

LMV821, LMV824

Single and Quad Low Voltage, Rail-to-Rail Operational Amplifiers

The LMV821 and LMV824 are operational amplifiers with low input voltage offset and drift vs. temperature. In spite of low quiescent current requirements these devices have 5 MHz bandwidth and 1.4 V/ μ s slew rate. In addition they provide rail-to-rail output swing into 600 Ω loads. The input common-mode voltage range includes ground, and the maximum input offset voltage is only 3.5 mV. Substantially large capacitive loads can be driven by simply adding a pullup resistor or isolation resistor.

The LMV821 (single) is available in a space-saving SC70-5 while the quad comes in SOIC and TSSOP packages.

Features

- Low Offset Voltage: 3.5 mV
- Very low Offset Drift: 1.0 μ V/ $^{\circ}$ C
- High Bandwidth: 5 MHz
- Rail-to-Rail Output Swing into a 600 Ω load
- Capable of driving highly capacitive loads
- Small Packages:
 - LMV821 in SC-70
 - LMV824 in SOIC-14 and TSSOP-14
- These Devices are Pb-Free and are RoHS Compliant

Typical Applications

- Notebook Computers
- PDAs
- Modem Transmitter/ Receivers

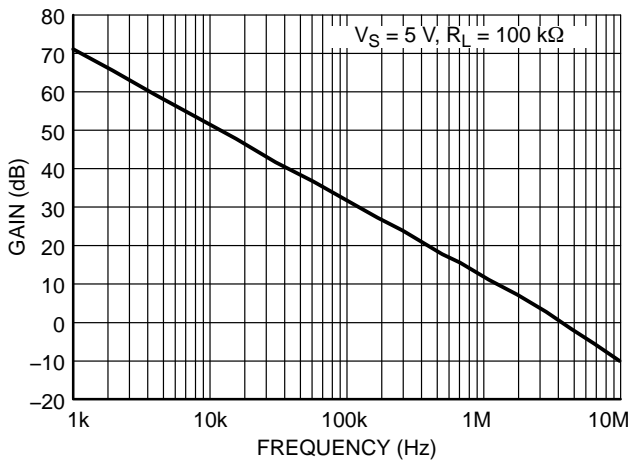


Figure 1. Gain vs. Frequency

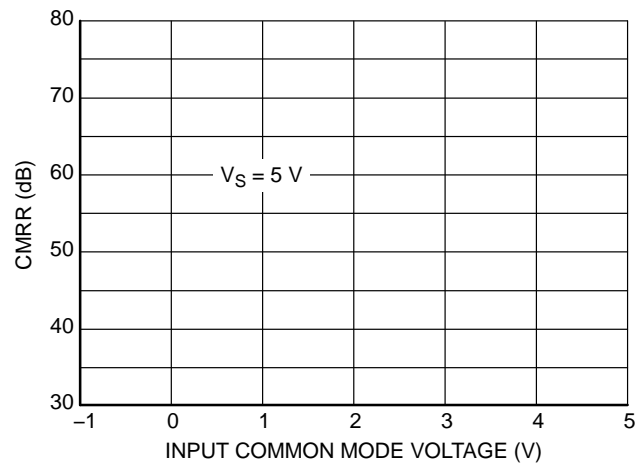


Figure 2. CMRR vs. Input Common Mode Voltage

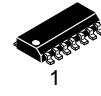


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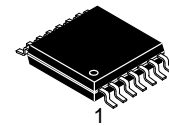
www.onsemi.com



SC-70
CASE 419A



SOIC-14
CASE 751A



TSSOP-14
CASE 948G

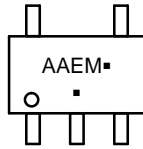
ORDERING AND MARKING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 2 of this data sheet.

LMV821, LMV824

MARKING DIAGRAMS

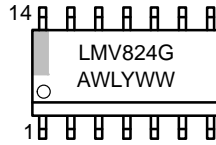
SC-70



AAE = Specific Device Code
M = Date Code
▪ = Pb-Free Package

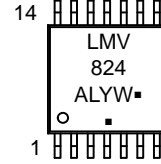
(Note: Microdot may be in either location)

SOIC-14



LMV824 = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
G = Pb-Free Package

TSSOP-14

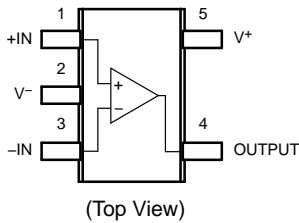


LMV824 = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb-Free Package

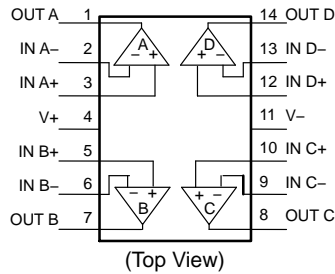
(Note: Microdot may be in either location)

PIN CONNECTIONS

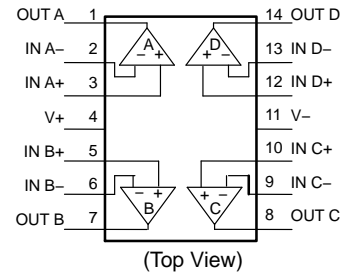
SC70-5



SOIC-14



TSSOP-14



ORDERING INFORMATION

| Order Number | Number of Channels | Specific Device Marking | Package Type | Shipping† |
|--------------|--------------------|-------------------------|-----------------------|--------------------|
| LMV821SQ3T2G | Single | AAE | SC-70 (Pb-Free) | 3000 / Tape & Reel |
| LMV824DR2G | Quad | LMV824 | SOIC-14 (Pb-Free) | 2500 / Tape & Reel |
| LMV824DTBR2G | Quad | LMV 824 | TSSOP-14 (Pb-Free) | 2500 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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MAXIMUM RATINGS

| Symbol | Rating | Value | Unit |
|---------------|---|----------------------|--------------------|
| V_S | Supply Voltage (Operating Range $V_S = 2.7\text{ V to }5.5\text{ V}$) | 5.5 | V |
| V_{IDR} | Input Differential Voltage | \pm Supply Voltage | V |
| V_{ICR} | Input Common Mode Voltage Range | -0.5 to (V+) +0.5 | V |
| | Maximum Input Current | 10 | mA |
| t_{SO} | Output Short Circuit (Note 1) | Continuous | |
| T_J | Maximum Junction Temperature (Operating Range $-40^\circ\text{C to }85^\circ\text{C}$) | 150 | $^\circ\text{C}$ |
| θ_{JA} | Thermal Resistance | | $^\circ\text{C/W}$ |
| | SC-70 | 280 | |
| | SOIC-14 | 156 | |
| | TSSOP-14 | 190 | |
| T_{STG} | Storage Temperature | -65 to 150 | $^\circ\text{C}$ |
| | Mounting Temperature (Infrared or Convection – 20 sec) | 235 | $^\circ\text{C}$ |
| V_{ESD} | ESD Tolerance | Machine Model | 200 |
| | | Human Body Model | 2000 |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Continuous short-circuit operation to ground at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150°C . Output currents in excess of 45 mA over long term may adversely affect reliability. Shorting output to either V+ or V- will adversely affect reliability.

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2.7V DC ELECTRICAL CHARACTERISTICS Unless otherwise noted, all min/max limits are guaranteed for $T_A = 25^\circ\text{C}$, $V_+ = 2.7\text{ V}$, $V_- = 0\text{ V}$, $V_{CM} = V_+/2$, $V_O = V_+/2$ and $R_L > 1\text{ M}\Omega$. Typical specifications represent the most likely parametric norm. Min/Max specifications are guaranteed by testing, characterization, or statistical analysis.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|------------------------------------|------------|---|------|----------------|------|------------------------------|
| Input Offset Voltage | V_{IO} | | | 1 | 3.5 | mV |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | | 4 | |
| Input Offset Voltage Average Drift | TCV_{OS} | | | 1 | | $\mu\text{V}/^\circ\text{C}$ |
| Input Bias Current | I_B | | | 105 | 210 | nA |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | | 315 | |
| Input Offset Current | I_{IO} | | | 0.5 | 30 | nA |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | | 50 | |
| Common-Mode Rejection Ratio | CMRR | $0\text{ V} \leq V_{CM} \leq 1.7\text{ V}$ | 70 | 85 | | dB |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 68 | | | |
| Power Supply Rejection Ratio | PSRR | $1.5\text{ V} \leq V_+ \leq 4\text{ V}$, $V_- = -1\text{ V}$, $V_O = 0\text{ V}$, $V_{CM} = 0.0\text{ V}$ | 75 | 85 | | dB |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 70 | | | |
| Input Common-Mode Voltage Range | V_{CM} | For CMRR $\geq 53\text{ dB}$ and $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | -0.2 | -0.3 to 2.0 | 1.9 | V |
| Large Signal Voltage Gain | AV | $R_L = 600\ \Omega$, $V_O = 0.5\text{ V to } 2.5\text{ V}$ | 80 | 95 | | dB |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 70 | | | |
| | | $R_L = 2\text{ k}\Omega$, $V_O = 0.5\text{ V to } 2.5\text{ V}$ | 83 | 89 | | |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 80 | | | |
| Output Swing | V_{OH} | $R_L = 600\ \Omega$ to 1.35 V | 2.5 | 2.58 | | V |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 2.4 | | | |
| | V_{OL} | $R_L = 600\ \Omega$ to 1.35 V | | 0.13 | 0.21 | |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | | 0.3 | |
| | V_{OH} | $R_L = 2\text{ k}\Omega$ to 1.35 V | 2.6 | 2.66 | | |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | 2.5 | | | |
| Output Current | I_O | Sourcing, $V_O = 0\text{ V}$ | 12 | | | mA |
| | | Sinking, $V_O = 2.7\text{ V}$ | 12 | 26 | | |
| Supply Current | I_{CC} | LMV821 (Single) | | 0.242 | 0.3 | mA |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | | 0.5 | |
| | | LMV824 (All Four Channels) | | 1 | 1.3 | |
| | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | | 1.5 | |

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2.5V DC ELECTRICAL CHARACTERISTICS Unless otherwise noted, all min/max limits are guaranteed for $T_A = 25^\circ\text{C}$, $V_+ = 2.5\text{ V}$, $V_- = 0\text{ V}$, $V_{CM} = V_+/2$, $V_O = V_+/2$ and $R_L > 1\text{ M}\Omega$. Typical specifications represent the most likely parametric norm. Min/Max specifications are guaranteed by testing, characterization, or statistical analysis.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|----------------------|----------|--|-----|------|------|------|
| Input Offset Voltage | V_{IO} | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | 1 | 3.5 | mV |
| | | | | | 4 | |
| Output Swing | V_{OH} | $R_L = 600\ \Omega$ to 1.25 V | 2.3 | 2.37 | | V |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 2.2 | | | |
| | V_{OL} | $R_L = 600\ \Omega$ to 1.25 V | | 0.13 | 0.20 | |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | | 0.3 | |
| | V_{OH} | $R_L = 2\text{ k}\Omega$ to 1.25 V | 2.4 | 2.46 | | |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 2.3 | | | |
| | V_{OL} | $R_L = 2\text{ k}\Omega$ to 1.25 V | | 0.08 | 0.12 | |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | | 0.20 | |

2.7V AC ELECTRICAL CHARACTERISTICS Unless otherwise specified, all limits are guaranteed for $T_A = 25^\circ\text{C}$, $V_+ = 2.7\text{ V}$, $V_- = 0\text{ V}$, $V_{CM} = 1.0\text{ V}$, $V_O = V_+/2$ and $R_L > 1\text{ M}\Omega$. Typical specifications represent the most likely parametric norm. Min/Max specifications are guaranteed by testing, characterization, or statistical analysis.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|----------------------------------|------------|--|-----|-------|-----|------------------------|
| Slew Rate | SR | (Note 2) | | 1.5 | | V/ μS |
| Gain Bandwidth Product | GBWP | | | 5 | | MHz |
| Phase Margin | θ_m | | | 55 | | $^\circ$ |
| Gain Margin | G_m | | | 12.9 | | dB |
| Input-Referred Voltage Noise | e_n | $f = 1\text{ kHz}$, $V_{CM} = 1\text{ V}$ | | 12 | | nV/ $\sqrt{\text{Hz}}$ |
| Input-Referred Current Noise | i_n | $f = 1\text{ kHz}$ | | 0.2 | | pA/ $\sqrt{\text{Hz}}$ |
| Total Harmonic Distortion | THD | $f = 1\text{ kHz}$, $AV = -2$, $R_L = 10\text{ k}\Omega$, $V_O = 1.8\text{ V}_{PP}$ | | 0.023 | | % |
| Amplifier-to-Amplifier Isolation | | (Note 3) | | 135 | | dB |

2. Connected as voltage follower with input step from 0.5 V to 1.5 V. Number specified is the average of the positive and negative slew rates.
3. Input referred, $R_L = 100\text{ k}\Omega$ connected to $V_+/2$. Each amp excited in turn with 1kHz to produce $V_O = 3\text{ V}_{PP}$. For Supply Voltages $< 3\text{ V}$, $V_O = V_+$.

LMV821, LMV824

5V DC ELECTRICAL CHARACTERISTICS Unless otherwise noted, all min/max limits are guaranteed for $T_A = 25^\circ\text{C}$, $V_+ = 5\text{ V}$, $V_- = 0\text{ V}$, $V_{CM} = V_+/2$, $V_O = V_+/2$ and $R_L > 1\text{ M}\Omega$. Typical specifications represent the most likely parametric norm. Min/Max specifications are guaranteed by testing, characterization, or statistical analysis.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|------------------------------------|--|--|------|----------------|------|------------------------------|
| Input Offset Voltage | V_{IO} | | | 1 | 3.5 | mV |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | | 4 | |
| Input Offset Voltage Average Drift | TCV_{OS} | | | 1 | | $\mu\text{V}/^\circ\text{C}$ |
| Input Bias Current | I_B | | | 119 | 245 | nA |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | | 380 | |
| Input Offset Current | I_{IO} | | | 0.5 | 30 | nA |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | | 50 | |
| Common-Mode Rejection Ratio | CMRR | $0\text{ V} \leq V_{CM} \leq 4.0\text{ V}$ | 72 | 90 | | dB |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 70 | | | |
| Power Supply Rejection Ratio | PSRR | $1.7\text{ V} \leq V_+ \leq 4\text{ V}$, $V_- = 1\text{ V}$, $V_O = 0\text{ V}$, $V_{CM} = 0.0\text{ V}$ | 75 | 85 | | dB |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 70 | | | |
| Input Common-Mode Voltage Range | V_{CM} | For CMRR $\geq 58\text{ dB}$ and $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | -0.2 | -0.2 to 4.3 | 4.2 | V |
| Large Signal Voltage Gain | A_V | $R_L = 600\ \Omega$, $V_O = 1.0\text{ V}$ to 4.0 V | 87 | 100 | | dB |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 73 | | | |
| | | $R_L = 2\text{ k}\Omega$, $V_O = 1.0\text{ V}$ to 4.0 V | 84 | 99 | | |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 82 | | | |
| Output Swing | V_{OH} | $R_L = 600\ \Omega$ to 2.5 V | 4.75 | 4.84 | | V |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 4.7 | | | |
| | V_{OL} | $R_L = 600\ \Omega$ to 2.5 V | | 0.17 | 0.33 | |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | | 0.4 | |
| | V_{OH} | $R_L = 2\text{ k}\Omega$ to 2.5 V | 4.85 | 4.9 | | |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 4.8 | | | |
| V_{OL} | $R_L = 2\text{ k}\Omega$ to 2.5 V | | 0.1 | 0.15 | | |
| | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | | 0.2 | | |
| Output Current | I_O | Sourcing, $V_O = 0\text{ V}$ | 20 | 45 | | mA |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 10 | | | |
| | | Sinking, $V_O = 5\text{ V}$ | 20 | 40 | | |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | 15 | | | |
| Supply Current | I_{CC} | | | 0.3 | 0.4 | mA |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | | 0.6 | |
| | | LMV822 (Both Applications) | | 0.5 | 0.7 | |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | | 0.9 | |
| | | LMV824 (All Four Applications) | | 1 | 1.3 | |
| | | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ | | | 1.5 | |

LMV821, LMV824

5V AC ELECTRICAL CHARACTERISTICS Unless otherwise specified, all limits are guaranteed for $T_A = 25^\circ\text{C}$, $V_+ = 5\text{ V}$, $V_- = 0\text{ V}$, $V_{CM} = 2.0\text{ V}$, $V_O = V_+/2$ and $R_L > 1\text{ M}\Omega$. Typical specifications represent the most likely parametric norm. Min/Max specifications are guaranteed by testing, characterization, or statistical analysis.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|----------------------------------|------------|--|-----|-------|-----|------------------------|
| Slew Rate | SR | (Note 4) | | 2 | | V/ μS |
| Gain Bandwidth Product | GBWP | | | 5.6 | | MHz |
| Phase Margin | θ_m | | | 63 | | $^\circ$ |
| Gain Margin | G_m | | | 11.7 | | dB |
| Input-Referred Voltage Noise | e_n | $f = 1\text{ kHz}$, $V_{CM} = 1\text{ V}$ | | 11 | | nV/ $\sqrt{\text{Hz}}$ |
| Input-Referred Current Noise | i_n | $f = 1\text{ kHz}$ | | 0.21 | | pA/ $\sqrt{\text{Hz}}$ |
| Total Harmonic Distortion | THD | $f = 1\text{ kHz}$, $A_V = -2$, $R_L = 10\text{ k}\Omega$, $V_O = 4.11\text{ V}_{PP}$ | | 0.012 | | % |
| Amplifier-to-Amplifier Isolation | | (Note 5) | | 135 | | dB |

4. Connected as voltage follower with input step from 0.5 V to 3.5 V. Number specified is the average of the positive and negative slew rates.
5. Input referred, $R_L = 100\text{ k}\Omega$ connected to $V_+/2$. Each amp excited in turn with 1 kHz to produce $V_O = 3\text{ V}_{PP}$. (For Supply Voltages $< 3\text{ V}$, $V_O = V_+$).

TYPICAL PERFORMANCE CHARACTERISTICS

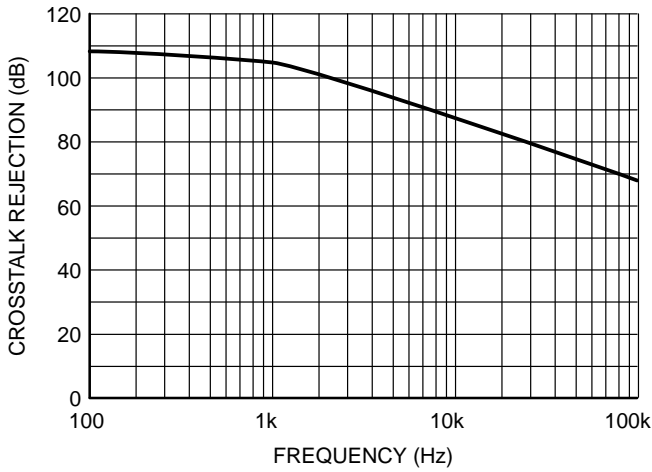


Figure 3. Crosstalk Rejection vs. Frequency

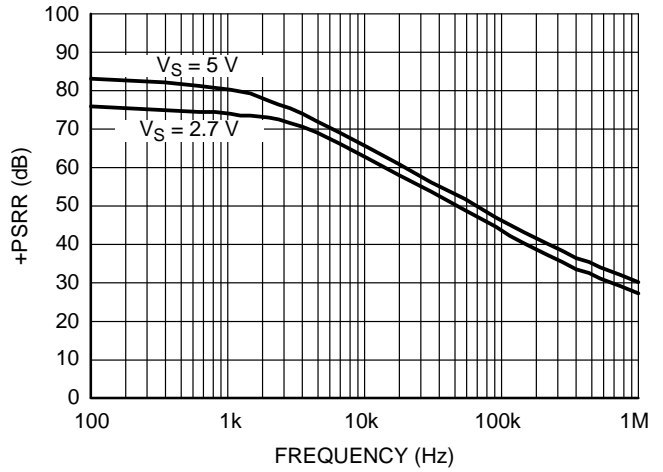


Figure 4. +PSRR vs. Frequency

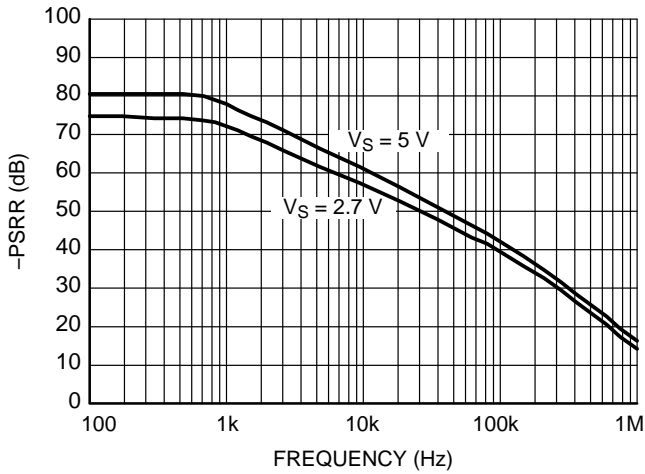


Figure 5. -PSRR vs. Frequency

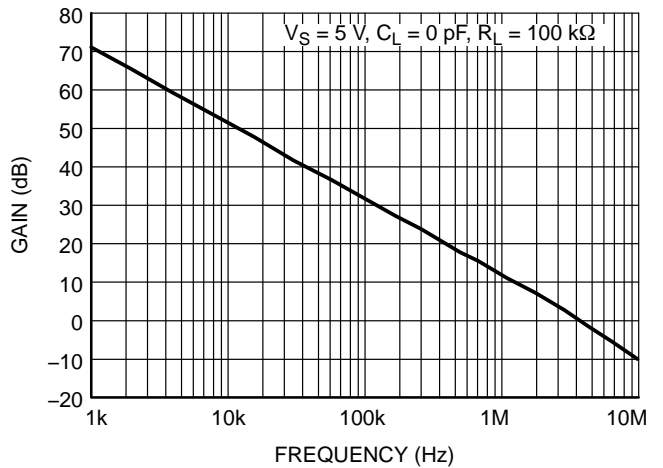


Figure 6. Gain vs. Frequency

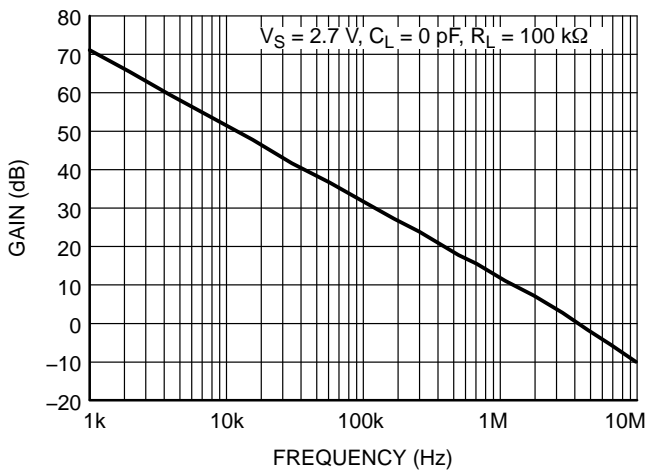


Figure 7. Gain vs. Frequency

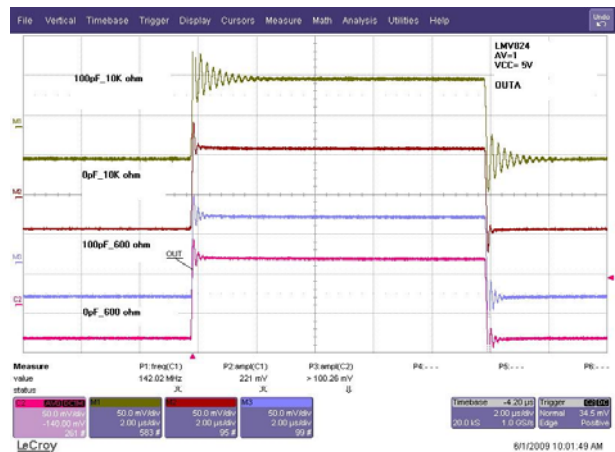


Figure 8. Non-Inverting Stability vs. Capacitive Load

LMV821, LMV824

TYPICAL PERFORMANCE CHARACTERISTICS

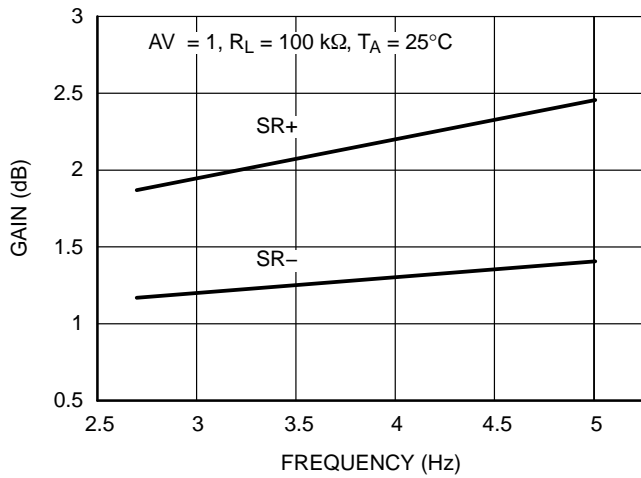


Figure 9. Gain vs. Frequency



Figure 10. Non-Inverting Large Signal Step Response

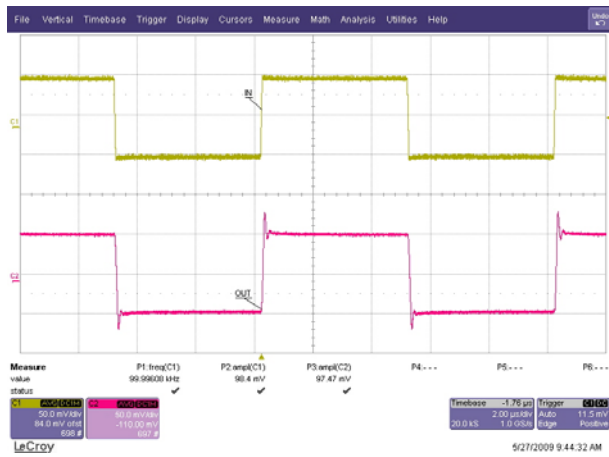


Figure 11. Non-Inverting Small Signal Step Response



Figure 12. Inverting Large Signal Step Response



Figure 13. Inverting Small Signal Step Response

LMV821, LMV824

APPLICATIONS INFORMATION

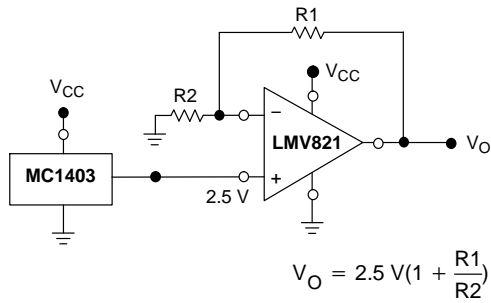


Figure 14. Voltage Reference

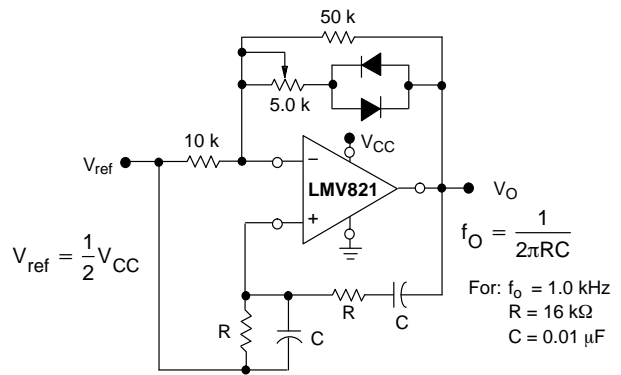


Figure 15. Wien Bridge Oscillator

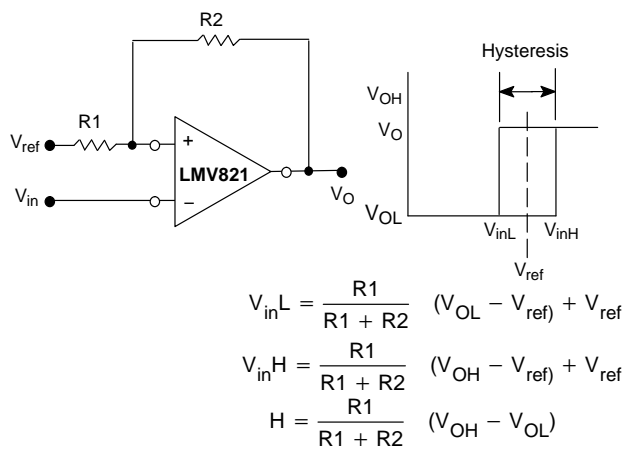
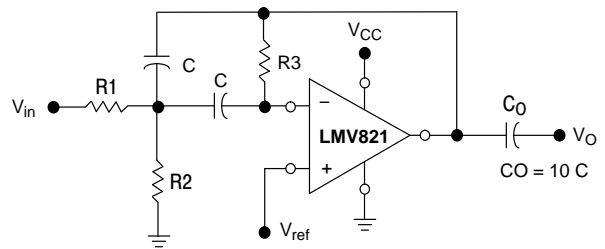


Figure 16. Comparator with Hysteresis



Given: f_o = center frequency
 $A(f_o)$ = gain at center frequency

Choose value f_o, C

$$\text{Then : } R_3 = \frac{Q}{\pi f_o C}$$

$$R_1 = \frac{R_3}{2 A(f_o)}$$

$$R_2 = \frac{R_1 R_3}{4Q^2 R_1 - R_3}$$

For less than 10% error from operational amplifier,
 $((Q_o f_o)/BW) < 0.1$ where f_o and BW are expressed in Hz.
 If source impedance varies, filter may be preceded with
 voltage follower buffer to stabilize filter parameters.

Figure 17. Multiple Feedback Bandpass Filter

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

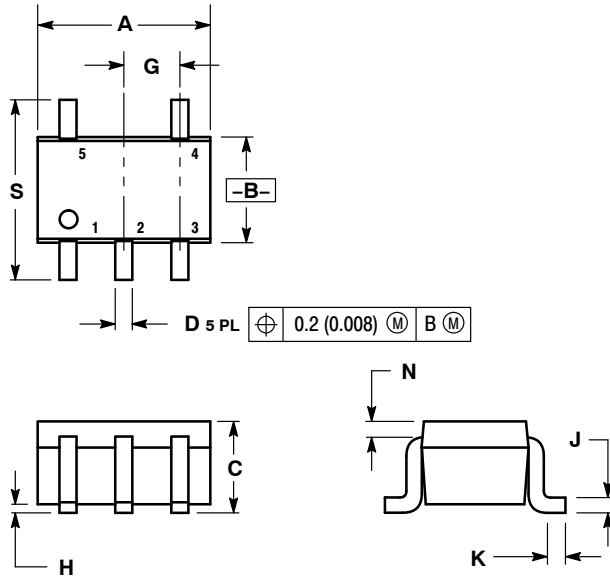
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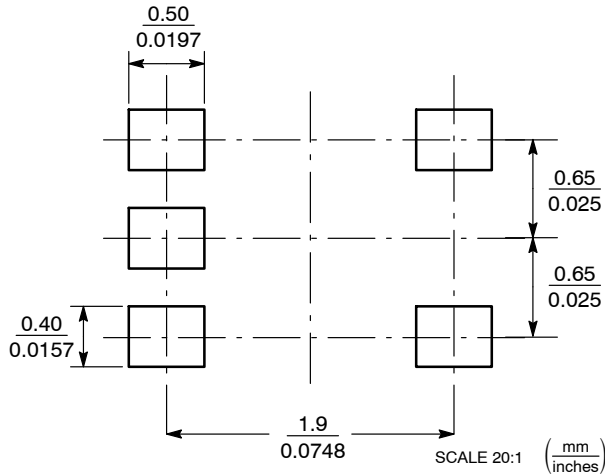
SCALE 2:1

SC-88A (SC-70-5/SOT-353)
CASE 419A-02
ISSUE L

DATE 17 JAN 2013



SOLDER FOOTPRINT

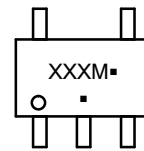


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.071 | 0.087 | 1.80 | 2.20 |
| B | 0.045 | 0.053 | 1.15 | 1.35 |
| C | 0.031 | 0.043 | 0.80 | 1.10 |
| D | 0.004 | 0.012 | 0.10 | 0.30 |
| G | 0.026 BSC | | 0.65 BSC | |
| H | --- | 0.004 | --- | 0.10 |
| J | 0.004 | 0.010 | 0.10 | 0.25 |
| K | 0.004 | 0.012 | 0.10 | 0.30 |
| N | 0.008 REF | | 0.20 REF | |
| S | 0.079 | 0.087 | 2.00 | 2.20 |

GENERIC MARKING DIAGRAM*



- XXX = Specific Device Code
- M = Date Code
- = Pb-Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

- | | | | | |
|--|--|--|--|--|
| <p>STYLE 1: PIN 1. BASE 2. EMITTER 3. BASE 4. COLLECTOR 5. COLLECTOR</p> | <p>STYLE 2: PIN 1. ANODE 2. EMITTER 3. BASE 4. COLLECTOR 5. CATHODE</p> | <p>STYLE 3: PIN 1. ANODE 1 2. N/C 3. ANODE 2 4. CATHODE 2 5. CATHODE 1</p> | <p>STYLE 4: PIN 1. SOURCE 1 2. DRAIN 1/2 3. SOURCE 1 4. GATE 1 5. GATE 2</p> | <p>STYLE 5: PIN 1. CATHODE 2. COMMON ANODE 3. CATHODE 2 4. CATHODE 3 5. CATHODE 4</p> |
| <p>STYLE 6: PIN 1. EMITTER 2 2. BASE 2 3. EMITTER 1 4. COLLECTOR 5. COLLECTOR 2/BASE 1</p> | <p>STYLE 7: PIN 1. BASE 2. EMITTER 3. BASE 4. COLLECTOR 5. COLLECTOR</p> | <p>STYLE 8: PIN 1. CATHODE 2. COLLECTOR 3. N/C 4. BASE 5. EMITTER</p> | <p>STYLE 9: PIN 1. ANODE 2. CATHODE 3. ANODE 4. ANODE 5. ANODE</p> | <p>Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.</p> |

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| DESCRIPTION: | SC-88A (SC-70-5/SOT-353) | PAGE 1 OF 1 |

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MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

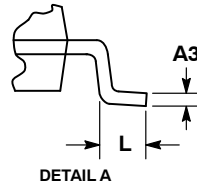
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SCALE 1:1

SOIC-14 NB
CASE 751A-03
ISSUE L

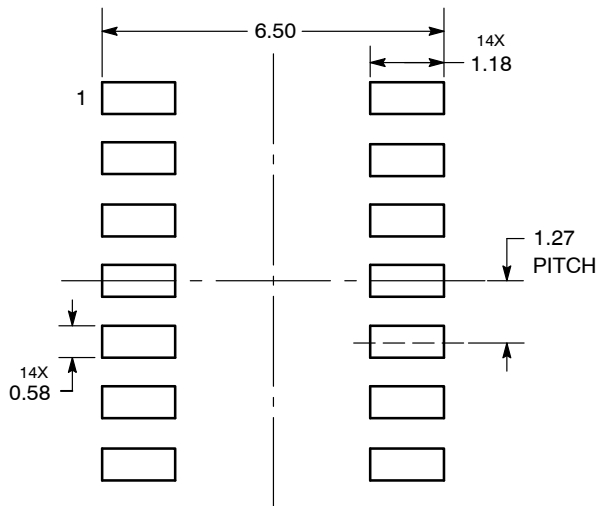
DATE 03 FEB 2016



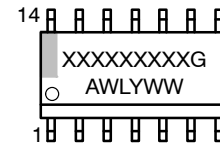
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: MILLIMETERS.
 3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
 4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
 5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.35 | 1.75 | 0.054 | 0.068 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| A3 | 0.19 | 0.25 | 0.008 | 0.010 |
| b | 0.35 | 0.49 | 0.014 | 0.019 |
| D | 8.55 | 8.75 | 0.337 | 0.344 |
| E | 3.80 | 4.00 | 0.150 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| H | 5.80 | 6.20 | 0.228 | 0.244 |
| h | 0.25 | 0.50 | 0.010 | 0.019 |
| L | 0.40 | 1.25 | 0.016 | 0.049 |
| M | 0° | 7° | 0° | 7° |

SOLDERING FOOTPRINT*



GENERIC MARKING DIAGRAM*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

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SOIC-14
CASE 751A-03
ISSUE L

DATE 03 FEB 2016

STYLE 1:
 PIN 1. COMMON CATHODE
 2. ANODE/CATHODE
 3. ANODE/CATHODE
 4. NO CONNECTION
 5. ANODE/CATHODE
 6. NO CONNECTION
 7. ANODE/CATHODE
 8. ANODE/CATHODE
 9. ANODE/CATHODE
 10. NO CONNECTION
 11. ANODE/CATHODE
 12. ANODE/CATHODE
 13. NO CONNECTION
 14. COMMON ANODE

STYLE 2:
 CANCELLED

STYLE 3:
 PIN 1. NO CONNECTION
 2. ANODE
 3. ANODE
 4. NO CONNECTION
 5. ANODE
 6. NO CONNECTION
 7. ANODE
 8. ANODE
 9. ANODE
 10. NO CONNECTION
 11. ANODE
 12. ANODE
 13. NO CONNECTION
 14. COMMON CATHODE

STYLE 4:
 PIN 1. NO CONNECTION
 2. CATHODE
 3. CATHODE
 4. NO CONNECTION
 5. CATHODE
 6. NO CONNECTION
 7. CATHODE
 8. CATHODE
 9. CATHODE
 10. NO CONNECTION
 11. CATHODE
 12. CATHODE
 13. NO CONNECTION
 14. COMMON ANODE

STYLE 5:
 PIN 1. COMMON CATHODE
 2. ANODE/CATHODE
 3. ANODE/CATHODE
 4. ANODE/CATHODE
 5. ANODE/CATHODE
 6. NO CONNECTION
 7. COMMON ANODE
 8. COMMON CATHODE
 9. ANODE/CATHODE
 10. ANODE/CATHODE
 11. ANODE/CATHODE
 12. ANODE/CATHODE
 13. NO CONNECTION
 14. COMMON ANODE

STYLE 6:
 PIN 1. CATHODE
 2. CATHODE
 3. CATHODE
 4. CATHODE
 5. CATHODE
 6. CATHODE
 7. CATHODE
 8. ANODE
 9. ANODE
 10. ANODE
 11. ANODE
 12. ANODE
 13. ANODE
 14. ANODE

STYLE 7:
 PIN 1. ANODE/CATHODE
 2. COMMON ANODE
 3. COMMON CATHODE
 4. ANODE/CATHODE
 5. ANODE/CATHODE
 6. ANODE/CATHODE
 7. ANODE/CATHODE
 8. ANODE/CATHODE
 9. ANODE/CATHODE
 10. ANODE/CATHODE
 11. COMMON CATHODE
 12. COMMON ANODE
 13. ANODE/CATHODE
 14. ANODE/CATHODE

STYLE 8:
 PIN 1. COMMON CATHODE
 2. ANODE/CATHODE
 3. ANODE/CATHODE
 4. NO CONNECTION
 5. ANODE/CATHODE
 6. ANODE/CATHODE
 7. COMMON ANODE
 8. COMMON ANODE
 9. ANODE/CATHODE
 10. ANODE/CATHODE
 11. NO CONNECTION
 12. ANODE/CATHODE
 13. ANODE/CATHODE
 14. COMMON CATHODE

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MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

ON Semiconductor®



TSSOP-14 WB
CASE 948G
ISSUE C

DATE 17 FEB 2016

SCALE 2:1



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
- DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
- TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
- DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.90 | 5.10 | 0.193 | 0.200 |
| B | 4.30 | 4.50 | 0.169 | 0.177 |
| C | --- | 1.20 | --- | 0.047 |
| D | 0.05 | 0.15 | 0.002 | 0.006 |
| F | 0.50 | 0.75 | 0.020 | 0.030 |
| G | 0.65 BSC | | 0.026 BSC | |
| H | 0.50 | 0.60 | 0.020 | 0.024 |
| J | 0.09 | 0.20 | 0.004 | 0.008 |
| J1 | 0.09 | 0.16 | 0.004 | 0.006 |
| K | 0.19 | 0.30 | 0.007 | 0.012 |
| K1 | 0.19 | 0.25 | 0.007 | 0.010 |
| L | 6.40 BSC | | 0.252 BSC | |
| M | 0° | 8° | 0° | 8° |

GENERIC MARKING DIAGRAM*



- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

SOLDERING FOOTPRINT



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