# LME49743 Quad High Performance, High Fidelity Audio Operational Amplifier

**Check for Samples: LME49743**

## FEATURES

- **Easily drives 600Ω loads**
- **Optimized for superior audio signal fidelity**
- **Output short circuit protection**
- **98dB (typ) PSRR and 106dB (typ) CMRR**
- **TSSOP package**

## APPLICATIONS

- **Audio amplifiers and preamplifiers**
- **Professional Audio**
- **Equalization and crossover networks**
- **Line drivers and receivers**
- **Active filters**

## DESCRIPTION

The LME49743 is a low distortion, low noise, high slew rate operational amplifier optimized and fully specified for high performance, high fidelity applications. The LME49743 audio operational amplifier delivers superior audio signal amplification for outstanding audio performance. The LME49743 combines low voltage noise density (3.5nV/$\sqrt{Hz}$) and THD+N (0.0001%) to easily satisfy demanding audio applications. To ensure that the most challenging loads are driven without compromise, the LME49743 has a slew rate of ±12V/μs and an output current capability of ±21mA.

The LME49743's outstanding CMRR(106dB), PSRR(98dB), and $V_{OS}$ (±0.15mV) give the amplifier excellent operational amplifier DC performance.

The LME49743 has a wide supply range of ±4.0V to ±17V. Over this supply range the LME49743's input circuitry maintains excellent common-mode, power supply rejection, and low input bias current. The LME49743 is unity gain stable.

The LME49743 is available in 14–lead TSSOP.

**Table 1. Key Specifications**

| | VALUE | UNIT |
|---|---|---|
| Power Supply Voltage Range | ±4.0V to ±17 | V |
| THD+N ($A_V$ = 1, $V_{OUT}$ = 3$V_{RMS}$, $f_{IN}$ = 1kHz) | | |
| $R_L$ = 2kΩ | 0.0001 | % (typ) |
| $R_L$ = 600Ω | 0.0001 | % (typ) |
| Input Noise Density | 3.5 | nV/$\sqrt{Hz}$ (typ) |
| Slew Rate | ±12 | V/μs (typ) |
| Gain Bandwidth Product | 30 | MHz (typ) |
| Open Loop Gain ($R_L$ = 600Ω) | 110 | dB (typ) |
| Input Bias Current | 190 | nA (typ) |
| Input Offset Voltage | ±0.15 | mV (typ) |

## Connection Diagram

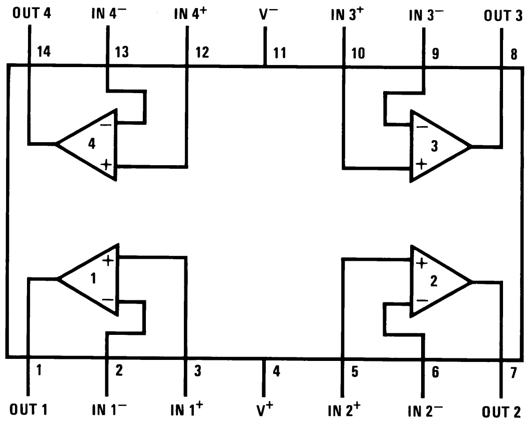



**Figure 1. Diagram**

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.

## Absolute Maximum Ratings [(1)] [(2)]

| | |
|---|---|
| Power Supply Voltage ($V_S = V^+ - V^-$) | 36V |
| Storage Temperature | −65°C to 150°C |
| Input Voltage | (V-) - 0.7V to (V+) + 0.7V |
| Output Short Circuit[(3)] | Continuous |
| Power Dissipation | Internally Limited |
| ESD Susceptibility[(4)] | 750V |
| ESD Susceptibility[(5)] | 175V |
| Junction Temperature | 150°C |
| Thermal Resistance | |
| $\theta_{JA}$ (MT) | 140°C/W |
| Temperature Range | |
| $T_{MIN} \le T_A \le T_{MAX}$ | $-40°C \le T_A \le 85°C$ |
| Supply Voltage Range | $\pm 4.0V \le V_S \le \pm 17V$ |

(1) *Absolute Maximum Ratings* indicate limits beyond which damage to the device may occur.
(2) Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
(3) Amplifier output connected to GND, any number of amplifiers within a package.
(4) Human body model, 100pF discharged through a 1.5kΩ resistor.
(5) Machine Model ESD test is covered by specification EIAJ IC-121-1981. A 200pF cap is charged to the specified voltage and then discharged directly into the IC with no external series resistor (resistance of discharge path must be under 50Ω).

## Electrical Characteristics

(1)(2)

The following specifications apply for $V_S$ = ±15V, $R_L$ = 2kΩ, $f_{IN}$ = 1kHz, and $T_A$ = 25C, unless otherwise specified.

| Symbol | Parameter | Conditions | LME49743 Typical (3) | LME49743 Limit (4) (5) | Units (Limits) |
|---|---|---|---|---|---|
| THD+N | Total Harmonic Distortion + Noise | $A_V$ = 1, $V_{OUT}$ = $3V_{RMS}$<br>$R_L$ = 2kΩ<br>$R_L$ = 600Ω | 0.0001<br>0.0001 | 0.0002 | % (max) |
| IMD | Intermodulation Distortion | $A_V$ = 1, $V_{OUT}$ = $3V_{RMS}$<br>Two-tone, 60Hz & 7kHz 4:1 | 0.0005 | | % (max) |
| GBWP | Gain Bandwidth Product | | 30 | 25 | MHz (min) |
| SR | Slew Rate | | 12 | 9.5 | V/μs (min) |
| FPBW | Full Power Bandwidth | $V_{OUT}$ = $1V_{P-P}$, –3dB<br>referenced to output magnitude<br>at f = 1kHz | 10 | | MHz |
| $t_s$ | Settling time | $A_V$ = 1, 10V step, $C_L$ = 100pF<br>0.1% error range | 1.2 | | μs |
| $e_n$ | Equivalent Input Noise Voltage | $f_{BW}$ = 20Hz to 20kHz | 0.48 | 0.65 | $\mu V_{RMS}$ |
| | Equivalent Input Noise Density | f = 1kHz<br>f = 10Hz | 3.5<br>6.4 | 4.5 | nV/√Hz (max)<br>nV/√Hz |
| $i_n$ | Current Noise Density | f = 1kHz<br>f = 10Hz | 1.6<br>3.1 | | pA/√Hz<br>pA/√Hz |
| $V_{OS}$ | Offset Voltage | | ±0.15 | ±1.0 | mV (max) |
| $\Delta V_{OS}/\Delta Temp$ | Average Input Offset Voltage Drift vs Temperature | 40°C ≤ $T_A$ ≤ 85°C | 0.05 | | μV/°C |
| PSRR | Average Input Offset Voltage Shift vs Power Supply Voltage | $\Delta V_S$ = 20V(6) | 98 | 94 | dB (min) |
| $ISO_{CH-CH}$ | Channel-to-Channel Isolation | $f_{IN}$ = 1kHz<br>$f_{IN}$ = 20kHz | 118<br>112 | | dB<br>dB |
| $I_B$ | Input Bias Current | $V_{CM}$ = 0V | 190 | 250 | nA (max) |
| $\Delta I_{OS}/\Delta Temp$ | Input Bias Current Drift vs Temperature | –40°C ≤ $T_A$ ≤ 85°C | 0.05 | | nA/°C |
| $I_{OS}$ | Input Offset Current | $V_{CM}$ = 0V | 7 | 40 | nA (max) |
| $V_{IN-CM}$ | Common-Mode Input Voltage Range | | ±13.2 | (V+)–2.0<br>(V-)+2.0 | V (min)<br>V (min) |
| CMRR | Common-Mode Rejection | –10V<$V_{CM}$<10V | 106 | 98 | dB (min) |
| $Z_{IN}$ | Differential Input Impedance | | 30 | | kΩ |
| | Common Mode Input Impedance | –10V<$V_{CM}$<10V | 1000 | | MΩ |
| $A_{VOL}$ | Open Loop Voltage Gain | –10V<$V_{OUT}$<10V, $R_L$ = 600Ω | 110 | | dB (min) |
| | | –10V<$V_{OUT}$<10V, $R_L$ = 2kΩ | 110 | | dB (min) |
| | | –10V<$V_{OUT}$<10V, $R_L$ = 10kΩ | 110 | 100 | dB (min) |
| $V_{OUTMAX}$ | Maximum Output Voltage Swing | $R_L$ = 600Ω | ±12.4 | ±12.0 | V (min) |
| | | $R_L$ = 2kΩ | ±13.0 | | V (min) |
| | | $R_L$ = 10kΩ | ±13.0 | | V (min) |
| $I_{OUT}$ | Output Current | $R_L$ = 600Ω, $V_S$ = ±17V | ±21 | ±20 | mA (min) |
| $I_{OUT-CC}$ | Short Circuit Current | | +30<br>–38 | | mA<br>mA |

(1) *Absolute Maximum Ratings* indicate limits beyond which damage to the device may occur.
(2) Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.
(3) Typical specifications are specified at +25ºC and represent the most likely parametric norm.
(4) Tested limits are guaranteed to National's AOQL (Average Outgoing Quality Level).
(5) Datasheet min/max specification limits are guaranteed by design, test, or statistical analysis.
(6) PSRR is measured as follows: $V_{OS}$ is measured at two supply voltages, ±5V and ±15V. PSRR = $|20\log(\Delta V_{OS}/\Delta V_S)|$.

## Electrical Characteristics (continued)

(1) (2)

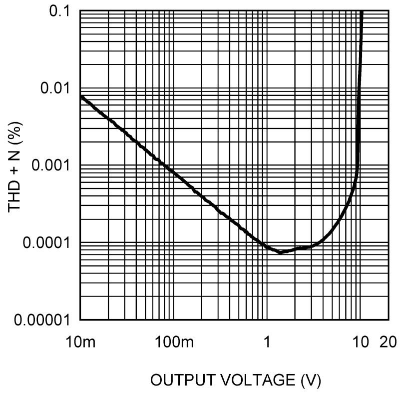
The following specifications apply for $V_S$ = ±15V, $R_L$ = 2kΩ, $f_{IN}$ = 1kHz, and $T_A$ = 25C, unless otherwise specified.

| Symbol | Parameter | Conditions | LME49743 | | Units (Limits) |
|---|---|---|---|---|---|
| | | | Typical (3) | Limit (4) (5) | |
| $R_{OUT}$ | Output Impedance | $f_{IN}$ = 10kHz<br>Closed-Loop<br>Open-Loop | <br>0.01<br>13 | | <br>Ω<br>Ω |
| $C_{LOAD}$ | Capacitive Load Drive Overshoot | 100pF | 16 | | % |
| $I_S$ | Total Quiescent Current | $I_{OUT}$ = 0mA | 10 | 14 | mA (max) |

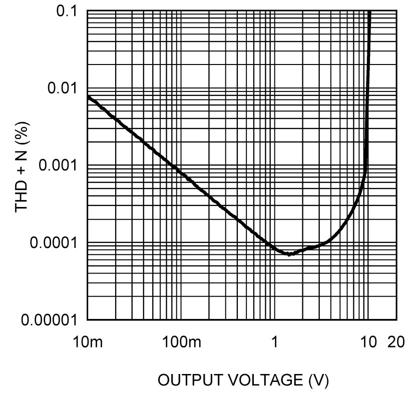
 

## Typical Performance Characteristics

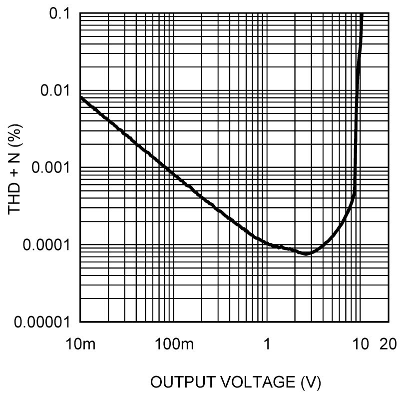
**THD+N vs Output Voltage**
**$V_S$ = ±15V, $R_L$ = 2kΩ, f = 1kHz**
**30kHz BW**



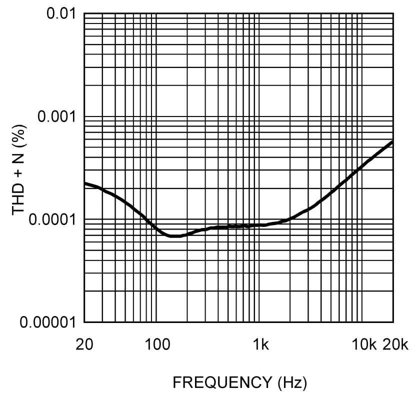

**THD+N vs Output Voltage**
**$V_S$ = ±15V, $R_L$ = 10kΩ, f = 1kHz**
**30kHz BW**



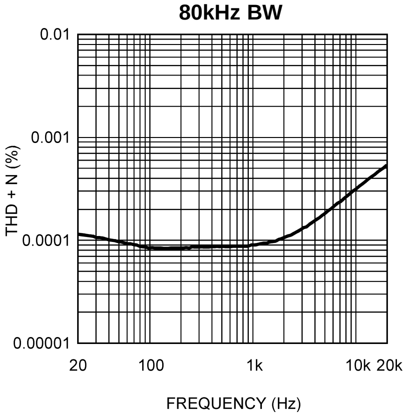

**THD+N vs Output Voltage**
**$V_S$ = ±15V, $R_L$ = 600Ω, f = 1kHz**
**30kHz BW**



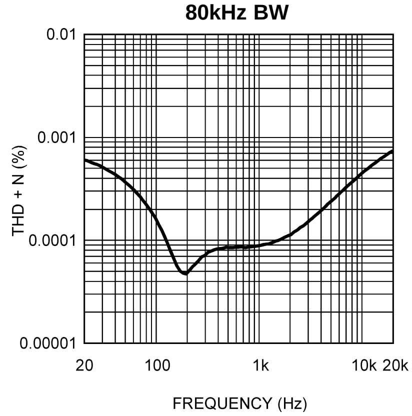

**THD+N vs Frequency**
**$V_S$ = ±15V, $V_{OUT}$ = 3$V_{RMS}$, $R_L$ = 2kΩ**
**80kHz BW**




**THD+N vs Frequency**
**$V_S$ = ±15V, $V_{OUT}$ = 3$V_{RMS}$, $R_L$ = 10kΩ**
**80kHz BW**

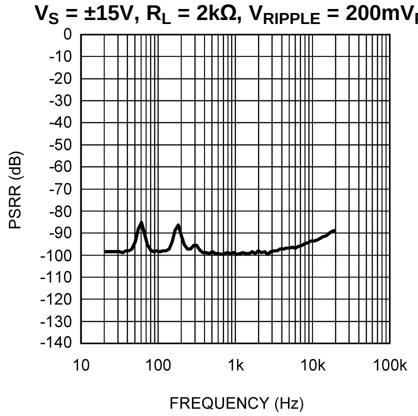



**THD+N vs Frequency**
**$V_S$ = ±15V, $V_{OUT}$ = 3$V_{RMS}$, $R_L$ = 600Ω**
**80kHz BW**

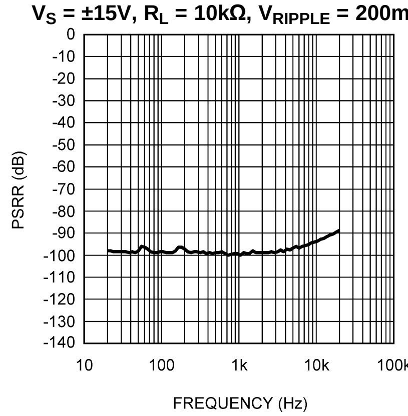


## Typical Performance Characteristics (continued)

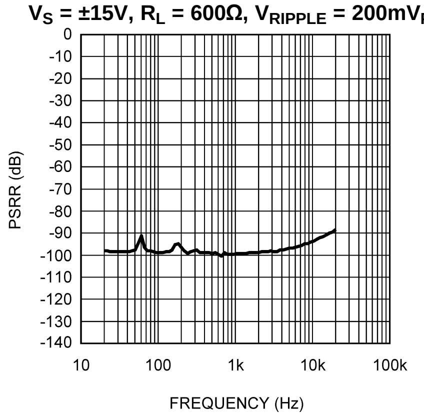
**+PSRR vs Frequency**
**$V_S$ = ±15V, $R_L$ = 2kΩ, $V_{RIPPLE}$ = 200m$V_{PP}$**



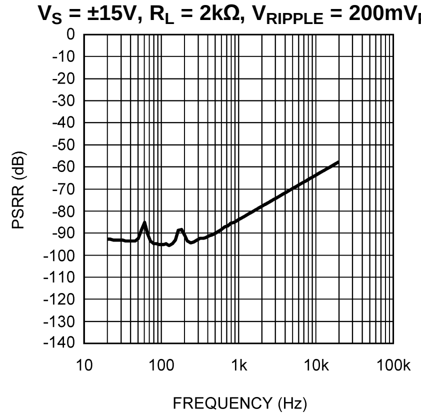

**+PSRR vs Frequency**
**$V_S$ = ±15V, $R_L$ = 10kΩ, $V_{RIPPLE}$ = 200m$V_{PP}$**



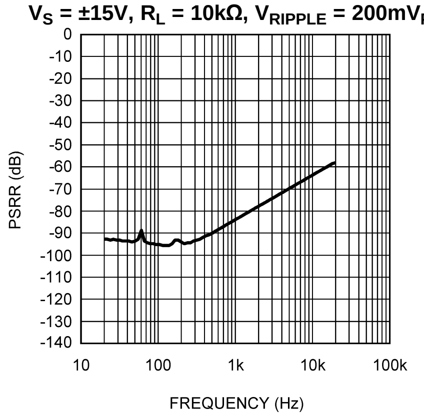

**+PSRR vs Frequency**
**$V_S$ = ±15V, $R_L$ = 600Ω, $V_{RIPPLE}$ = 200m$V_{PP}$**



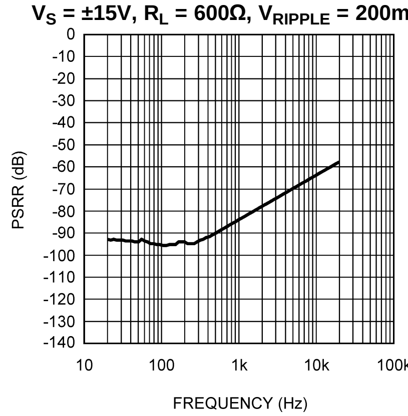

**−PSRR vs Frequency**
**$V_S$ = ±15V, $R_L$ = 2kΩ, $V_{RIPPLE}$ = 200m$V_{PP}$**




**−PSRR vs Frequency**
**$V_S$ = ±15V, $R_L$ = 10kΩ, $V_{RIPPLE}$ = 200m$V_{PP}$**



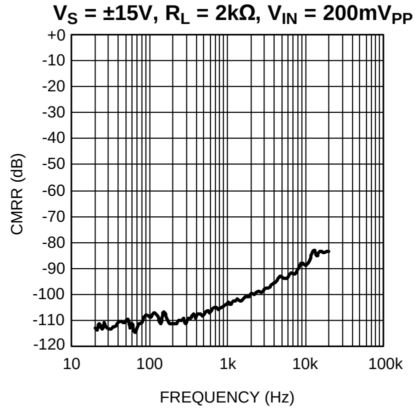

**−PSRR vs Frequency**
**$V_S$ = ±15V, $R_L$ = 600Ω, $V_{RIPPLE}$ = 200m$V_{PP}$**



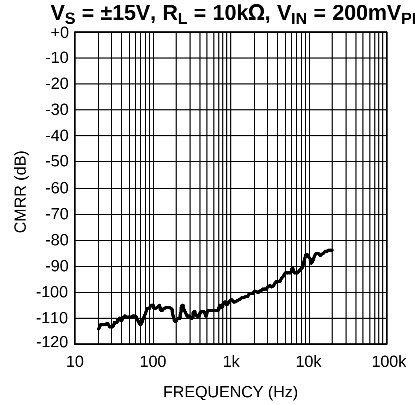

 

## Typical Performance Characteristics (continued)

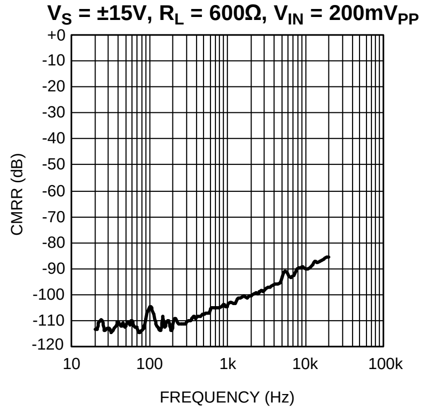
**CMRR vs Frequency**
**$V_S$ = ±15V, $R_L$ = 2kΩ, $V_{IN}$ = 200m$V_{PP}$**



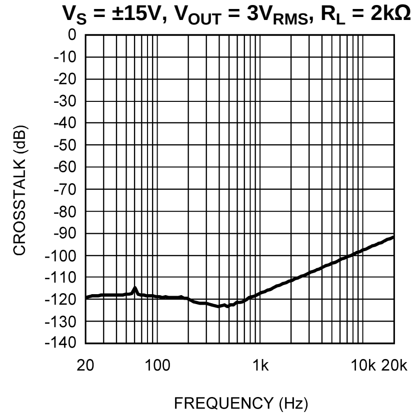

**CMRR vs Frequency**
**$V_S$ = ±15V, $R_L$ = 10kΩ, $V_{IN}$ = 200m$V_{PP}$**



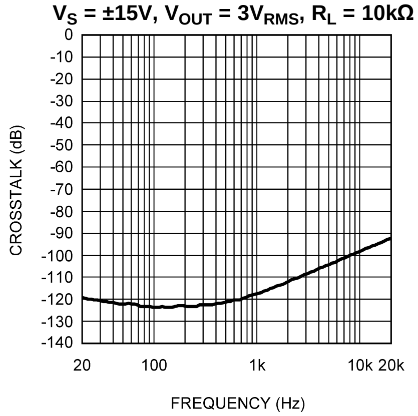

**CMRR vs Frequency**
**$V_S$ = ±15V, $R_L$ = 600Ω, $V_{IN}$ = 200m$V_{PP}$**



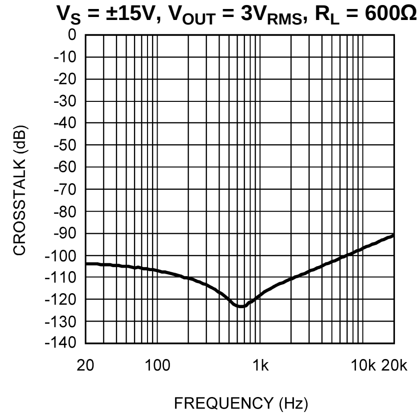

**Crosstalk vs Frequency**
**$V_S$ = ±15V, $V_{OUT}$ = 3$V_{RMS}$, $R_L$ = 2kΩ**




**Crosstalk vs Frequency**
**$V_S$ = ±15V, $V_{OUT}$ = 3$V_{RMS}$, $R_L$ = 10kΩ**

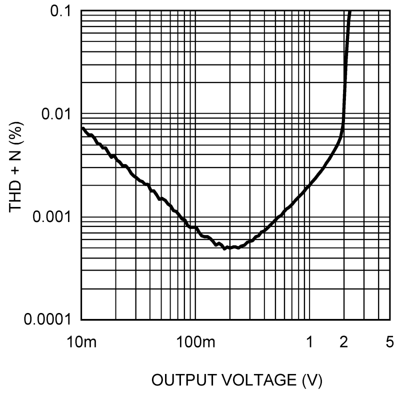



**Crosstalk vs Frequency**
**$V_S$ = ±15V, $V_{OUT}$ = 3$V_{RMS}$, $R_L$ = 600Ω**

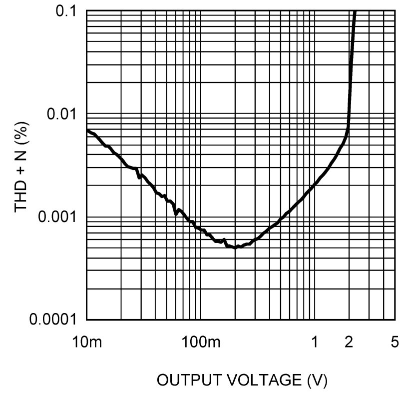


## Typical Performance Characteristics (continued)

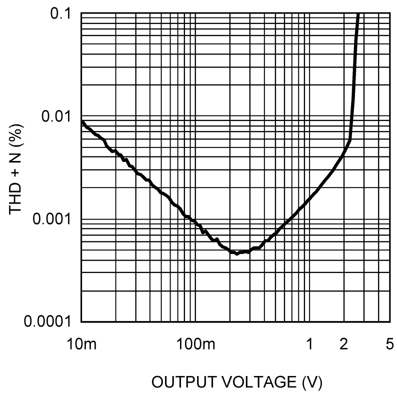
**IMD vs Output Voltage**
**$V_S$ = ±5V, $R_L$ = 2kΩ**
**7kHz/60Hz 4:1 SMPTE**



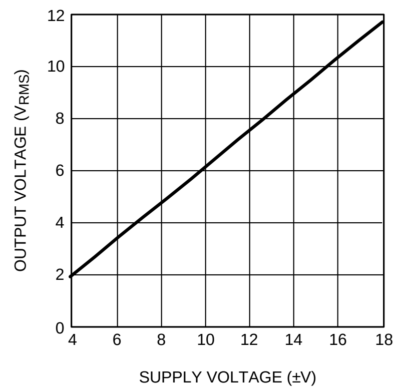

**IMD vs Output Voltage**
**$V_S$ = ±5V, $R_L$ = 10kΩ**
**7kHz/60Hz 4:1 SMPTE**



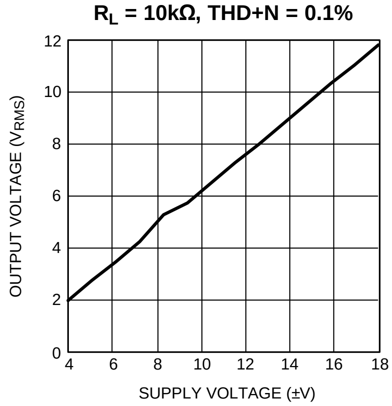

**IMD vs Output Voltage**
**$V_S$ = ±5V, $R_L$ = 600Ω**
**7kHz/60Hz 4:1 SMPTE**



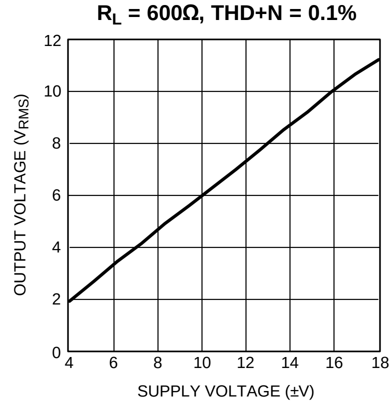

**Output Voltage vs Supply Voltage**
**$R_L$ = 2kΩ, THD+N = 0.1%**




**Output Voltage vs Supply Voltage**
**$R_L$ = 10kΩ, THD+N = 0.1%**

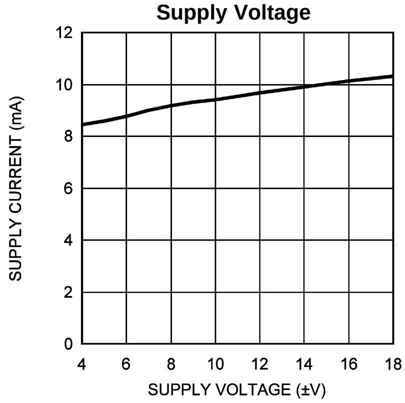



**Output Voltage vs Supply Voltage**
**$R_L$ = 600Ω, THD+N = 0.1%**

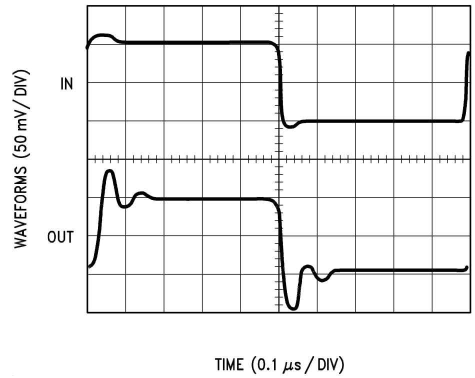


## Typical Performance Characteristics (continued)

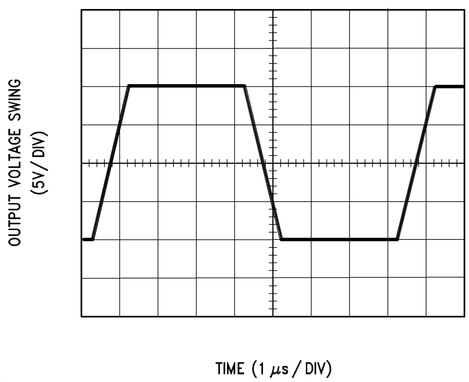
**Supply Current vs Supply Voltage**



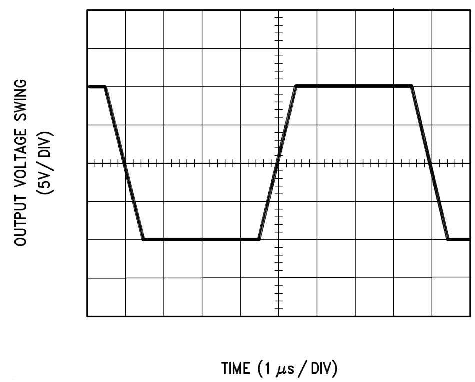

**Scope Photo Small Signal**



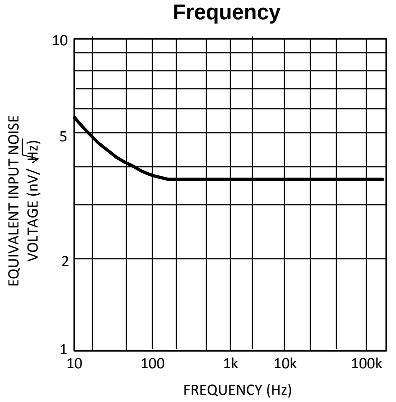

**Scope Photo Large Signal, Non-Inverting**



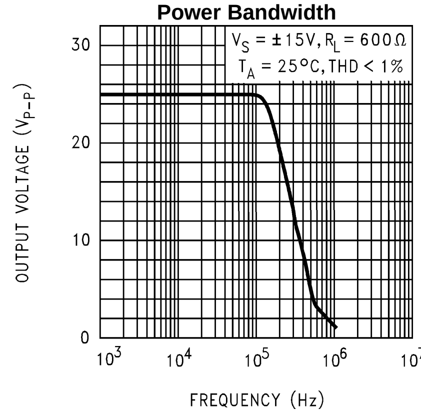

**Scope Photo Large Signal, Inverting**




**Equivalent Input Noise vs Frequency**

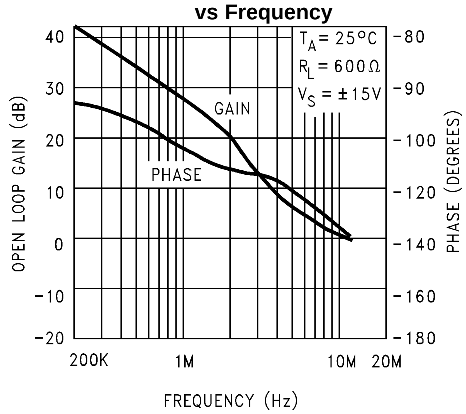



**Power Bandwidth**



## Typical Performance Characteristics (continued)

**Open Loop Gain and Phase vs Frequency**




## Application Information

### DISTORTION MEASUREMENTS

The vanishingly low residual distortion produced by LME49743 is below the capabilities of all commercially available equipment. This makes distortion measurements just slightly more difficult than simply connecting a distortion meter to the amplifier's inputs and outputs. The solution, however, is quite simple: an additional resistor. Adding this resistor extends the resolution of the distortion measurement equipment.

The LME49743's low residual distortion is an input referred internal error. As shown in Figure 2, adding the 10Ω resistor connected between the amplifier's inverting and non-inverting inputs changes the amplifier's noise gain. The result is that the error signal (distortion) is amplified by a factor of 101. Although the amplifier's closed-loop gain is unaltered, the feedback available to correct distortion errors is reduced by 101, which means that measurement resolution increases by 101. To ensure minimum effects on distortion measurements, keep the value of R1 low as shown in Figure 2.

This technique is verified by duplicating the measurements with high closed loop gain and/or making the measurements at high frequencies. Doing so produces distortion components that are within the measurement equipment's capabilities. This datasheet's THD+N and IMD values were generated using the above described circuit connected to an Audio Precision System Two Cascade.

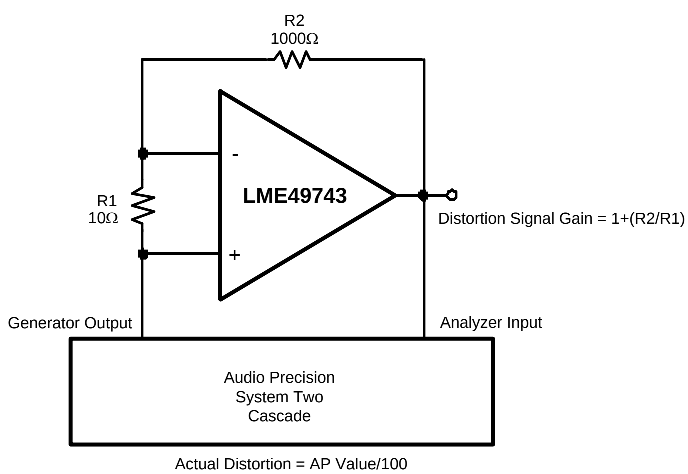


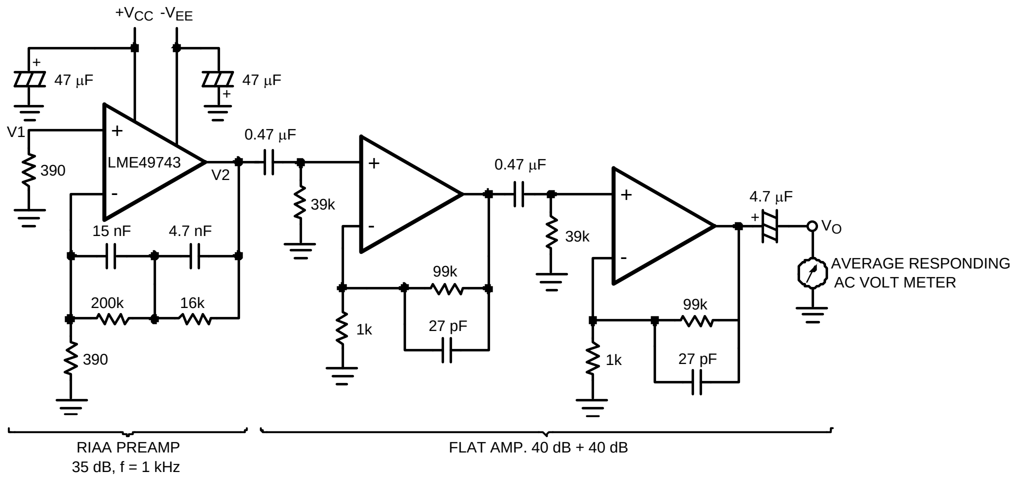

**Figure 2. THD+N and IMD Distortion Test Circuit**

## Application Hints

The LME49743 is a high speed op amp with excellent phase margin and stability. Capacitive loads up to 100pF will cause little change in the phase characteristics of the amplifiers and are therefore allowable.

Capacitive loads greater than 100pF must be isolated from the output. The most straightforward way to do this is to put a resistor in series with the output. This resistor will also prevent excess power dissipation if the output is accidentally shorted.

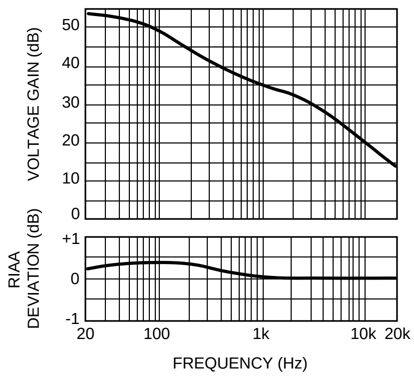
## Noise Measurement Circuit



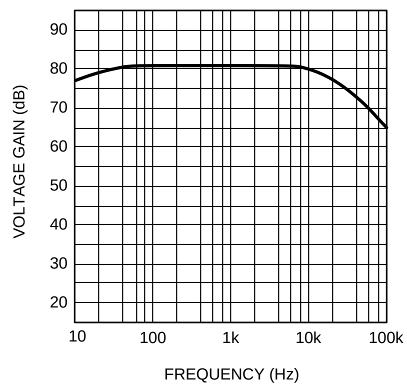

Complete shielding is required to prevent induced pick up from external sources. Always check with oscilloscope for power line noise.

**Figure 3. Total Gain: 115 dB at f = 1 kHz**
**Input Referred Noise Voltage: $e_n = V_O/560,000$ (V)**

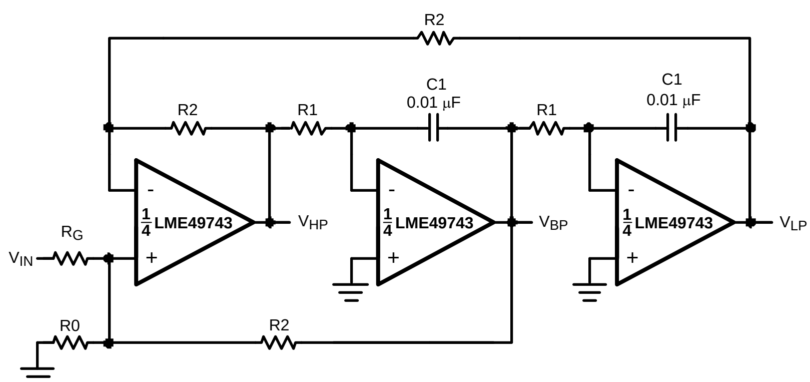
**RIAA Preamp Voltage Gain, RIAA Deviation vs Frequency $V_{IN}$ = 10mV, $A_V$ = 35.0dB, f = 1kHz**




**Flat Amp Voltage Gain vs Frequency $V_O$ = 0dB, $A_V$ = 80.0dB, f = 1kHz**




## Typical Applications




$$f_0 = \frac{1}{2\pi C1R1}, Q = \frac{1}{2}\left(1 + \frac{R2}{R0} + \frac{R2}{RG}\right), A_{BP} = QA_{LP} = QA_{LH} = \frac{R2}{RG}$$

**Figure 4. State Variable Filter**

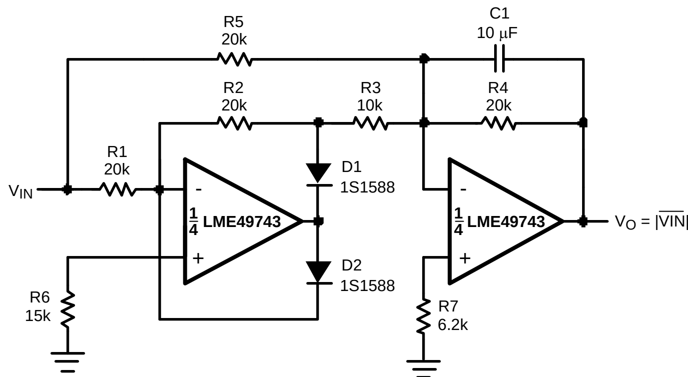



**Figure 5. AC/DC Converter**

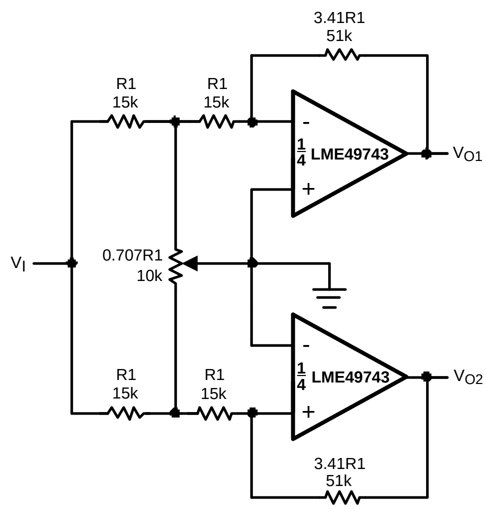



**Figure 6. 2 Channel Panning Circuit (Pan Pot)**

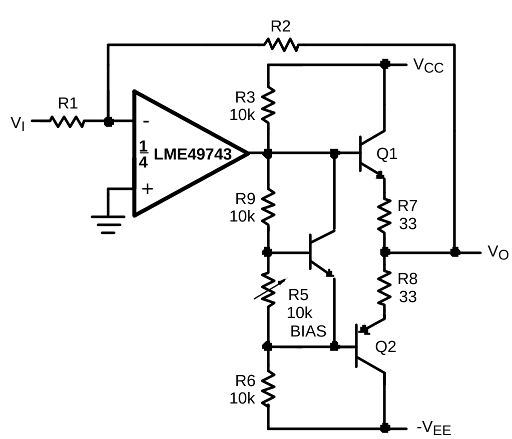
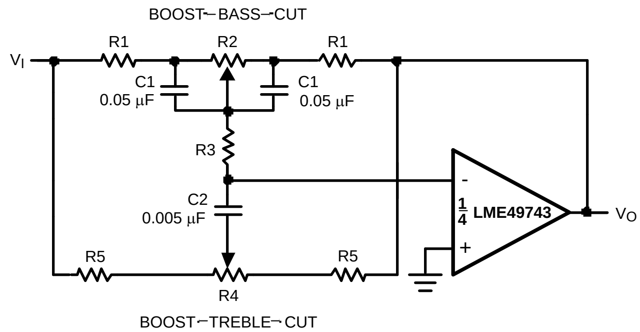



**Figure 7. Line Driver**




$$f_L = \frac{1}{2\pi R2C1},\ f_{LB} = \frac{1}{2\pi R1C1}$$

$$f_H = \frac{1}{2\pi R5C2},\ f_{HB} = \frac{1}{2\pi (R1 + R5 + 2R3)C2}$$

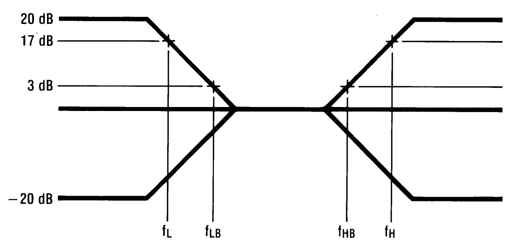
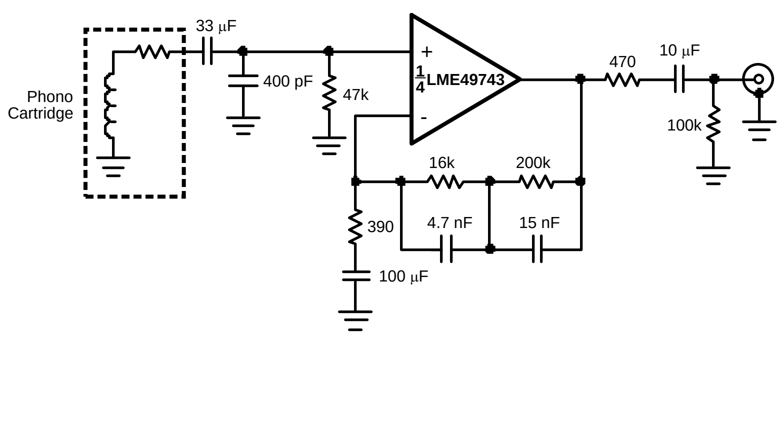
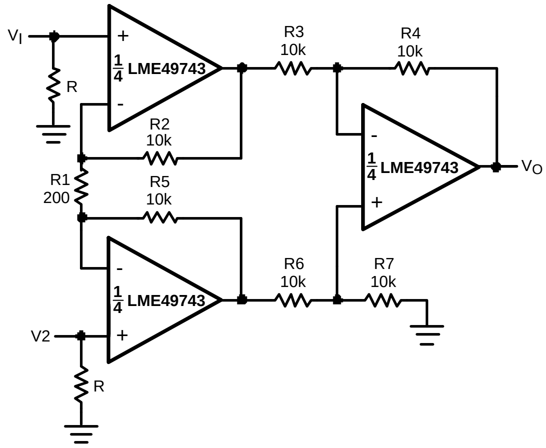



**Figure 8. Tone Control**




$A_v$ = 35 dB
$E_n$ = 0.33 µV
S/N = 90 dB
f = 1 kHz
A Weighted
A Weighted, $V_{IN}$ = 10 mV
@f = 1 kHz

**Figure 9. RIAA Preamp**




If R2 = R5, R3 = R6, R4 = R7

$$V0 = \left(1 + \frac{2R2}{R1}\right)\frac{R4}{R3}(V2 - V1)$$

Illustration is:

V0 = 101(V2 − V1)

**Figure 10. Balanced Input Mic Amp**

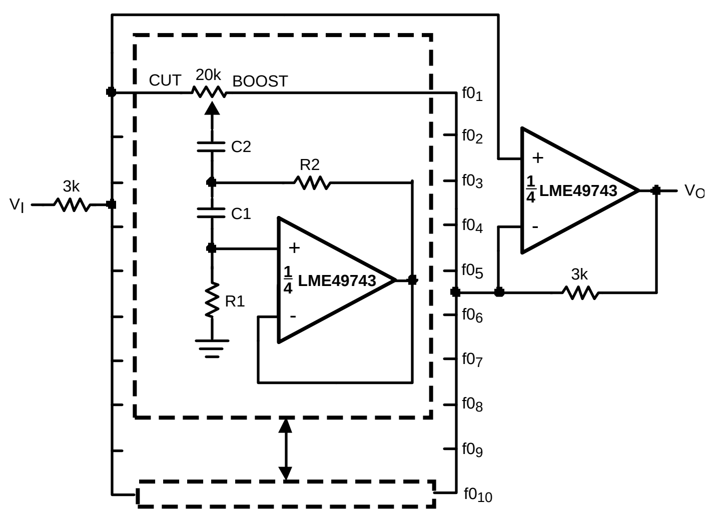



**Figure 11. 10 Band Graphic Equalizer**

| fo (Hz) | $C_1$ | $C_2$ | $R_1$ | $R_2$ |
|---|---|---|---|---|
| 32 | 0.12µF | 4.7µF | 75kΩ | 500Ω |
| 64 | 0.056µF | 3.3µF | 68kΩ | 510Ω |
| 125 | 0.033µF | 1.5µF | 62kΩ | 510Ω |
| 250 | 0.015µF | 0.82µF | 68kΩ | 470Ω |
| 500 | 8200pF | 0.39µF | 62kΩ | 470Ω |
| 1k | 3900pF | 0.22µF | 68kΩ | 470Ω |
| 2k | 2000pF | 0.1µF | 68kΩ | 470Ω |
| 4k | 1100pF | 0.056µF | 62kΩ | 470Ω |
| 8k | 510pF | 0.022µF | 68kΩ | 510Ω |
| 16k | 330pF | 0.012µF | 51kΩ | 510Ω |

**NOTE**

At volume of change = ±12 dB

Q = 1.7

Reference: "AUDIO/RADIO HANDBOOK", National Semiconductor, 1980, Page 2–61

## Revision History

| Rev | Date | Description |
|---|---|---|
| 1.0 | 03/26/08 | Initial release. |
| 1.01 | 01/12/09 | Fixed a typo. |

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| LME49743MT/NOPB | ACTIVE | TSSOP | PW | 14 | 94 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | |
| LME49743MTX/NOPB | ACTIVE | TSSOP | PW | 14 | 2500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | |

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
**TBD:** The Pb-Free/Green conversion plan has not been defined.
**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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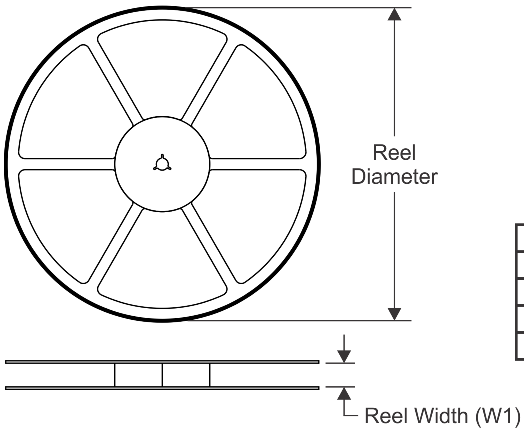
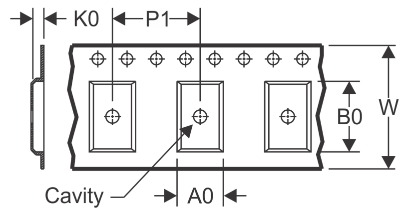
## TAPE AND REEL INFORMATION

### REEL DIMENSIONS

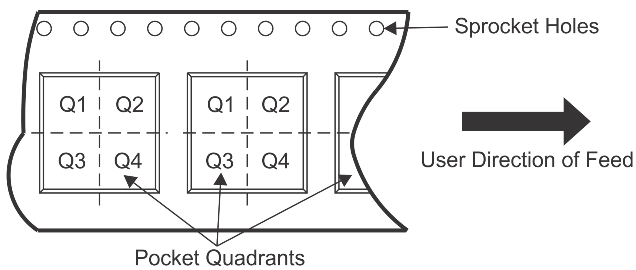



### TAPE DIMENSIONS




| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

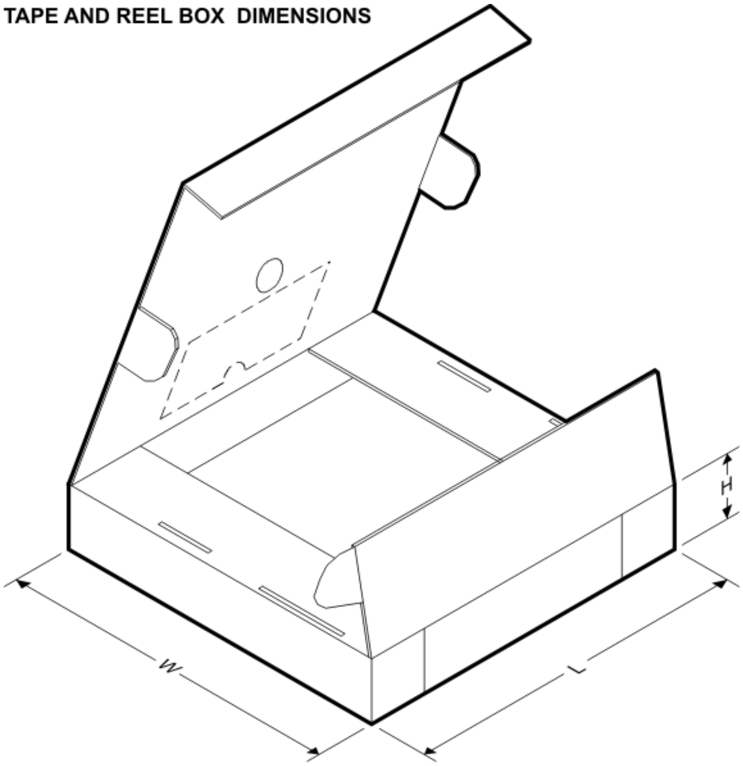
### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LME49743MTX/NOPB | TSSOP | PW | 14 | 2500 | 330.0 | 12.4 | 6.95 | 8.3 | 1.6 | 8.0 | 12.0 | Q1 |

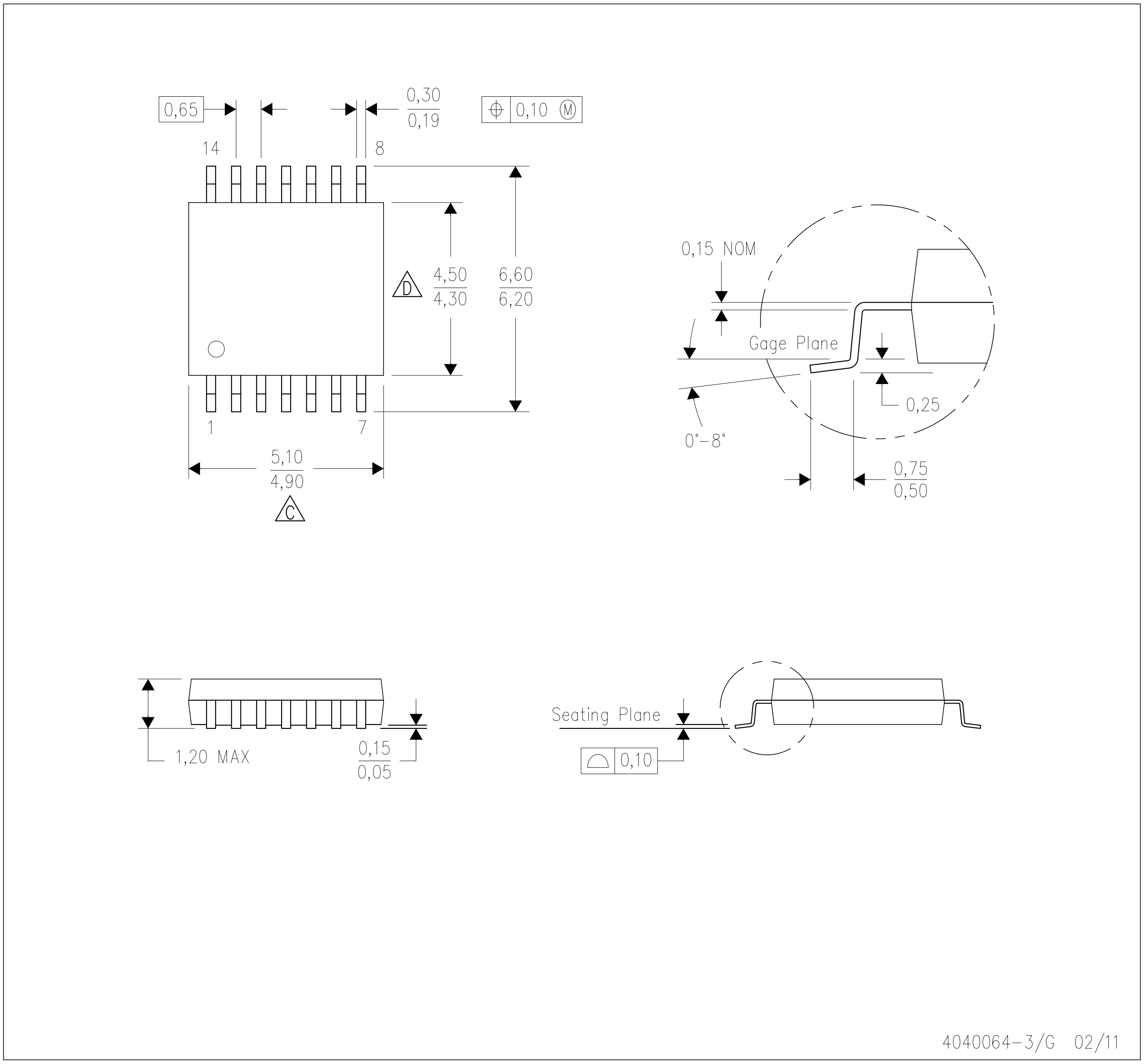
## TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| LME49743MTX/NOPB | TSSOP | PW | 14 | 2500 | 349.0 | 337.0 | 45.0 |

PW (R-PDSO-G14) PLASTIC SMALL OUTLINE




NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
E. Falls within JEDEC MO-153

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