

## LM748QML Operational Amplifier

 Check for Samples: [LM748QML](#)

### FEATURES

- Frequency Compensation with a Single 30 pF Capacitor
- Operation from  $\pm 5V$  to Operation from  $\pm 20V$
- Continuous Short-Circuit Protection
- Operation as a Comparator with Differential Inputs as High as  $\pm 30V$
- No Latch-Up when Common Mode Range is Exceeded
- Same Pin Configuration as the LM101

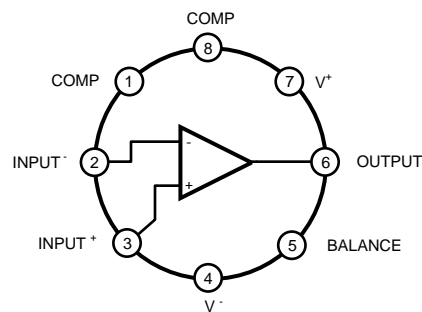
### DESCRIPTION

The LM748 is a general purpose operational amplifier with external frequency compensation.

The unity-gain compensation specified makes the circuit stable for all feedback configurations, even with capacitive loads. It is possible to optimize compensation for best high frequency performance at any gain. As a comparator, the output can be clamped at any desired level to make it compatible with logic circuits.

The LM748 is specified for operation over the  $-55^{\circ}C$  to  $+125^{\circ}C$  military temperature range.

### Connection Diagram



**Figure 1. 8LD Metal Can Package (Top View)  
See Package Number LMC0008C**



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.



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### Absolute Maximum Ratings<sup>(1)</sup>

|  |                                |
|--|--------------------------------|
| Supply Voltage                               | ±22V                           |
| Power Dissipation <sup>(2)</sup>             | 500mW                          |
| Differential Input Voltage                   | ±30V                           |
| Input Voltage <sup>(3)</sup>                 | ±15V                           |
| Output Short-Circuit Duration <sup>(4)</sup> | Indefinite                     |
| Operating Temperature Range                  | -55°C ≤ T <sub>A</sub> ≤ 125°C |
| Storage Temperature Range                    | -65°C ≤ T <sub>A</sub> ≤ 150°C |
| Maximum Junction Temperature                 | 150°C                          |
| Lead Temperature (Soldering, 10 seconds)     | 300°C                          |

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
- (2) For operating at elevated temperatures, the device must be derated based on a maximum junction to case thermal resistance of 45°C/W, or 150°C/W
- (3) For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.
- (4) Continuous short circuit is allowed for case temperatures to +125°C.

### Quality Conformance Inspection

**Table 1. Mil-Std-883, Method 5005 - Group A**

| Subgroup | Description         | Temp (°C) |
|----------|---------------------|-----------|
| 1        | Static tests at     | +25       |
| 2        | Static tests at     | +125      |
| 3        | Static tests at     | -55       |
| 4        | Dynamic tests at    | +25       |
| 5        | Dynamic tests at    | +125      |
| 6        | Dynamic tests at    | -55       |
| 7        | Functional tests at | +25       |
| 8A       | Functional tests at | +125      |
| 8B       | Functional tests at | -55       |
| 9        | Switching tests at  | +25       |
| 10       | Switching tests at  | +125      |
| 11       | Switching tests at  | -55       |
| 12       | Settling time at    | +25       |
| 13       | Settling time at    | +125      |
| 14       | Settling time at    | -55       |

## LM748 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified. DC:  $V_{CC} = \pm 15V$ ,  $V_{CM} = 0V$

| Symbol        | Parameter                    | Conditions                                   | Notes              | Min | Max  | Units | Sub-groups |      |
|---------------|------------------------------|--|--------------------|-----|------|-------|------------|------|
| $V_{IO}$      | Input Offset Voltage         | $V_{CM} = 12V$                               |                    |     | 3.0  | mV    | 1          |      |
|               |                              |  |                    |     | 4.0  | mV    | 2, 3       |      |
|               |                              | $V_{CM} = -12V$                              |                    |     | 3.0  | mV    | 1          |      |
|               |                              |  |                    |     | 4.0  | mV    | 2, 3       |      |
|               |                              | $V_{CC} = \pm 5V$                            |                    |     |      | 3.0   | mV         | 1    |
|               |                              |  |                    |     |      | 4.0   | mV         | 2, 3 |
|               |                              |  |                    |     |      | 3.0   | mV         | 1    |
|               |                              |  |                    |     |      | 4.0   | mV         | 2, 3 |
| $I_{IO}$      | Input Offset Current         | $V_{CM} = 12V$                               |                    |     | 200  | nA    | 1          |      |
|               |                              |  |                    |     | 500  | nA    | 2, 3       |      |
|               |                              | $V_{CM} = -12V$                              |                    |     | 200  | nA    | 1          |      |
|               |                              |  |                    |     | 500  | nA    | 2, 3       |      |
|               |                              | $V_{CC} = \pm 5V$                            |                    |     |      | 200   | nA         | 1    |
|               |                              |  |                    |     |      | 500   | nA         | 2, 3 |
|               |                              |  |                    |     |      | 200   | nA         | 1    |
|               |                              |  |                    |     |      | 500   | nA         | 2, 3 |
| $I_{IB}$      | Input Bias Current           | $V_{CM} = 12V$                               |                    |     | 500  | nA    | 1          |      |
|               |                              |  |                    |     | 1500 | nA    | 2, 3       |      |
|               |                              | $V_{CM} = -12V$                              |                    |     | 500  | nA    | 1          |      |
|               |                              |  |                    |     | 1500 | nA    | 2, 3       |      |
|               |                              | $V_{CC} = \pm 5V$                            |                    |     |      | 500   | nA         | 1    |
|               |                              |  |                    |     |      | 1500  | nA         | 2, 3 |
|               |                              |  |                    |     |      | 500   | nA         | 1    |
|               |                              |  |                    |     |      | 1500  | nA         | 2, 3 |
| PSRR+         | Power Supply Rejection Ratio | $+V_{CC} = 15V$ to $5V$ , $-V_{CC} = -15V$   |                    | 77  |      | dB    | 1, 2, 3    |      |
| PSRR-         | Power Supply Rejection Ratio | $-V_{CC} = -15V$ to $-5V$ , $+V_{CC} = +15V$ |                    | 77  |      | dB    | 1, 2, 3    |      |
| CMRR          | Common Mode Rejection Ratio  | $-12V \leq V_{CM} \leq +12V$                 |                    | 70  |      | dB    | 1, 2, 3    |      |
| $-A_{VS}$     | Large Signal Voltage Gain    | $R_L = 2K\Omega$ , $V_O = -10V$              | See <sup>(1)</sup> |     | 50   | V/mV  | 1          |      |
|               |                              |  |                    |     | 25   | V/mV  | 2, 3       |      |
| $+A_{VS}$     | Large Signal Voltage Gain    | $R_L = 2K\Omega$ , $V_O = +10V$              | See <sup>(1)</sup> |     | 50   | V/mV  | 1          |      |
|               |                              |  |                    |     | 25   | V/mV  | 2, 3       |      |
| $+V_{IO Adj}$ | Offset Null                  | $V_{CC} = \pm 20V$                           |                    | 4.0 |      | mV    | 1          |      |
| $-V_{IO Adj}$ | Offset Null                  | $V_{CC} = \pm 20V$                           |                    |     | -4.0 | mV    | 1          |      |

(1) Datalog reading in K = V/mV.

### LM748 Electrical Characteristics DC Parameters (continued)

The following conditions apply, unless otherwise specified. DC:  $V_{CC} = \pm 15V$ ,  $V_{CM} = 0V$

| Symbol           | Parameter             | Conditions            | Notes | Min | Max  | Units | Sub-groups |
|------------------|-----------------------|-----------------------|-------|-----|------|-------|------------|
| +I <sub>OS</sub> | Short Circuit Current |                       |       | -45 | -7.0 | mA    | 1          |
|                  |                       |                       |       | -45 | -5.0 | mA    | 2          |
|                  |                       |                       |       | -55 | -7.0 | mA    | 3          |
| -I <sub>OS</sub> | Short Circuit Current |                       |       | 7.0 | 45   | mA    | 1          |
|                  |                       |                       |       | 5.0 | 45   | mA    | 2          |
|                  |                       |                       |       | 7.0 | 55   | mA    | 3          |
| V <sub>O+</sub>  | Output Voltage Swing  | R <sub>L</sub> = 10KΩ |       | 12  |      | V     | 1, 2, 3    |
|                  |                       | R <sub>L</sub> = 2KΩ  |       | 10  |      | V     | 1, 2, 3    |
| V <sub>O-</sub>  | Output Voltage Swing  | R <sub>L</sub> = 2KΩ  |       |     | -10  | V     | 1, 2, 3    |
|                  |                       | R <sub>L</sub> = 10KΩ |       |     | -12  | V     | 1, 2, 3    |
| I <sub>CC</sub>  | Supply Current        |                       |       |     | 2.8  | mA    | 1          |
|                  |                       |                       |       |     | 2.25 | mA    | 2          |
|                  |                       |                       |       |     | 3.3  | mA    | 3          |

**REVISION HISTORY**

| <b>Released</b> | <b>Revision</b> | <b>Section</b>                | <b>Changes</b>   |
|-----------------|-----------------|-------------------------------|--|
| 12/16/2010      | A               | New Release, Corporate format | 1 MDS data sheet converted into one Corp. data sheet format. The drift table was eliminated from the 883 section since it did not apply; MNLM748-X Rev 0BL will be archived. |
| 03/26/13        | A               | All                           | Changed layout of National Data Sheet to TI format.  |

**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)         | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)             | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|-------------------------|--------------------------------------|----------------------|--------------|-------------------------------------|---------|
| LM748H/883       | ACTIVE        | TO-99        | LMC                | 8    | 20             | Non-RoHS &<br>Non-Green | Call TI                              | Call TI              | -55 to 125   | LM748H/883 Q ACO<br>LM748H/883 Q >T | Samples |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=100ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**TRAY**

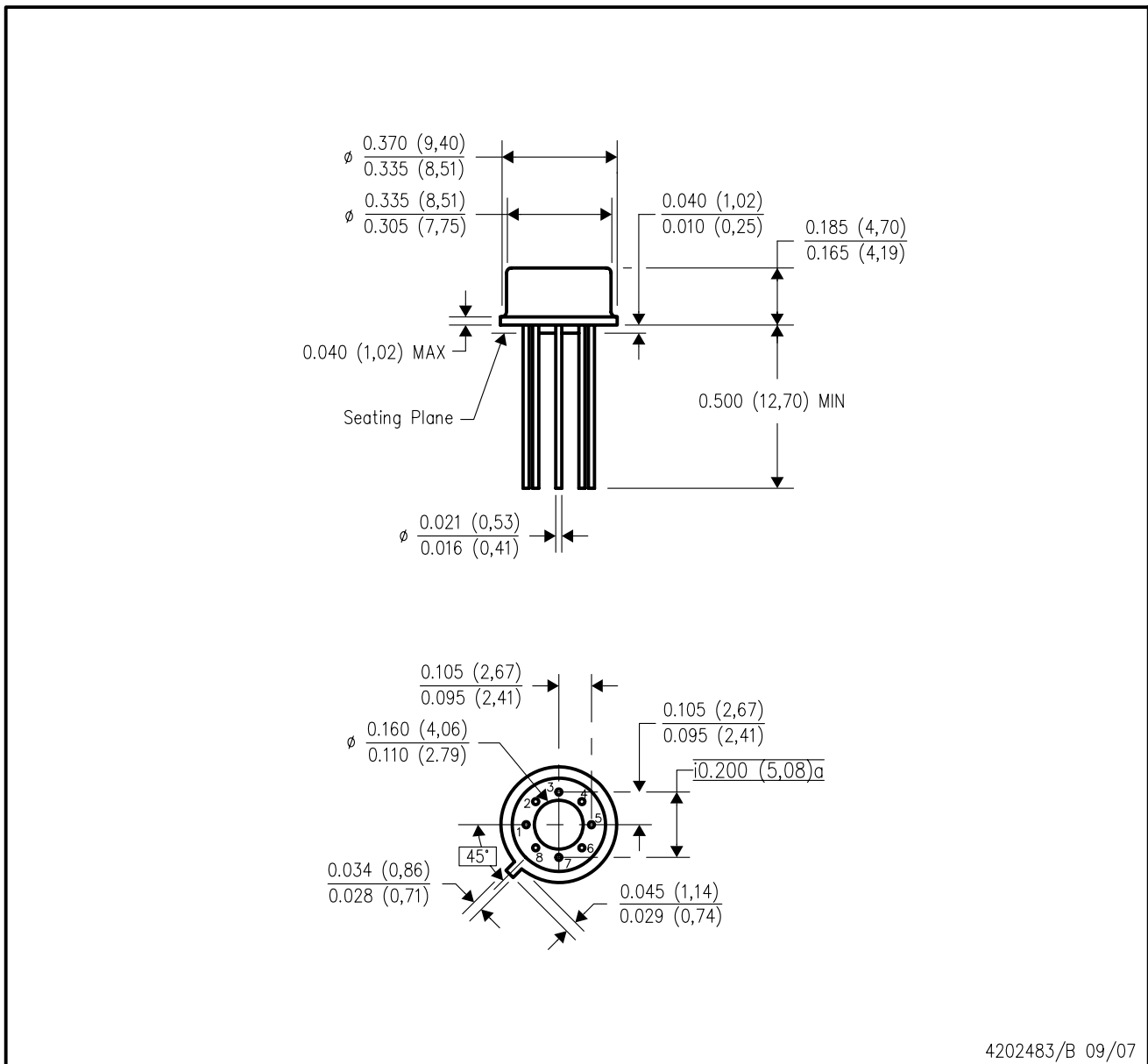

Chamfer on Tray corner indicates Pin 1 orientation of packed units.

\*All dimensions are nominal

| Device     | Package Name | Package Type | Pins | SPQ | Unit array matrix | Max temperature (°C) | L (mm) | W (mm) | K0 (µm) | P1 (mm) | CL (mm) | CW (mm) |
|------------|--------------|--------------|------|-----|-------------------|----------------------|--------|--------|---------|---------|---------|---------|
| LM748H/883 | LMC          | TO-CAN       | 8    | 20  | 2 X 10            | 150                  | 126.49 | 61.98  | 8890    | 11.18   | 12.95   | 18.54   |

LMC (O-MBCY-W8)

METAL CYLINDRICAL PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Leads in true position within 0.010 (0,25) R @ MMC at seating plane.
  - Pin numbers shown for reference only. Numbers may not be marked on package.
  - Falls within JEDEC MO-002/TO-99.



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