SGS LM748 LM748C

# LINEAR INTEGRATED CIRCUITS

7929225 S G S SEMICONDUCTOR CORP

## OPERATIONAL AMPLIFIERS

- SHORT CIRCUIT PROTECTION
- OFFSET VOLTAGE NULL CAPABILITY
- LARGE COMMON MODE AND DIFFERENTIAL VOLTAGE RANGE
- NO LATCH-UP
- SLEW-RATE = 5.5V/μs ($G_v$ = 10, $C_C$ = 3.5 pF)

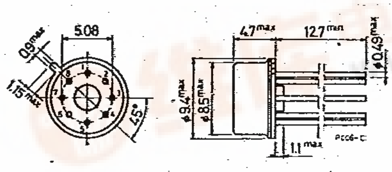
The LM748 series consists of general purpose operational amplifiers, intended for a wide range of analog applications where tailoring of frequency characteristics is desirable. High common mode voltage range and absence of "Latch-up" tendencies make the LM748 series ideal for use as a voltage follower. The high gain and wide range of operating voltage provide superior performance in integrators, summing amplifiers and general feedback applications. Unity gain frequency compensation is achieved by means of a single 30 pF capacitor.

| ABSOLUTE MAXIMUM RATINGS | | LM748 | LM748C |
|---|---|---|---|
| $V_s$ | Supply voltage | ± 22V | ± 22V |
| $V_i$ (1) | Input voltage | ± 15V | ± 15V |
| $\Delta V_i$ | Differential input voltage | ± 30V | ± 30V |
| $T_{op}$ | Operating temperature | -55 to 125 °C | 0 to 70 °C |
| | Output short circuit duration (2) | indefinite | indefinite |
| $P_{tot}$ | Power dissipation at $T_{amb}$ = 70°C: TO-99 | 520 mW | 520 mW |
| | Minidip | — | 665 mW |
| $T_{stg}$ | Storage temperature | 65 to 150 °C | -55 to 150 °C |

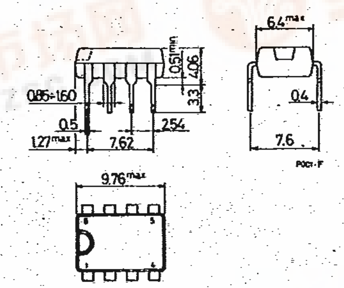
1) For supply voltage less than ± 15V, input voltage is equal to the supply voltage
2) The short circuit duration is limited by thermal dissipation.

## MECHANICAL DATA

Dimensions in mm




TO-99

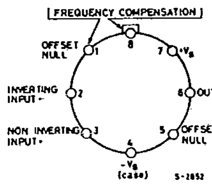


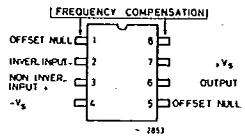

Minidip

**LM748**
**LM748C**



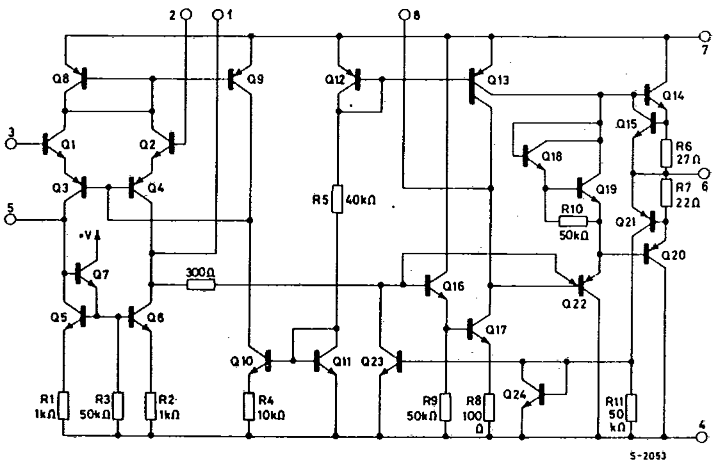
## CONNECTION DIAGRAMS AND ORDERING NUMBERS
(top views)




| Type | TO-99 | Minidip |
|---|---|---|
| LM 748 | LM 748H | — |
| LM 748C | LM 748 CH | LM 748 CN |

## SCHEMATIC DIAGRAM




| THERMAL DATA | | | TO-99 | Minidip |
|---|---|---|---|---|
| $R_{th\ j\text{-}amb}$ | Thermal resistance junction-ambient | max | 155 °C/W | 120 °C/W |

## ELECTRICAL CHARACTERISTICS (see note)

| Parameter | | Test conditions | | LM748 Min. | LM748 Typ. | LM748 Max. | LM748C Min. | LM748C Typ. | LM748C Max. | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| $V_{os}$ | Input offset voltage | $T_{amb}$ = 25°C<br>$R_g \leqslant$ 10 kΩ<br>$R_g \leqslant$ 50Ω | | | 1 | 5 | | 2 | 6 | mV |
| | | $T_{amb}$ = $T_{min}$ to $T_{max}$<br>$R_g \leqslant$ 10 kΩ<br>$R_g \leqslant$ 50Ω | | | 1 | 6 | | | 7.5 | mV |
| $\Delta V_{os}$ | Input offset voltage adjust. range | $T_{amb}$ = 25°C | | | ±15 | | | ±15 | | mV |
| $I_{os}$ | Input offset current | $T_{amb}$ = 25°C<br>$T_{amb}$ = $T_{min}$ to $T_{max}$ | | | 20<br>50 | 200<br>500 | | 20 | 200<br>300 | nA<br>nA |
| $I_b$ | Input bias current | $T_{amb}$ = 25°C<br>$T_{amb}$ = $T_{min}$ to $T_{max}$ | | | 80 | 500<br>1.5 | | 80 | 500<br>0.8 | nA<br>μA |
| $R_i$ | Input resistance | $T_{amb}$ = 25°C | | 0.3 | 2 | | 0.3 | 2 | | MΩ |
| $V_i$ | Input voltage range | | | ±12 | ±13 | | ±12 | ±13 | | V |
| $G_v$ | Large signal voltage gain | $T_{amb}$ = 25°C<br>$R_L \geqslant$ 2 kΩ<br>$V_s$ = ±15V $V_o$ = ±10V | | 94 | 104 | | 86 | 104 | | dB |
| | | $T_{amb}$ = $T_{min}$ to $T_{max}$<br>$R_L \geqslant$ 2 kΩ<br>$V_s$ = ±15V $V_o$ = ±10V | | 88 | | | 84 | | | dB |
| $V_o$ | Output voltage swing | $V_s$ = ±15V<br>$R_L \geqslant$ 10 kΩ<br>$R_L \geqslant$ 2 kΩ | | ±12<br>±10 | ±14<br>±13 | | ±12<br>±10 | ±14<br>±13 | | V<br>V |
| $I_{sc}$ | Output short circuit current | | | | 25 | | | 25 | | mA |
| CMR | Common mode rejection | $R_g \leqslant$ 10 kΩ $V_{CM}$ = ±12V | | 70 | 90 | | 70 | 90 | | dB |
| SVR | Supply voltage rejection | $V_s$ = ±5 to ± 20V<br>$R_g \leqslant$ 10 kΩ | | 76 | 90 | | 76 | 90 | | dB |
| SR | Slew rate | $T_{amb}$ = 25°C<br>$R_L \geqslant$ 2 kΩ | $G_v$ = 1 | | 0.5 | | | 0.5 | | V/μs |
| | | | $G_v$ = 10* | | 5.5 | | | 5.5 | | V/μs |

* $C_C$ = 3.5 pF

## ELECTRICAL CHARACTERISTICS (continued)

| | Parameter | Test conditions | LM748 | | | LM748C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| | Transient respon. (unity gain)<br>Rise time<br>Overshoot | $T_{amb}$= 25°C<br>$V_i$= 20 mV $C_c$= 30 pF<br>$R_L$= 2 kΩ $C_L$ ≤ 100 pF | | 0.2<br>5 | | | 0.2<br>5 | | µs<br>% |
| $I_s$ | Supply current | $T_{amb}$= 25°C | | 1.9 | 2.8 | | 1.9 | 2.8 | mA |
| $P_S$ | Power consumption | $T_{amb}$= 25°C<br>$V_s$= ±15V | | 60 | 85 | | 60 | 85 | mW |
| | | $V_s$= ±15V<br>$T_{amb}$= $T_{min}$<br>$T_{amb}$= $T_{max}$ | | 60<br>45 | 100<br>75 | | 60 | 100 | mW<br>mW |

**Note:** These specifications, unless otherwise specified, apply for $V_s$= ±15V and $T_{amb}$= -55 to 125°C for LM748. For LM748C these specifications apply for $T_{amb}$= 0 to 70°C ($C_c$ = 30 pF).

Fig. 1 - Voltage offset null circuits

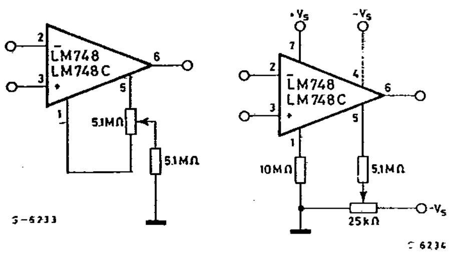



Fig. 2 - Transient response test circuit

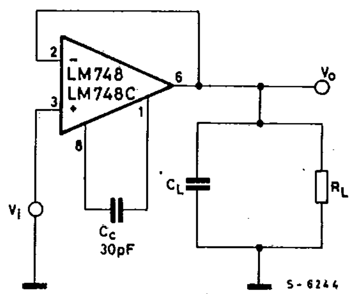


Fig. 3 - Input noise voltage vs. frequency

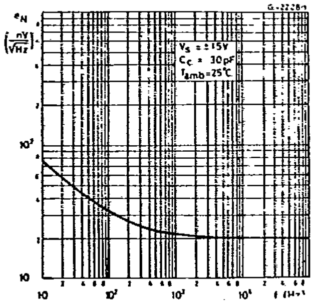



Fig. 4 - Input noise current vs. frequency

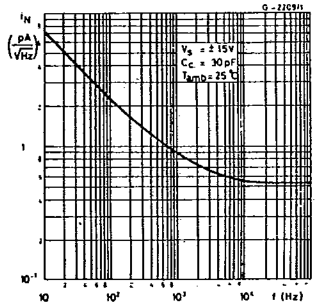



Fig. 5 - Broadband noise for various bandwidths

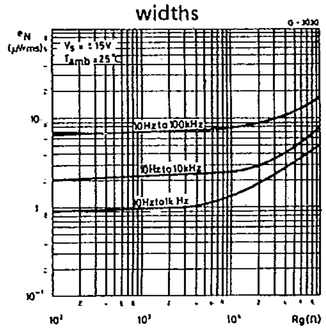



Fig. 6 - Open loop frequency and phase response vs. frequency

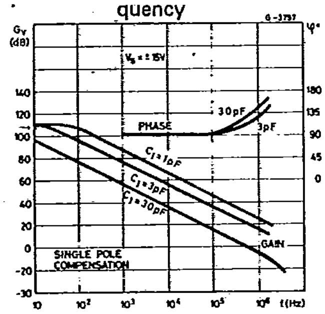



Fig. 7 - Output voltage swing vs. frequency

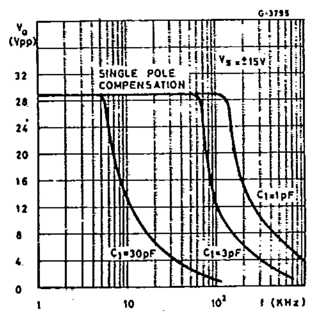



Fig. 8 - Slew-rate

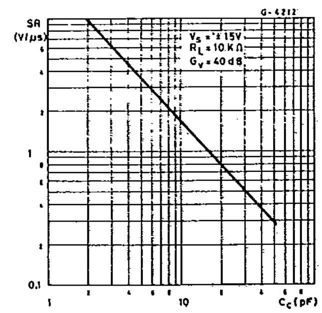



Fig. 9 - Compensation capacitance vs. closed loop voltage gain

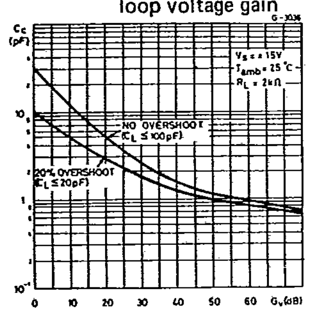



Fig. 10 - Input resistance and input capacitance vs. frequency

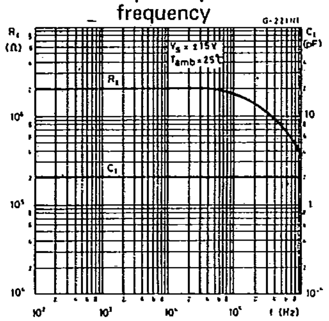



Fig. 11 - Output resistance vs. frequency