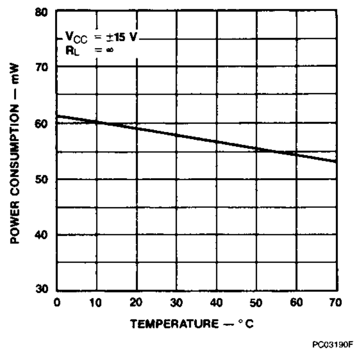
Input Offset Current vs Supply Voltage for μA748C



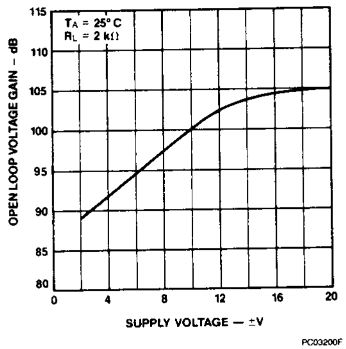
Input Offset Current vs Temperature for μA748C



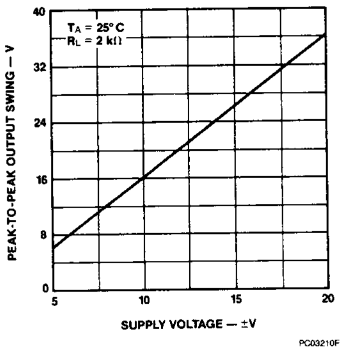
Power Consumption vs Temperature for μA748C



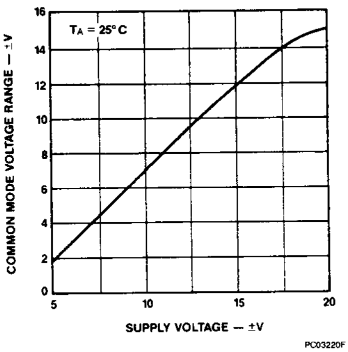
Voltage Gain vs Supply Voltage



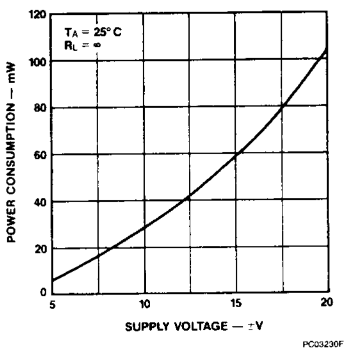
Output Voltage Swing vs Supply Voltage



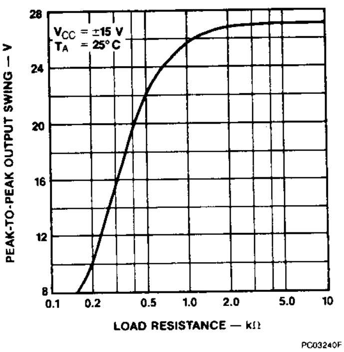
Input Common Mode Voltage Range vs Supply Voltage



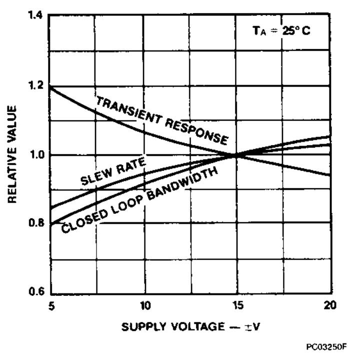
Power Consumption vs Supply Voltage



Output Voltage Swing vs Load Resistance

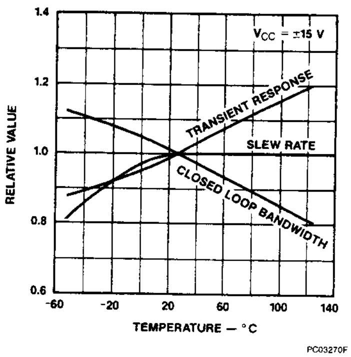


Frequency Characteristics vs Supply Voltage

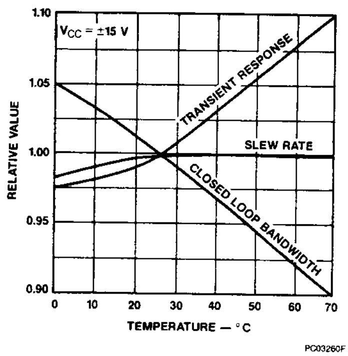


Typical Performance Curves for μA748 and μA748C (Cont.)

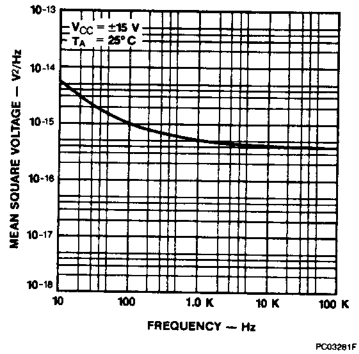
Frequency Characteristics vs Temperature for μA748



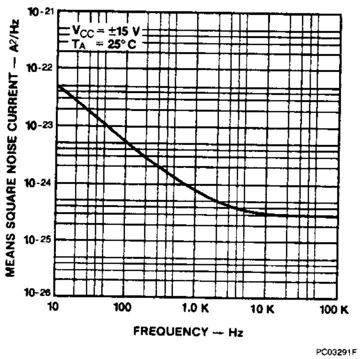
Frequency Characteristics vs Temperature for μA748C



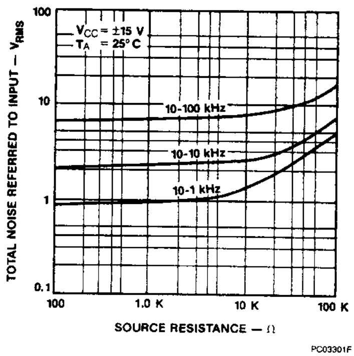
Input Noise Voltage vs Frequency



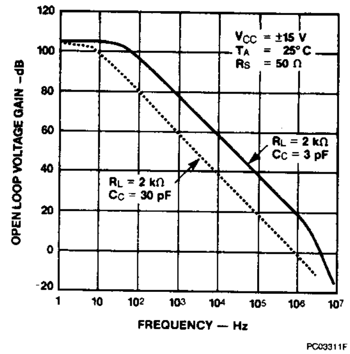
Input Noise Current vs Frequency



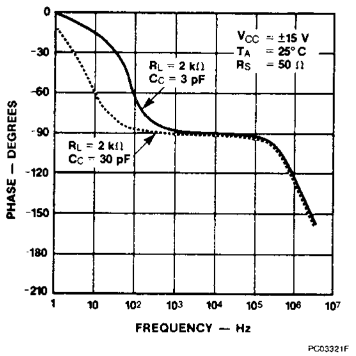
Broadband Noise for Various Bandwidths



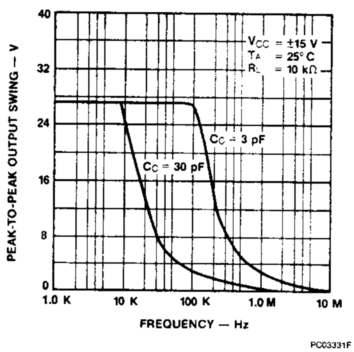
Open Loop Frequency Response for R_L = 2 kΩ



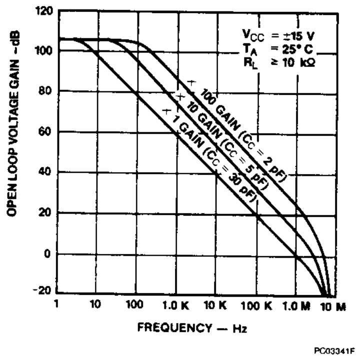
Open Loop Phase Response vs Frequency



Output Voltage Swing vs Frequency

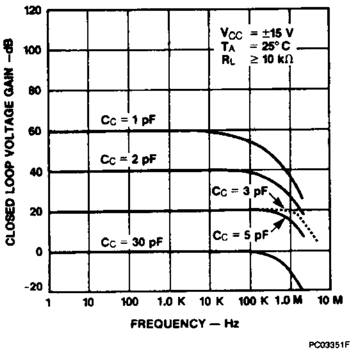


Open Loop Frequency Response for $R_L \geq$ 10 kΩ

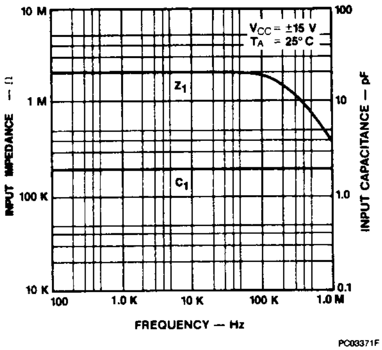


Typical Performance Curves for μA748 and μA748C (Cont.)

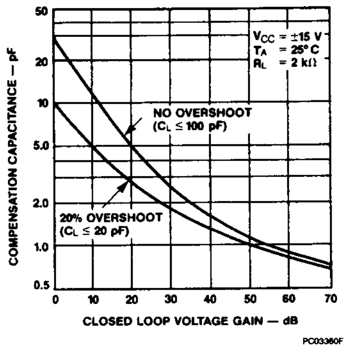
Frequency Response for Various Closed Loop Gains



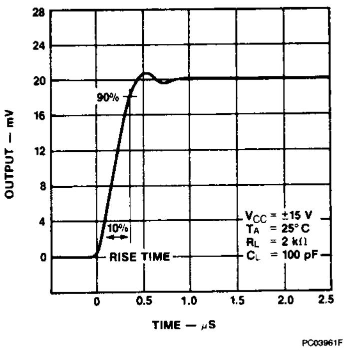
Input Impedance and Input Capacitance vs Frequency



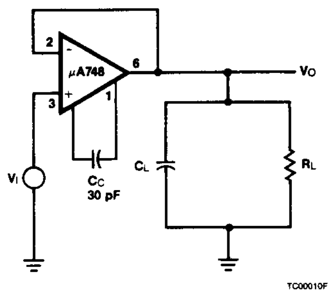
Compensation Capacitance vs Closed Loop Voltage Gain



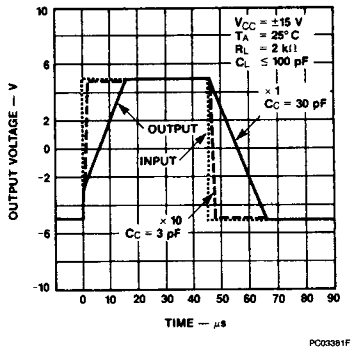
Voltage Follower Transient Response (Gain of 1)



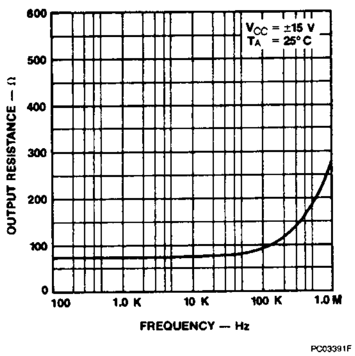
Transient Response Test Circuit



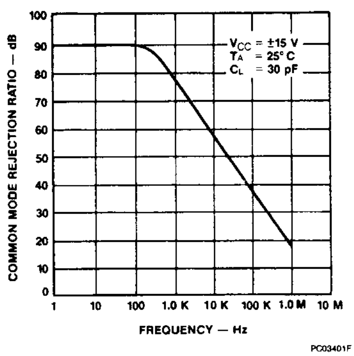
Voltage Follower Large Signal Pulse Response



Output Resistance vs Frequency

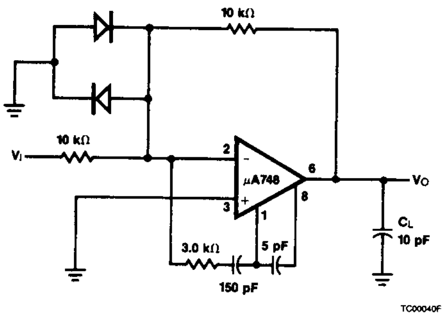


Common Mode Rejection Ratio vs Frequency

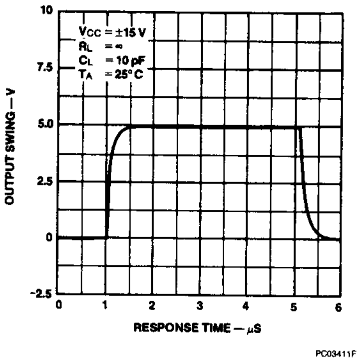


Test Circuits

Feed Forward Compensation

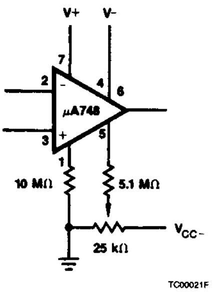


Large Signal Feed Forward Transient Response

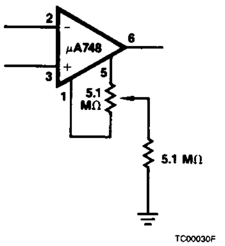


Voltage Offset Null Circuit

Suggested

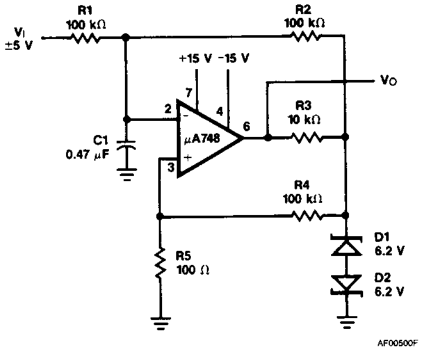


Alternate

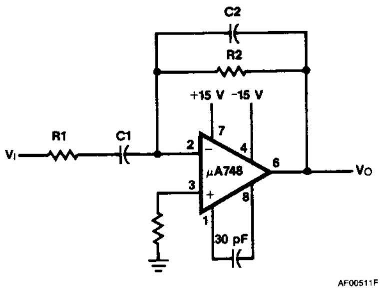


Typical Applications

Pulse Width Modulator



Practical Differentiator

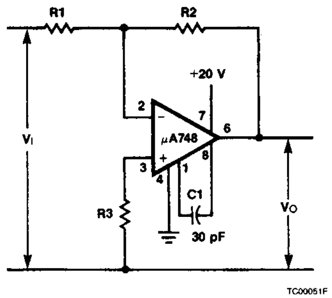


$$f_c = \frac{1}{2\pi\ R2\ C1}$$

$$f_h = \frac{1}{2\pi\ R1\ C1} = \frac{1}{2\pi\ R2\ C2}$$

$f_c < f_h < f_{unity\ gain}$

Circuit for Operating the μA748 Without a Negative Supply



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