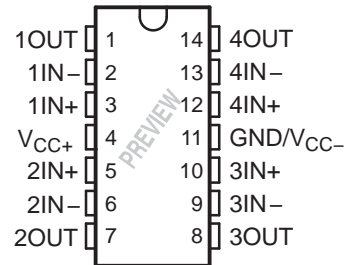
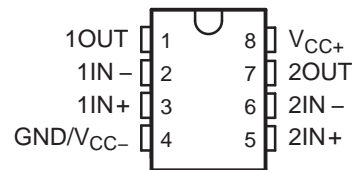
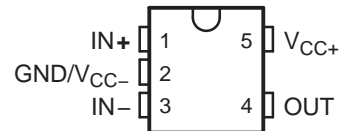


## LOW-VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIERS

### FEATURES

- Qualified for Automotive Applications
- 2.5-V, 2.7-V, and 5-V Performance
- –40°C to 125°C Operation
- No Crossover Distortion
- Low Supply Current at  $V_{CC+} = 5\text{ V}$ :
  - LMV821...0.3 mA Typ
  - LMV822...0.5 mA Typ
  - LMV824...1 mA Typ
- Rail-to-Rail Output Swing
- Gain Bandwidth of 5.5 MHz Typ at 5 V
- Slew Rate of 1.9 V/μs Typ at 5 V

**LMV824 . . . D, DGV, OR PW PACKAGE  
(TOP VIEW)**

**LMV822 . . . D OR DGK PACKAGE  
(TOP VIEW)**

**LMV821 . . . DBV OR DCK PACKAGE  
(TOP VIEW)**


### DESCRIPTION/ORDERING INFORMATION

The LMV821 single, LMV822 dual, and LMV824 quad devices are low-voltage (2.5 V to 5.5 V), low-power commodity operational amplifiers. Electrical characteristics are very similar to the LMV3xx operational amplifiers (low supply current, rail-to-rail outputs, input common-mode range, which includes ground). However, the LMV8xx devices offer a higher bandwidth (5.5 MHz typical) and faster slew rate (1.9 V/μs typical).

The LMV8xx devices are cost-effective solutions for applications requiring low-voltage/low-power operation and space-saving considerations. The LMV821 is available in the ultra-small DCK package, which is approximately half the size of SOT-23-5. The DCK package saves space on printed circuit boards and enables the design of small portable electronic devices (cordless and cellular phones, laptops, PDAs, PC/MIA). It also allows the designer to place the device closer to the signal source to reduce noise pickup and increase signal integrity.

The LMV8xx-Q1 devices are characterized for operation from –40°C to 125°C.



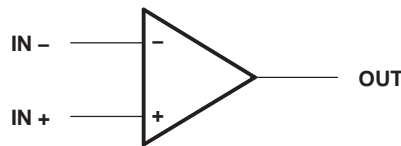
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

**ORDERING INFORMATION<sup>(1)</sup>**

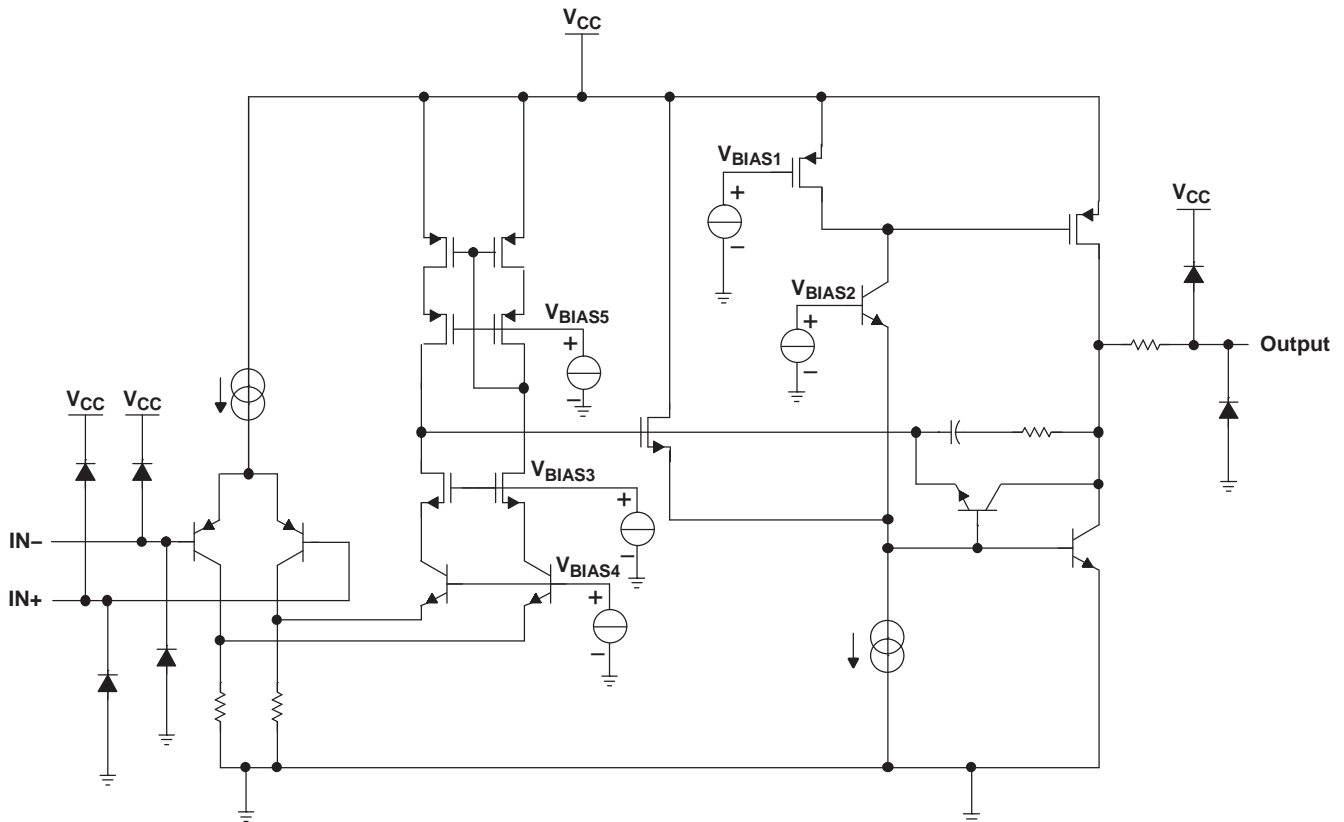
| T <sub>A</sub> | PACKAGE <sup>(2)</sup> |                  | ORDERABLE PART NUMBER | TOP-SIDE MARKING <sup>(3)</sup> |         |
|----------------|------------------------|------------------|-----------------------|---------------------------------|---------|
| -40°C to 125°C | Single                 | SC-70 – DCK      | Reel of 3000          | LMV821QDCKRQ1                   | PREVIEW |
|                |                        | SOT-23 – DBV     | Reel of 3000          | LMV821QDBVRQ1                   | RB1_    |
|                | Dual                   | SOIC – D         | Reel of 2500          | LMV822QDRQ1                     | PREVIEW |
|                |                        | MSOP/VSSOP – DGK | Reel of 2500          | LMV822QDGKRQ1                   | R8B     |
|                | Quad                   | SOIC – D         | Reel of 2500          | LMV824QDRQ1                     | PREVIEW |
|                |                        | TSSOP – PW       | Reel of 2000          | LMV824QPWRQ1                    | PREVIEW |
| TVSOP – DGV    |                        | Reel of 2000     | LMV824QDGVRQ1         | PREVIEW                         |         |

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).
- (2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).
- (3) DBV/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site.

**SYMBOL (EACH AMPLIFIER)**



**LMV824 SIMPLIFIED SCHEMATIC**



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

over operating free-air temperature range (unless otherwise noted)

|   |   | MIN   | MAX          | UNIT      |      |
|---|---|---|--------------|-----------|------|
| $V_{CC}$  | Supply voltage <sup>(2)</sup>               |   | 5.5          | V         |      |
| $V_{ID}$  | Differential input voltage <sup>(3)</sup>   |   | $\pm V_{CC}$ | V         |      |
| $V_I$   | Input voltage range (either input)          | $V_{CC-}$   | $V_{CC+}$    | V         |      |
| Duration of output short circuit (one amplifier) to ground <sup>(4)</sup> |   | At or below $T_A = 25^\circ\text{C}$ , $V_{CC} \leq 5.5\text{ V}$ |              | Unlimited |      |
| $\theta_{JA}$   | Package thermal impedance <sup>(5)(6)</sup> | D package   | 8 pin        | 97        | °C/W |
|   |   |   | 14 pin       | 86        |      |
|   |   | DBV package   | 206          |           |      |
|   |   | DCK package   | 252          |           |      |
|   |   | DGK package   | 172          |           |      |
|   |   | DGV package   | 127          |           |      |
|   |   | PW package  | 113          |           |      |
| $T_J$   | Operating virtual junction temperature      |   | 150          | °C        |      |
| $T_{stg}$   | Storage temperature range                   | -65   | 150          | °C        |      |

- (1) Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values (except differential voltages and  $V_{CC}$  specified for the measurement of  $I_{OS}$ ) are with respect to the network GND.
- (3) Differential voltages are at IN+ with respect to IN-.
- (4) Short circuits from outputs to  $V_{CC}$  can cause excessive heating and eventual destruction.
- (5) Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
- (6) The package thermal impedance is calculated in accordance with JESD 51-7.

## Recommended Operating Conditions

|          |  | MIN | MAX | UNIT |
|----------|--|-----|-----|------|
| $V_{CC}$ | Supply voltage (single-supply operation) | 2.5 | 5   | V    |
| $T_A$    | Operating free-air temperature           | -40 | 125 | °C   |

## 2.5-V Electrical Characteristics

 $V_{CC+} = 2.5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 1\text{ V}$ ,  $V_O = 1.25\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER | TEST CONDITIONS      |   | $T_A$          | MIN            | TYP  | MAX  | UNIT |      |
|-----------|----------------------|---|----------------|----------------|------|------|------|------|
| $V_{IO}$  | Input offset voltage |   | 25°C           |                | 1    | 6    | mV   |      |
|           |                      |   | -40°C to 125°C |                |      | 6    |      |      |
| $V_O$     | Output swing         | $V_{CC+} = 2.5\text{ V}$ , $R_L = 600\ \Omega$ to 1.25 V      | High level     | 25°C           | 2.28 | 2.37 | V    |      |
|           |                      |   |                | -40°C to 125°C | 2.18 |      |      |      |
|           |                      |   | Low level      | 25°C           |      | 0.13 |      | 0.22 |
|           |                      |   |                | -40°C to 125°C |      |      |      | 0.32 |
|           |                      | $V_{CC+} = 2.5\text{ V}$ , $R_L = 2\text{ k}\Omega$ to 1.25 V | High level     | 25°C           | 2.38 | 2.46 |      |      |
|           |                      |   |                | -40°C to 125°C | 2.28 |      |      |      |
|           |                      |   | Low level      | 25°C           |      | 0.08 |      | 0.14 |
|           |                      |   |                | -40°C to 125°C |      |      |      | 0.22 |

**2.7-V Electrical Characteristics**

$V_{CC+} = 2.7\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 1\text{ V}$ ,  $V_O = 1.35\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER  |   | TEST CONDITIONS  |          | $T_A$          | MIN            | TYP            | MAX  | UNIT                         |     |
|--|---|--|----------|----------------|----------------|----------------|------|------------------------------|-----|
| $V_{IO}$   | Input offset voltage                                    |  |          | 25°C           |                | 1              | 6    | mV                           |     |
|  |   |  |          | -40°C to 125°C |                |                | 6    |                              |     |
| $\alpha_{VIO}$   | Average temperature coefficient of input offset voltage |  |          | 25°C           |                | 1              |      | $\mu\text{V}/^\circ\text{C}$ |     |
| $I_{IB}$   | Input bias current                                      |  |          | 25°C           |                | 30             | 90   | nA                           |     |
|  |   |  |          | -40°C to 125°C |                |                | 140  |                              |     |
| $I_{IO}$   | Input offset current                                    |  |          | 25°C           |                | 0.5            | 30   | nA                           |     |
|  |   |  |          | -40°C to 125°C |                |                | 50   |                              |     |
| CMRR   | Common-mode rejection ratio                             | $V_{IC} = 0\text{ to }1.7\text{ V}$  |          | 25°C           | 70             | 85             |      | dB                           |     |
|  |   |  |          | -40°C to 125°C | 68             |                |      |                              |     |
| $+k_{SVR}$   | Positive supply-voltage rejection ratio                 | $V_{CC+} = 1.7\text{ V to }4\text{ V}$ , $V_{CC-} = -1\text{ V}$ , $V_O = 0$ , $V_{IC} = 0$    |          | 25°C           | 75             | 85             |      | dB                           |     |
|  |   |  |          | -40°C to 125°C | 70             |                |      |                              |     |
| $-k_{SVR}$   | Negative supply-voltage rejection ratio                 | $V_{CC+} = 1.7\text{ V}$ , $V_{CC-} = -1\text{ V to }-3.3\text{ V}$ , $V_O = 0$ , $V_{IC} = 0$ |          | 25°C           | 73             | 85             |      | dB                           |     |
|  |   |  |          | -40°C to 125°C | 70             |                |      |                              |     |
| $V_{ICR}$  | Common-mode input voltage range                         | CMRR $\geq 50\text{ dB}$   |          | 25°C           | -0.2 to 1.9    | -0.3 to 2      |      | V                            |     |
| $A_V$  | Large-signal voltage amplification                      | $R_L = 600\ \Omega\text{ to }1.35\text{ V}$ , $V_O = 1.35\text{ V to }2.2\text{ V}$            | Sourcing | 25°C           | 90             | 100            |      | dB                           |     |
|  |   |  |          | -40°C to 125°C | 85             |                |      |                              |     |
|  |   | $R_L = 600\ \Omega\text{ to }1.35\text{ V}$ , $V_O = 1.35\text{ V to }0.5\text{ V}$            | Sinking  | 25°C           | 85             | 90             |      |                              |     |
|  |   |  |          | -40°C to 125°C | 80             |                |      |                              |     |
| $R_L = 2\text{ k}\Omega\text{ to }1.35\text{ V}$ , $V_O = 1.35\text{ V to }2.2\text{ V}$ | Sourcing  | 25°C   | 95       | 100            |                |                |      |                              |     |
|  |   | -40°C to 125°C   | 90       |                |                |                |      |                              |     |
| $R_L = 2\text{ k}\Omega\text{ to }1.35\text{ V}$ , $V_O = 1.35\text{ V to }0.5\text{ V}$ | Sinking   | 25°C   | 90       | 95             |                |                |      |                              |     |
|  |   | -40°C to 125°C   | 85       |                |                |                |      |                              |     |
| $V_O$  | Output swing  | $V_{CC+} = 2.7\text{ V}$ , $R_L = 600\ \Omega\text{ to }1.35\text{ V}$                         |          | High level     | 25°C           | 2.5            | 2.58 |                              | V   |
|  |   |  |          |                |                | -40°C to 125°C | 2.4  |                              |     |
|  |   |  |          | Low level      | 25°C           |                | 0.13 | 0.2                          |     |
|  |   |  |          |                | -40°C to 125°C |                |      | 0.3                          |     |
|  |   | $V_{CC+} = 2.7\text{ V}$ , $R_L = 2\text{ k}\Omega\text{ to }1.35\text{ V}$                    |          | High level     | 25°C           | 2.6            | 2.66 |                              |     |
|  |   |  |          |                |                | -40°C to 125°C | 2.5  |                              |     |
| Low level  | 25°C  |  | 0.08     | 0.12           |                |                |      |                              |     |
|  | -40°C to 125°C  |  |          | 0.2            |                |                |      |                              |     |
| $I_O$  | Output current  | $V_O = 0\text{ V}$   | Sourcing | 25°C           | 12             | 16             |      | mA                           |     |
|  |   | $V_O = 2.7\text{ V}$   | Sinking  | 25°C           | 12             | 26             |      |                              |     |
| $I_{CC}$   | Supply current  | LMV821   |          | 25°C           |                | 0.22           | 0.3  | mA                           |     |
|  |   |  |          |                | -40°C to 125°C |                |      |                              | 0.5 |
|  |   | LMV822 (both amplifiers)   |          | 25°C           |                | 0.45           | 0.6  |                              |     |
|  |   |  |          |                | -40°C to 125°C |                |      |                              | 0.8 |
|  |   | LMV824 (all four amplifiers)   |          | 25°C           |                | 0.72           | 1    |                              |     |
|  |   |  |          |                | -40°C to 125°C |                |      |                              | 1.2 |

**2.7-V Electrical Characteristics (continued)**
 $V_{CC+} = 2.7\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 1\text{ V}$ ,  $V_O = 1.35\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER |                                  | TEST CONDITIONS   | $T_A$ | MIN | TYP  | MAX | UNIT                   |
|-----------|----------------------------------|---|-------|-----|------|-----|------------------------|
| SR        | Slew rate <sup>(1)</sup>         |   | 25°C  |     | 1.7  |     | V/ $\mu$ s             |
| GBW       | Gain bandwidth product           | <sup>(2)</sup>  | 25°C  |     | 5    |     | MHz                    |
| $\Phi_m$  | Phase margin                     | <sup>(2)</sup>  | 25°C  |     | 60   |     | deg                    |
|           | Gain margin                      | <sup>(2)</sup>  | 25°C  |     | 8.6  |     | dB                     |
|           | Amplifier-to-amplifier isolation | $V_{CC+} = 5\text{ V}$ , $R_L = 100\text{ k}\Omega$ to $2.5\text{ V}$ <sup>(3)</sup>        | 25°C  |     | 135  |     | dB                     |
| $V_n$     | Equivalent input noise voltage   | $f = 1\text{ kHz}$ , $V_{IC} = 1\text{ V}$  | 25°C  |     | 45   |     | nV/ $\sqrt{\text{Hz}}$ |
| $I_n$     | Equivalent input noise current   | $f = 1\text{ kHz}$  | 25°C  |     | 0.18 |     | pA/ $\sqrt{\text{Hz}}$ |
| THD       | Total harmonic distortion        | $f = 1\text{ kHz}$ , $A_V = -2$ , $R_L = 10\text{ k}\Omega$ ,<br>$V_O = 4.1\text{ V}_{p-p}$ | 25°C  |     | 0.01 |     | %                      |

(1) Connected as voltage follower with 1-V step input. Value specified is the slower of the positive and negative slew rates.

(2) 40-dB closed-loop dc gain,  $C_L = 22\text{ pF}$

(3) Each amplifier excited in turn with 1 kHz to produce  $V_O = 3\text{ V}_{p-p}$

**5-V Electrical Characteristics**

$V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 2\text{ V}$ ,  $V_O = 2.5\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER      |   | TEST CONDITIONS  |            | $T_A$          | MIN            | TYP         | MAX | UNIT                         |
|----------------|---|--|------------|----------------|----------------|-------------|-----|------------------------------|
| $V_{IO}$       | Input offset voltage                                    |  |            | 25°C           |                | 1           | 6   | mV                           |
|                |   |  |            | -40°C to 125°C |                |             | 6   |                              |
| $\alpha_{VIO}$ | Average temperature coefficient of input offset voltage |  |            | 25°C           |                | 1           |     | $\mu\text{V}/^\circ\text{C}$ |
| $I_{IB}$       | Input bias current                                      |  |            | 25°C           |                | 40          | 100 | nA                           |
|                |   |  |            | -40°C to 125°C |                |             | 150 |                              |
| $I_{IO}$       | Input offset current                                    |  |            | 25°C           |                | 0.5         | 30  | nA                           |
|                |   |  |            | -40°C to 125°C |                |             | 50  |                              |
| CMRR           | Common-mode rejection ratio                             | $V_{IC} = 0\text{ to }4\text{ V}$  |            | 25°C           | 72             | 90          |     | dB                           |
|                |   |  |            | -40°C to 125°C | 70             |             |     |                              |
| $+k_{SVR}$     | Positive supply-voltage rejection ratio                 | $V_{CC+} = 1.7\text{ V to }4\text{ V}$ , $V_{CC-} = -1\text{ V}$ , $V_O = 0$ , $V_{IC} = 0$    |            | 25°C           | 75             | 85          |     | dB                           |
|                |   |  |            | -40°C to 125°C | 70             |             |     |                              |
| $-k_{SVR}$     | Negative supply-voltage rejection ratio                 | $V_{CC+} = 1.7\text{ V}$ , $V_{CC-} = -1\text{ V to }-3.3\text{ V}$ , $V_O = 0$ , $V_{IC} = 0$ |            | 25°C           | 73             | 85          |     | dB                           |
|                |   |  |            | -40°C to 125°C | 70             |             |     |                              |
| $V_{ICR}$      | Common-mode input voltage range                         | CMRR $\geq 50\text{ dB}$   |            | 25°C           | -0.2 to 4.2    | -0.3 to 4.3 |     | V                            |
| $A_V$          | Large-signal voltage amplification                      | $R_L = 600\ \Omega\text{ to }2.5\text{ V}$ , $V_O = 2.5\text{ V to }4.5\text{ V}$              | Sourcing   | 25°C           | 95             | 105         |     | dB                           |
|                |   |  |            | -40°C to 125°C | 90             |             |     |                              |
|                |   | $R_L = 600\ \Omega\text{ to }2.5\text{ V}$ , $V_O = 2.5\text{ V to }0.5\text{ V}$              | Sinking    | 25°C           | 95             | 105         |     |                              |
|                |   |  |            | -40°C to 125°C | 90             |             |     |                              |
| $V_O$          | Output swing  | $V_{CC+} = 5\text{ V}$ , $R_L = 600\ \Omega\text{ to }2.5\text{ V}$                            | High level | 25°C           | 4.75           | 4.84        |     | V                            |
|                |   |  |            | -40°C to 125°C | 4.6            |             |     |                              |
|                |   | $V_{CC+} = 5\text{ V}$ , $R_L = 2\text{ k}\Omega\text{ to }2.5\text{ V}$                       | High level | 25°C           | 4.85           | 4.9         |     |                              |
|                |   |  |            | -40°C to 125°C | 4.8            |             |     |                              |
| $I_O$          | Output current  | $V_O = 0\text{ V}$   | Sourcing   | 25°C           | 20             | 45          |     | mA                           |
|                |   |  |            | -40°C to 125°C | 15             |             |     |                              |
|                |   | $V_O = 5\text{ V}$   | Sinking    | 25°C           | 20             | 40          |     |                              |
|                |   |  |            | -40°C to 125°C | 15             |             |     |                              |
| $I_{CC}$       | Supply current  | LMV821   |            | 25°C           | 0.3            | 0.4         |     | mA                           |
|                |   |  |            |                | -40°C to 125°C |             | 0.6 |                              |
|                |   | LMV822 (both amplifiers)   |            | 25°C           | 0.5            | 0.7         |     |                              |
|                |   |  |            |                | -40°C to 125°C |             | 0.9 |                              |
|                |   | LMV824 (all four amplifiers)   |            | 25°C           | 1              | 1.3         |     |                              |
|                |   |  |            |                | -40°C to 125°C |             | 1.5 |                              |

**5-V Electrical Characteristics (continued)**
 $V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 2\text{ V}$ ,  $V_O = 2.5\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER |                                  | TEST CONDITIONS   | $T_A$ | MIN | TYP  | MAX | UNIT                   |
|-----------|----------------------------------|---|-------|-----|------|-----|------------------------|
| SR        | Slew rate                        | $V_{CC+} = 5\text{ V}^{(1)}$  | 25°C  | 1.4 | 1.9  |     | V/ $\mu$ s             |
| GBW       | Gain bandwidth product           | <sup>(2)</sup>  | 25°C  |     | 5.5  |     | MHz                    |
| $\Phi_m$  | Phase margin                     | <sup>(2)</sup>  | 25°C  |     | 64.2 |     | deg                    |
|           | Gain margin                      | <sup>(2)</sup>  | 25°C  |     | 8.7  |     | dB                     |
|           | Amplifier-to-amplifier isolation | $V_{CC+} = 5\text{ V}$ , $R_L = 100\text{ k}\Omega$ to $2.5\text{ V}^{(3)}$                 | 25°C  |     | 135  |     | dB                     |
| $V_n$     | Equivalent input noise voltage   | $f = 1\text{ kHz}$ , $V_{IC} = 1\text{ V}$  | 25°C  |     | 42   |     | nV/ $\sqrt{\text{Hz}}$ |
| $I_n$     | Equivalent input noise current   | $f = 1\text{ kHz}$  | 25°C  |     | 0.2  |     | pA/ $\sqrt{\text{Hz}}$ |
| THD       | Total harmonic distortion        | $f = 1\text{ kHz}$ , $A_V = -2$ , $R_L = 10\text{ k}\Omega$ ,<br>$V_O = 4.1\text{ V}_{p-p}$ | 25°C  |     | 0.01 |     | %                      |

- (1) Connected as voltage follower with 3-V step input. Value specified is the slower of the positive and negative slew rates.
- (2) 40-dB closed-loop dc gain,  $C_L = 22\text{ pF}$
- (3) Each amplifier excited in turn with 1 kHz to produce  $V_O = 3\text{ V}_{p-p}$

**TYPICAL CHARACTERISTICS**

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)

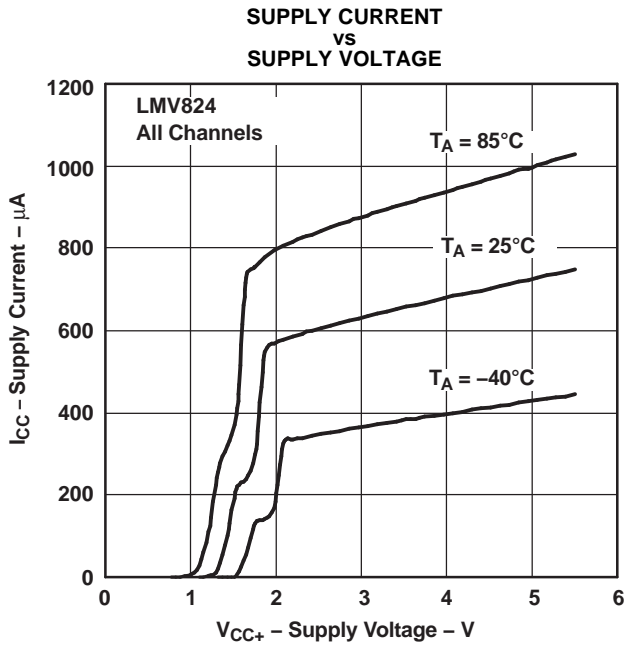


Figure 1.

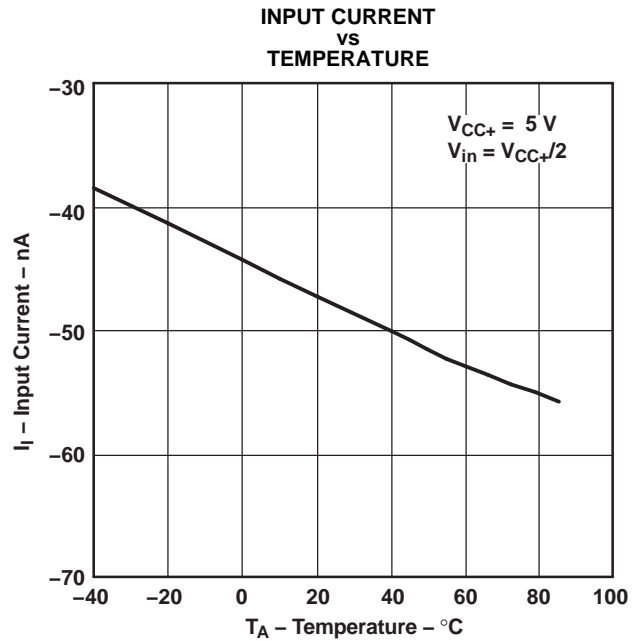


Figure 2.

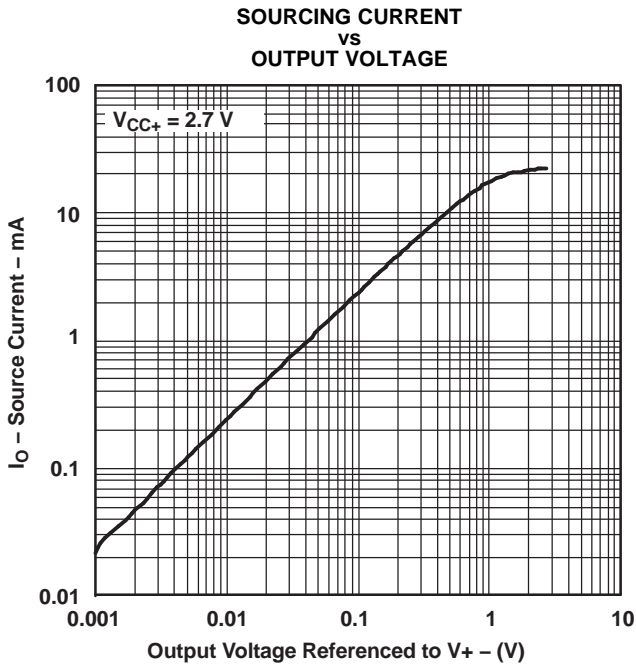


Figure 3.

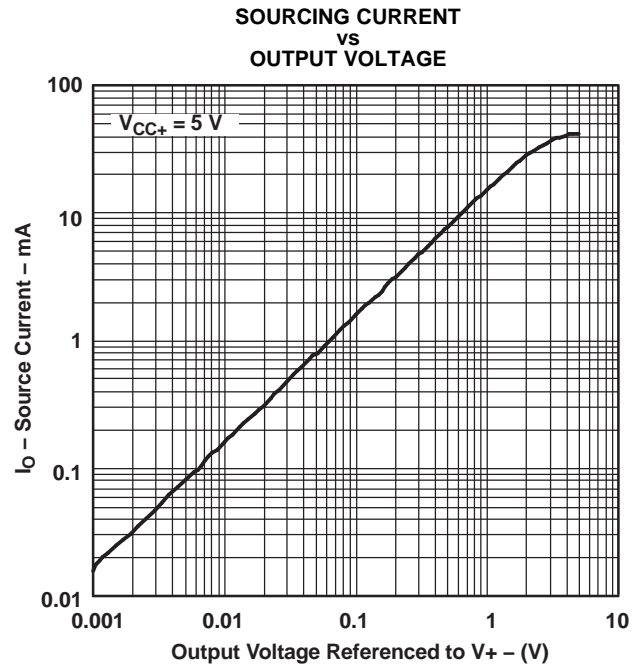


Figure 4.



TYPICAL CHARACTERISTICS (continued)

T<sub>A</sub> = 25°C, V<sub>CC+</sub> = 5-V Single Supply (Unless Otherwise Noted)

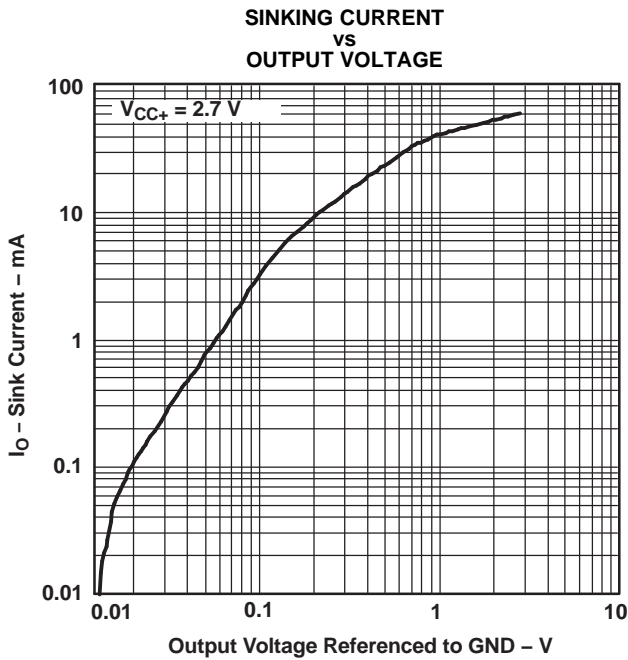


Figure 5.

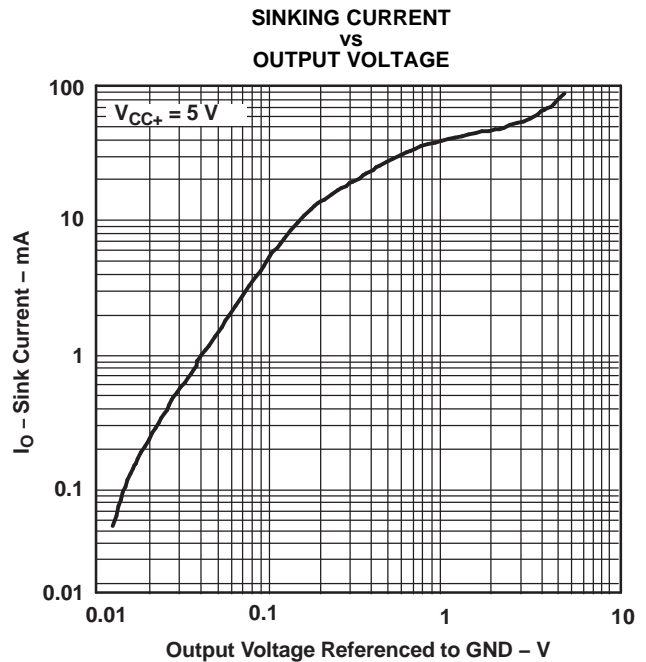


Figure 6.

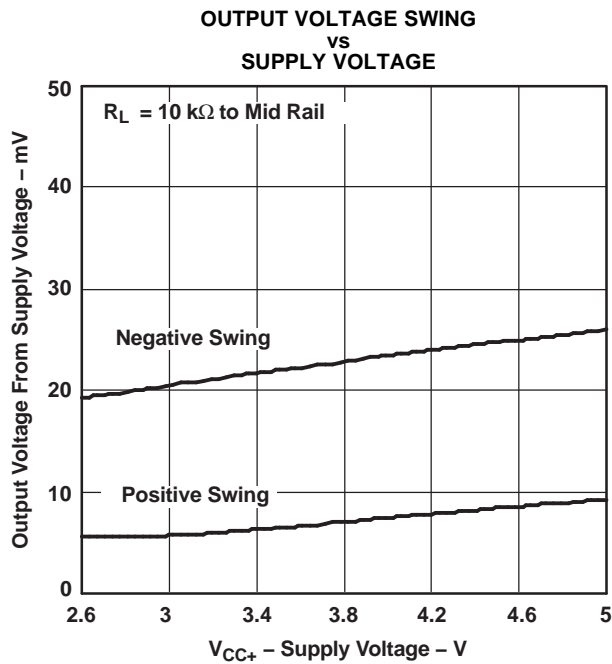


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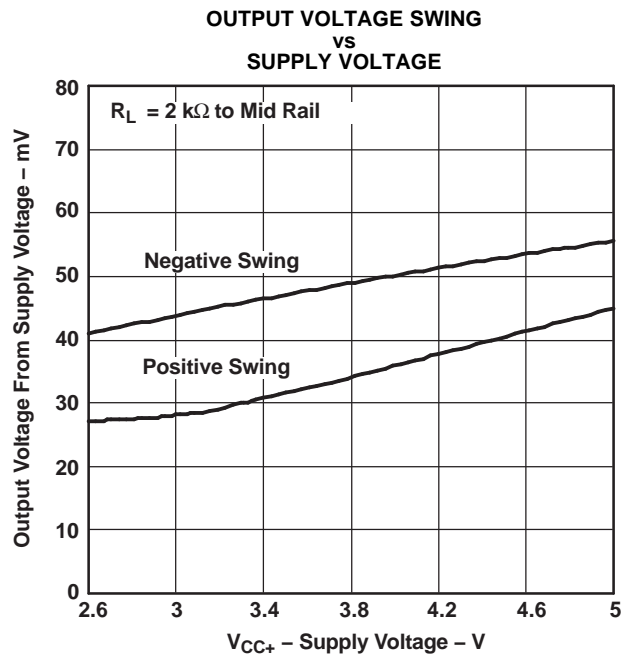


Figure 8.

**TYPICAL CHARACTERISTICS (continued)**

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)

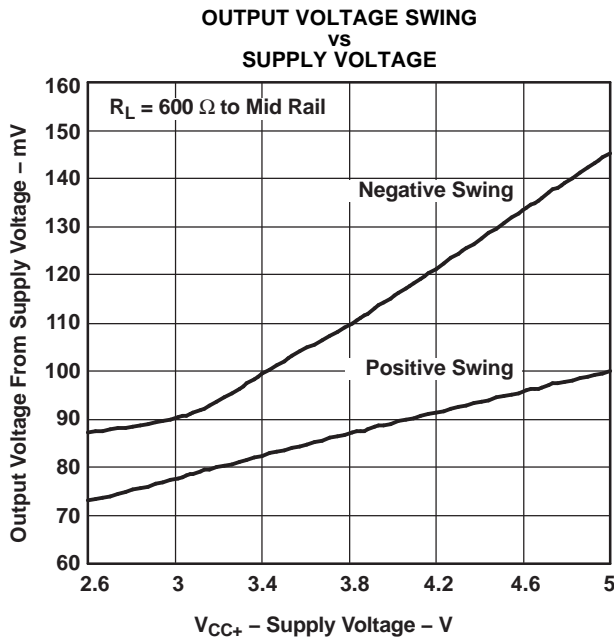


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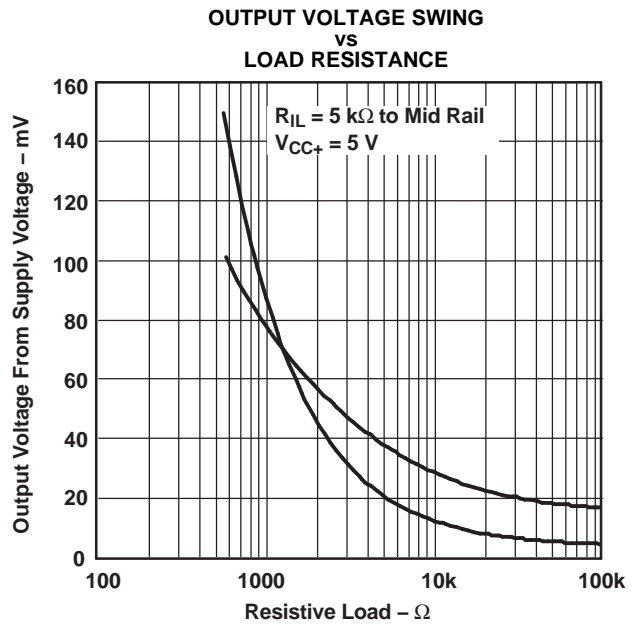


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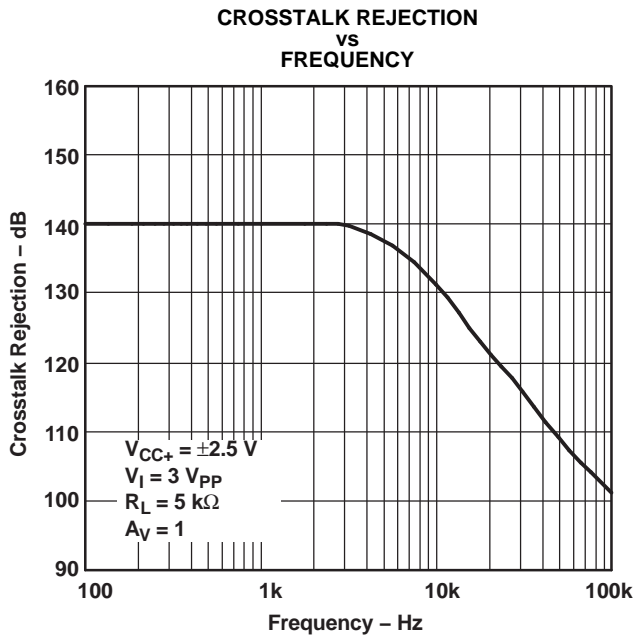


Figure 11.

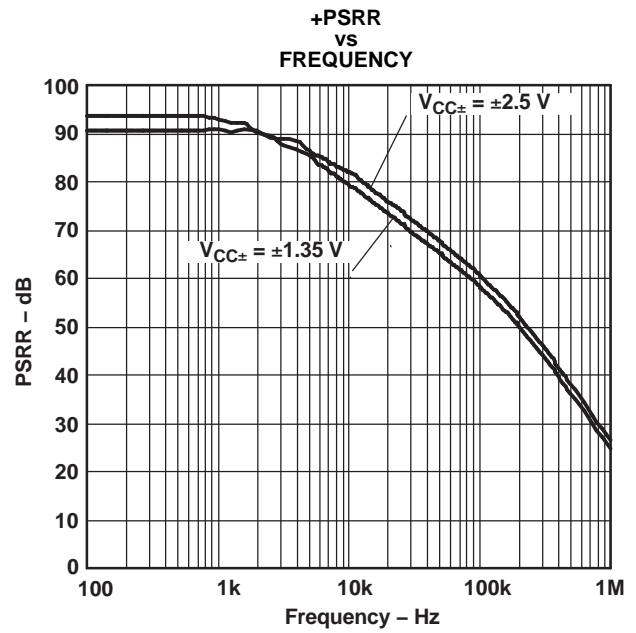
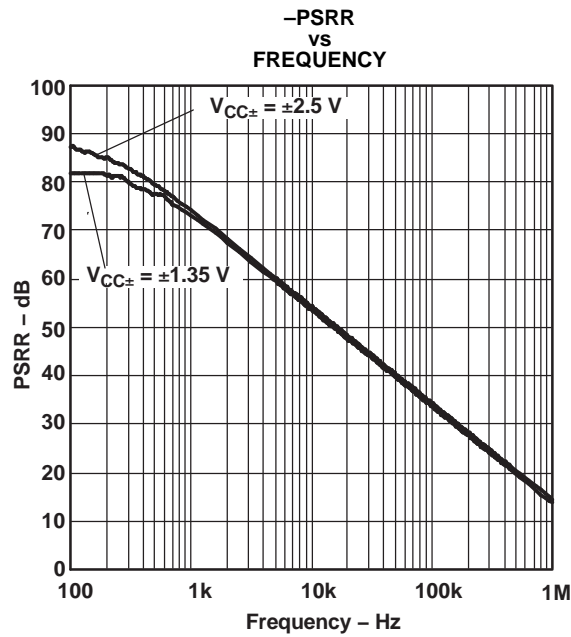


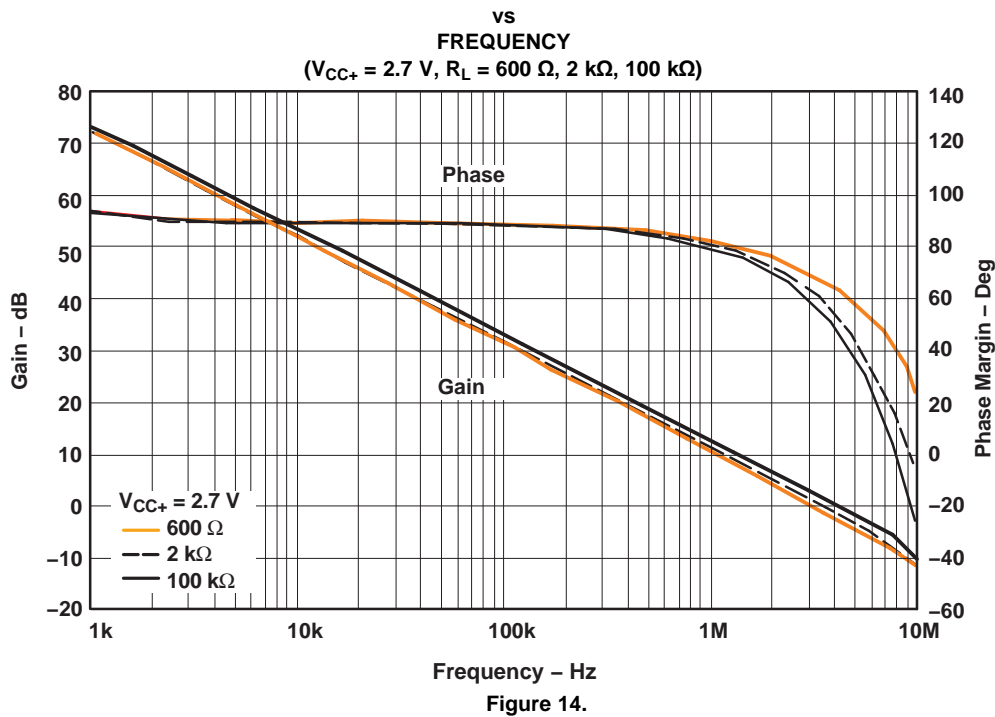
Figure 12.

TYPICAL CHARACTERISTICS (continued)

T<sub>A</sub> = 25°C, V<sub>CC+</sub> = 5-V Single Supply (Unless Otherwise Noted)

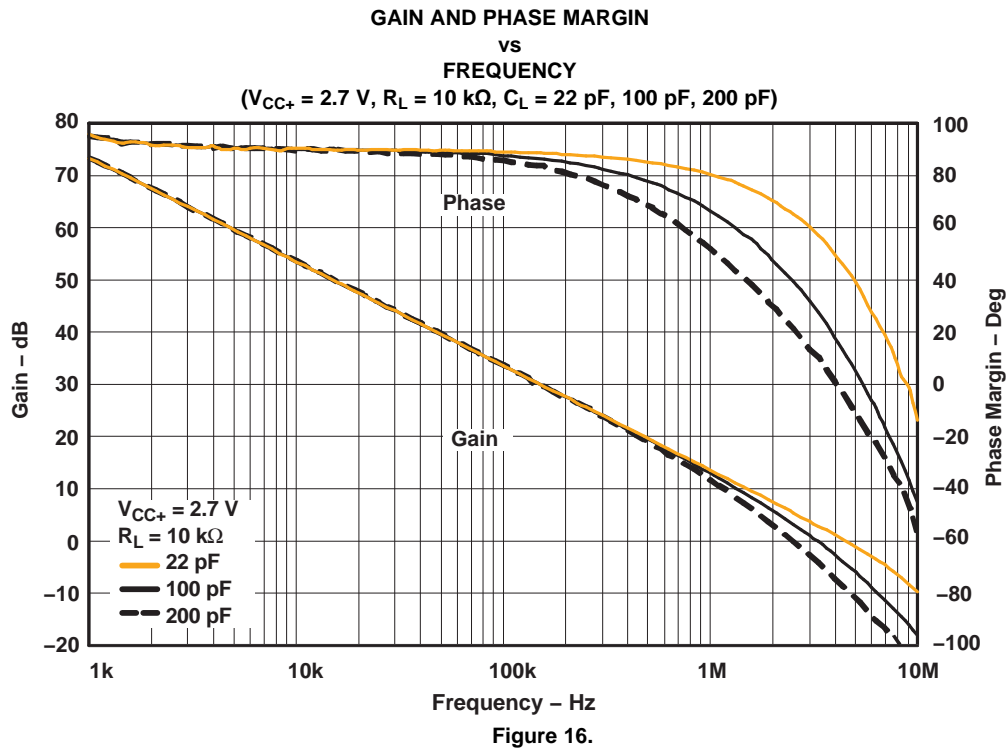
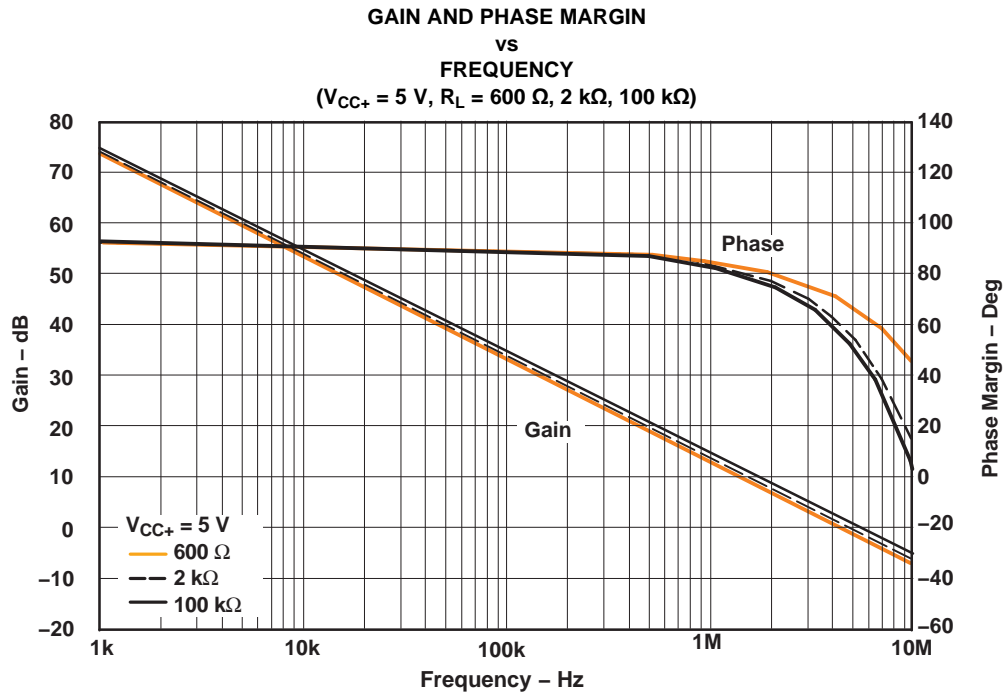


GAIN AND PHASE MARGIN  
vs  
FREQUENCY



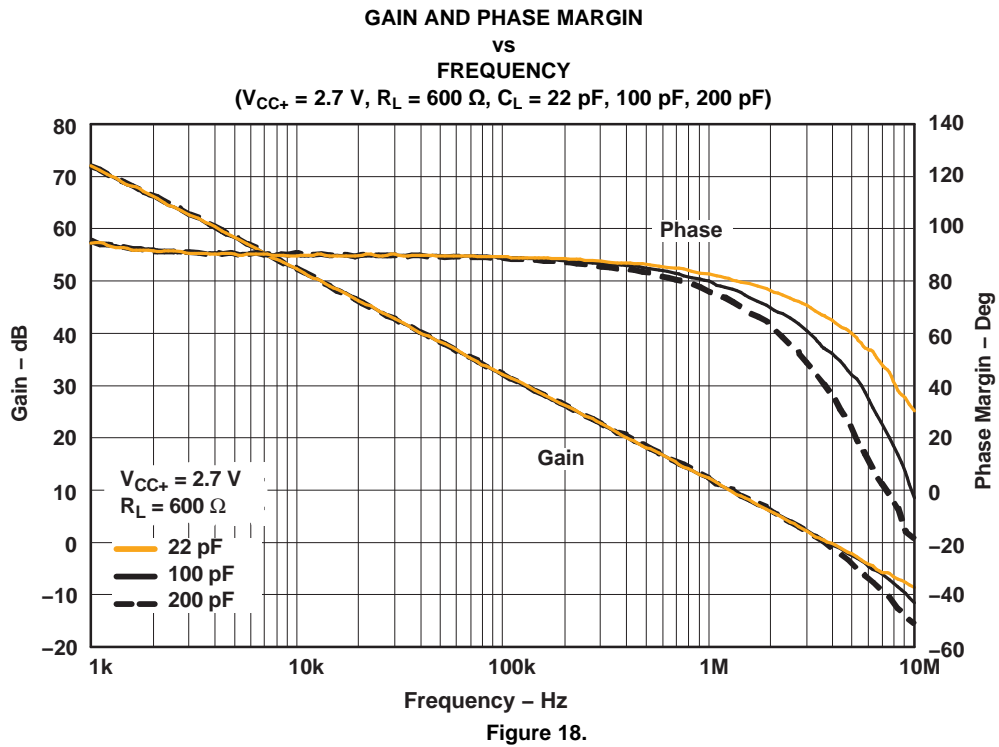
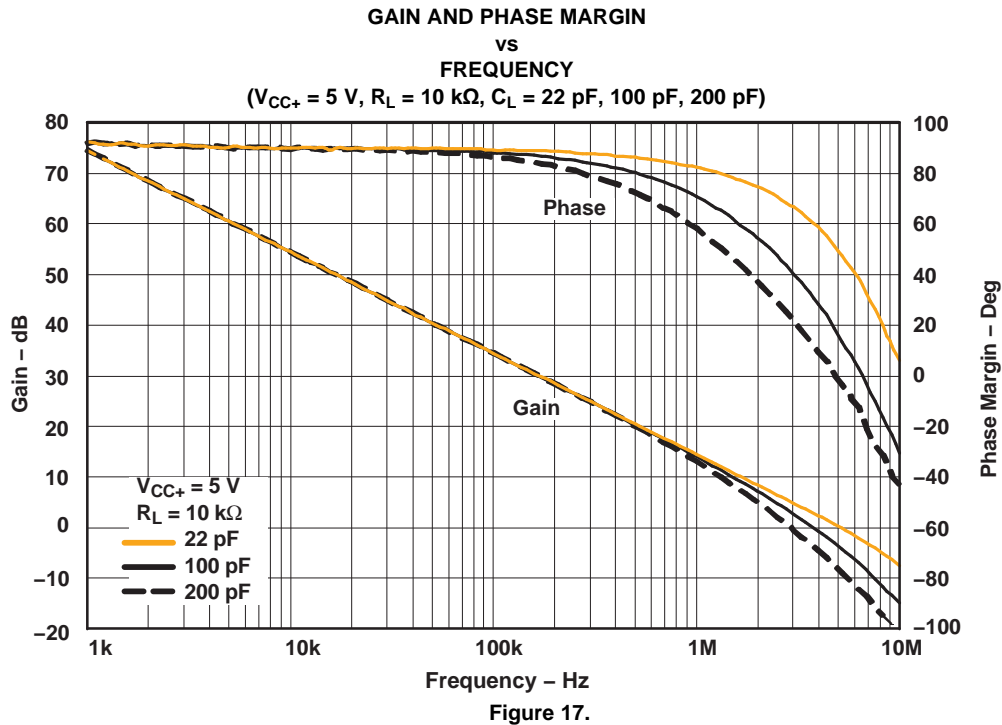
**TYPICAL CHARACTERISTICS (continued)**

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)



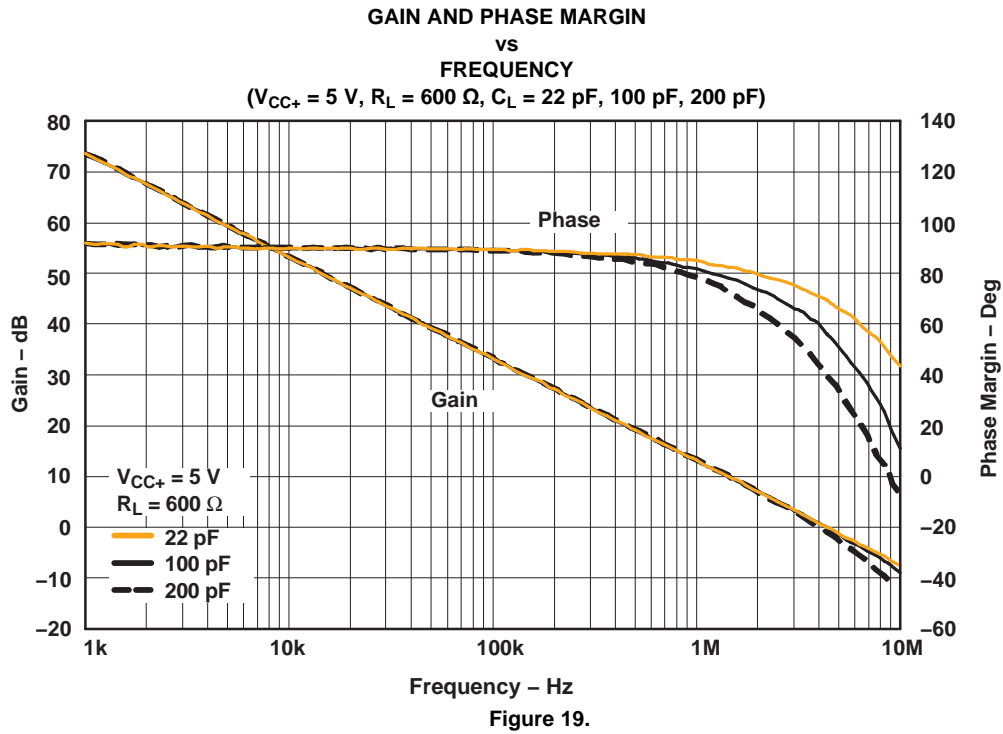
TYPICAL CHARACTERISTICS (continued)

T<sub>A</sub> = 25°C, V<sub>CC+</sub> = 5-V Single Supply (Unless Otherwise Noted)



**TYPICAL CHARACTERISTICS (continued)**

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)



**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| LMV821QDBVRQ1    | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| LMV822QDGKRQ1    | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | Call TI          | Level-1-260C-UNLIM           |

<sup>(1)</sup> 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.

<sup>(2)</sup> 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)

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

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**OTHER QUALIFIED VERSIONS OF LMV821-Q1, LMV822-Q1 :**

- Catalog: [LMV821](#), [LMV822](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

DBV (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE

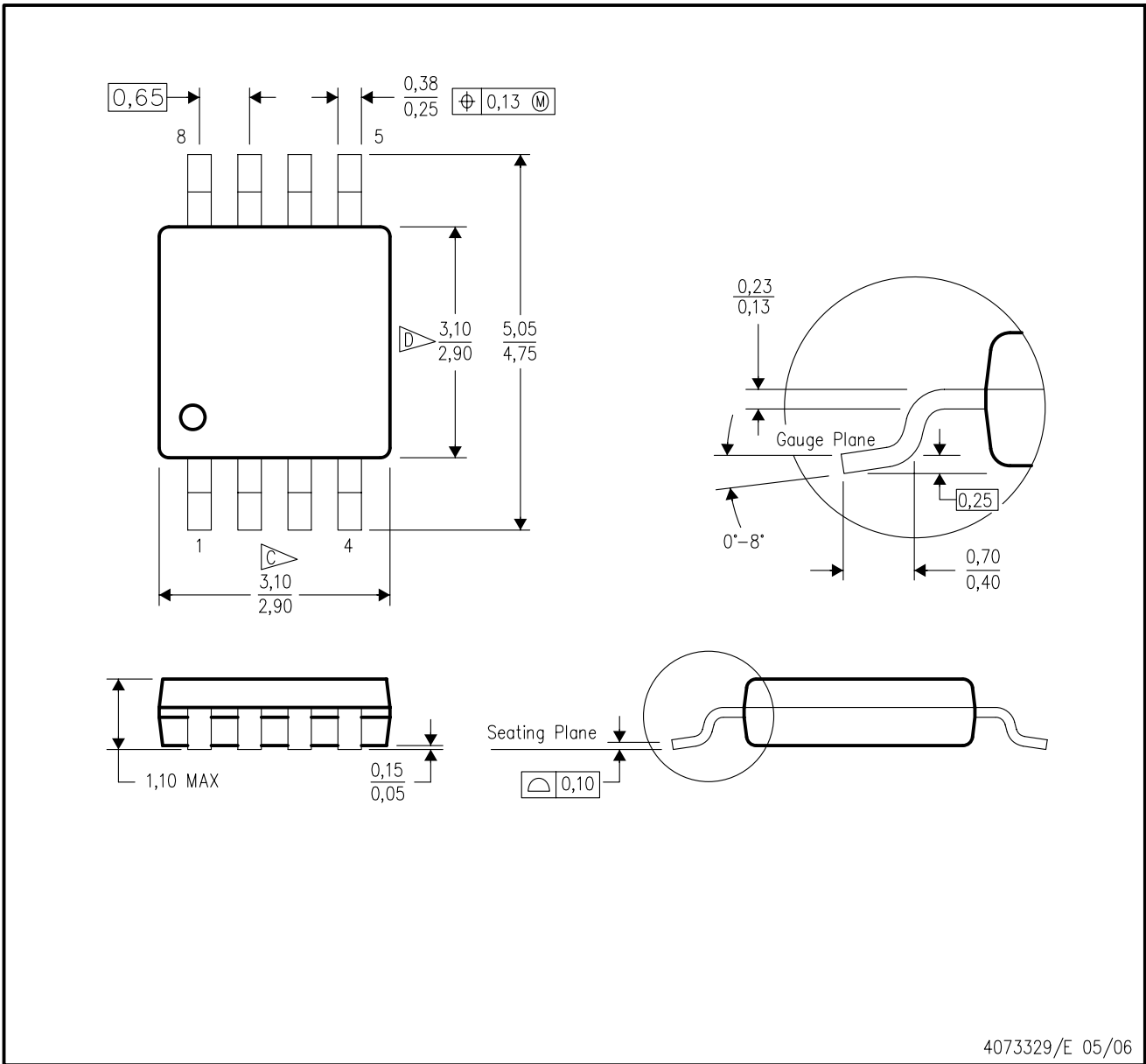


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Falls within JEDEC MO-178 Variation AA.



DGK (S-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - 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 per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
  - E. Falls within JEDEC MO-187 variation AA, except interlead flash.

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| Military           | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
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