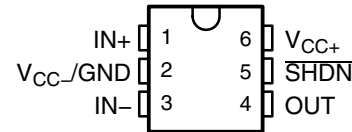
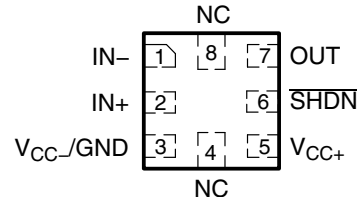


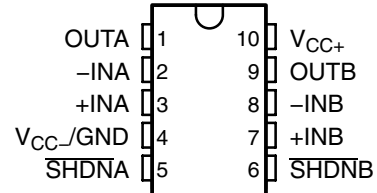
LMV981 SINGLE, LMV982 DUAL 1.8-V OPERATIONAL AMPLIFIERS WITH RAIL-TO-RAIL INPUT AND OUTPUT AND SHUTDOWN

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- 1.8-V, 2.7-V, and 5-V Specifications
- Rail-to-Rail Output Swing
 - 600- Ω Load . . . 80 mV From Rail
 - 2-k Ω Load . . . 30 mV From Rail
- V_{ICR} . . . 200 mV Beyond Rails
- Gain Bandwidth . . . 1.4 MHz
- Supply Current . . . 100 μ A/Amplifier
- Max V_{IO} . . . 4 mV
- Turn-On Time From Shutdown . . . 8.4 μ s
- Space-Saving Packages
 - LMV981: SOT-23-6, SC-70, and QFN
 - LMV982: MSOP and VSSOP
- Applications
 - Industrial (Utility/Energy Metering)
 - Automotive
 - Communications (Optical Telecom, Data/Voice Cable Modems)
 - Consumer Electronics (PDAs, PCs, CDR/W, Portable Audio)
 - Supply-Current Monitoring
 - Battery Monitoring

LMV981 . . . DBV (SOT23-6) OR DCK (SC-70) PACKAGE
(TOP VIEW)LMV981 . . . RUG (QFN) PACKAGE
(TOP VIEW)

NC – No internal connection

LMV982 . . . DGS (VSSOP/MSOP) PACKAGE
(TOP VIEW)

description/ordering information

The LMV981 and LMV982 devices are low-voltage, low-power operational amplifiers that are well suited for today's low-voltage and/or portable applications. Specified for operation of 1.8 V to 5 V, they can be used in portable applications that are powered from a single-cell Li-ion or two-cell batteries. They have rail-to-rail input and output capability for maximum signal swings in low-voltage applications. The LMV98x input common-mode voltage extends 200 mV beyond the rails for increased flexibility. The output can swing rail-to-rail unloaded and typically can reach 80 mV from the rails, while driving a 600- Ω load (at 1.8-V operation).

ORDERING INFORMATION†

| T _A | PACKAGE [‡] | | | ORDERABLE PART NUMBER | TOP-SIDE MARKING [§] |
|----------------|----------------------|------------------|--------------|--------------------------|----------------------------------|
| –40°C to 125°C | Single | QFN (RUG) | Reel of 3000 | LMV981IRUGR | R7 |
| | | SOT-23 (DBV) | Reel of 3000 | LMV981IDBVR | RBA_ |
| | | | Reel of 250 | LMV981IDBVT | PREVIEW |
| | | SC-70 (DCK) | Reel of 3000 | LMV981IDCKR | R7_ |
| | | | Reel of 250 | LMV981IDCKT | PREVIEW |
| | Dual | MSOP/VSSOP (DGS) | Reel of 2500 | LMV982IDGSR | RCB |
| | | | Reel of 250 | LMV982IDGST | |

† 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.

‡ Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

§ DBV/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site.



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

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LMV981 SINGLE, LMV982 DUAL

1.8-V OPERATIONAL AMPLIFIERS

WITH RAIL-TO-RAIL INPUT AND OUTPUT AND SHUTDOWN

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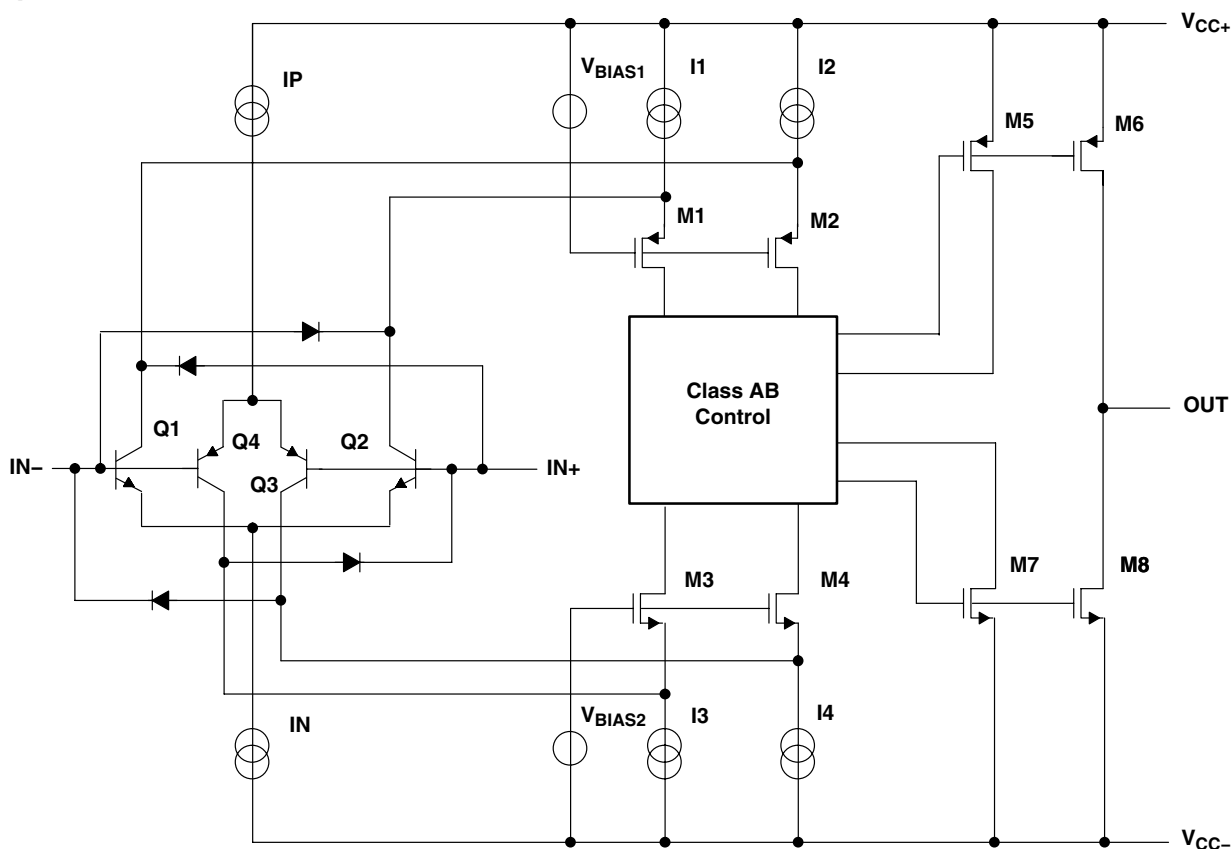
description/ordering information (continued)

The LMV981 and LMV982 devices offer shutdown capability for additional power savings. Pulling the SHDN pin low puts the amplifiers in shutdown, where only 0.156 μA typically is consumed from a 1.8-V supply. In normal operation with the same 1.8-V supply, the devices typically consume a quiescent current of 103 μA per channel, and yet they are able to achieve excellent electrical specifications, such as 101-dB open-loop DC gain and 1.4-MHz-gain bandwidth. Furthermore, the amplifiers offer good output drive characteristics, with the ability to drive a 600- Ω load and 1000-pF capacitance, with minimal ringing.

The LMV981 and LMV982 devices are offered in the latest packaging technology to meet the most demanding space-constraint applications. The LMV981 is offered in standard SOT-23 and SC-70 packages. The LMV982 is available in the 10-pin MSOP package.

The LMV98x devices are characterized for operation from -40°C to 125°C , making them universally suited for commercial, industrial, and automotive applications.

simplified schematic



LMV981 SINGLE, LMV982 DUAL 1.8-V OPERATIONAL AMPLIFIERS WITH RAIL-TO-RAIL INPUT AND OUTPUT AND SHUTDOWN

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absolute maximum ratings over free-air temperature range (unless otherwise noted)[†]

| | |
|---|--|
| Supply voltage, $V_{CC+} - V_{CC-}$ (see Note 1) | 5.5 V |
| Differential input voltage, V_{ID} (see Note 2) | Supply voltage |
| Input voltage range, V_I (either input) | $V_{CC-} - 0.2 \text{ V}$ to $V_{CC+} + 0.2 \text{ V}$ |
| Duration of output short circuit (one amplifier) to $V_{CC\pm}$ (see Notes 3 and 4) | Unlimited |
| Package thermal impedance, θ_{JA} (see Notes 4 and 5): | |
| DBV package | 165°C/W |
| DCK package | 259°C/W |
| DGS package | 165°C/W |
| RUG package | 253°C/W |
| Operating virtual junction temperature, T_J | 150°C |
| Storage temperature range, T_{stg} | –65 to 150°C |

[†] 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.

- NOTES:
1. All voltage values (except differential voltages and V_{CC} specified for the measurement of I_{OS}) are with respect to the network GND.
 2. Differential voltages are at $IN+$ with respect to $IN-$.
 3. Applies to both single-supply and split-supply operation. Continuous short-circuit operation 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.
 4. Maximum power dissipation is a function of $T_J(\text{max})$, θ_{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.
 5. The package thermal impedance is calculated in accordance with JEDEC 51-7.

recommended operating conditions

| | MIN | MAX | UNIT |
|---|-----|-----|------|
| V_{CC} Supply voltage ($V_{CC+} - V_{CC-}$) | 1.8 | 5 | V |
| T_A Operating free-air temperature | –40 | 125 | °C |

ESD protection

| TEST CONDITIONS | TYP | UNIT |
|------------------|------|------|
| Human-Body Model | 2000 | V |
| Machine Model | 200 | V |



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electrical characteristics at $T_A = 25^\circ\text{C}$, $V_{CC+} = 1.8\text{ V}$, $V_{CC-} = 0\text{ V}$, $V_{IC} = V_{CC+}/2$, $V_O = V_{CC+}/2$, $R_L > 1\text{ M}\Omega$, and SHDN tied to V_{CC+} (unless otherwise noted)

| PARAMETER | | | TEST CONDITIONS | | T _A | MIN | TYP | MAX | UNIT |
|-----------------------------|---|---|---|----------------|------------------------|-------------|------------------------|-----|-------|
| V _{IO} | Input offset voltage | LMV981 (single) | | 25°C | | 1 | | 4 | mV |
| | | | | Full range | | | 6 | | |
| | | LMV982 (dual) | | 25°C | | 1 | | 5.5 | |
| | | | | Full range | | | 7.5 | | |
| α _{V_{IO}} | Average temperature coefficient of input offset voltage | | | 25°C | | 5.5 | | | μV/°C |
| I _{IB} | Input bias current | V _{IC} = V _{CC+} − 0.8 V | | 25°C | | 15 | | 35 | nA |
| | | | | 25°C | | | 65 | | |
| | | | | Full range | | | 75 | | |
| I _{IO} | Input offset current | | | 25°C | | 13 | | 25 | nA |
| | | | | Full range | | | 40 | | |
| I _{CC} | Supply current (per channel) | | | 25°C | | 103 | | 185 | μA |
| | | | | Full range | | | 205 | | |
| | | In shutdown | LMV981 | 25°C | | 0.156 | | 1 | |
| | | | | Full range | | | 2 | | |
| | | | LM982 | 25°C | | 0.178 | | 3.5 | |
| | | | | Full range | | | 5 | | |
| CMRR | Common-mode rejection ratio | 0 ≤ V _{IC} ≤ 0.6 V, 1.4 V ≤ V _{IC} ≤ 1.8 V | | 25°C | | 60 | 78 | dB | |
| | | | | −40°C to 85°C | | 55 | | | |
| | | 0.2 V ≤ V _{IC} ≤ 0.6 V, 1.4 V ≤ V _{IC} ≤ 1.6 V | | −40°C to 125°C | | 55 | | | |
| | | | | 25°C | | 50 | 72 | | |
| k _{SVR} | Supply-voltage rejection ratio | 1.8 V ≤ V _{CC+} ≤ 5 V, V _{IC} = 0.5 V | | 25°C | | 75 | 100 | dB | |
| | | | | Full range | | 70 | | | |
| V _{ICR} | Common-mode input voltage range | CMRR ≥ 50 dB | | 25°C | V _{CC−} − 0.2 | −0.2 to 2.1 | V _{CC+} + 0.2 | V | |
| | | | | −40°C to 85°C | V _{CC−} | | V _{CC+} | | |
| | | | | −40°C to 125°C | V _{CC−} + 0.2 | | V _{CC+} − 0.2 | | |
| A _V | Large-signal voltage gain | LMV981 | R _L = 600 Ω to 0.9 V, V _O = 0.2 V to 1.6 V, V _{IC} = 0.5 V | 25°C | | 77 | 101 | dB | |
| | | | | Full range | | 73 | | | |
| | | | R _L = 2 kΩ to 0.9 V, V _O = 0.2 V to 1.6 V, V _{IC} = 0.5 V | 25°C | | 80 | 105 | | |
| | | | | Full range | | 75 | | | |
| | | LMV982 | R _L = 600 Ω to 0.9 V, V _O = 0.2 V to 1.6 V, V _{IC} = 0.5 V | 25°C | | 75 | 90 | | |
| | | | | Full range | | 72 | | | |
| | | | R _L = 2 kΩ to 0.9 V, V _O = 0.2 V to 1.6 V, V _{IC} = 0.5 V | 25°C | | 78 | 100 | | |
| | | | | Full range | | 75 | | | |

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electrical characteristics at $T_A = 25^\circ\text{C}$, $V_{CC+} = 1.8\text{ V}$, $V_{CC-} = 0\text{ V}$, $V_{IC} = V_{CC+}/2$, $V_O = V_{CC+}/2$, $R_L > 1\text{ M}\Omega$, and SHDN tied to V_{CC+} (unless otherwise noted) (continued)

| PARAMETER | | TEST CONDITIONS | | T_A | MIN | TYP | MAX | UNIT |
|------------|--------------------------------|--|------------|--------------------|------|-------|-------|------------------------------|
| V_O | Output swing | $R_L = 600\ \Omega$ to 0.9 V , $V_{ID} = \pm 100\text{ mV}$ | High level | 25°C | 1.65 | 1.72 | | V |
| | | | | Full range | 1.63 | | | |
| | | | Low level | 25°C | | 0.077 | 0.105 | |
| | | | | Full range | | | 0.12 | |
| | | $R_L = 2\text{ k}\Omega$ to 0.9 V , $V_{ID} = \pm 100\text{ mV}$ | High level | 25°C | 1.75 | 1.77 | | |
| | | | | Full range | 1.74 | | | |
| | | | Low level | 25°C | | 0.024 | 0.035 | |
| | | | | Full range | | | 0.04 | |
| I_{OS} | Output short-circuit current | $V_O = 0\text{ V}$, $V_{ID} = 100\text{ mV}$ | Sourcing | 25°C | 4 | 8 | | mA |
| | | | | Full range | 3.3 | | | |
| | | $V_O = 1.8\text{ V}$, $V_{ID} = -100\text{ mV}$ | Sinking | 25°C | 7 | 9 | | |
| | | | | Full range | 5 | | | |
| T_{on} | Turn-on time from shutdown | | | 25°C | | 19 | | μs |
| V_{SHDN} | Turn-on voltage to enable part | | | 25°C | | 1.0 | | V |
| | Turn-off voltage | | | | | 0.55 | | |
| GBW | Gain bandwidth product | | | 25°C | | 1.4 | | MHz |
| SR | Slew rate | See Note 6 | | 25°C | | 0.35 | | $\text{V}/\mu\text{s}$ |
| Φ_m | Phase margin | | | 25°C | | 67 | | deg |
| | Gain margin | | | 25°C | | 7 | | dB |
| V_n | Equivalent input noise voltage | $f = 1\text{ kHz}$, $V_{IC} = 0.5\text{ V}$ | | 25°C | | 60 | | $\text{nV}/\sqrt{\text{Hz}}$ |
| I_n | Equivalent input noise current | $f = 1\text{ kHz}$ | | 25°C | | 0.06 | | $\text{pA}/\sqrt{\text{Hz}}$ |
| THD | Total harmonic distortion | $f = 1\text{ kHz}$, $A_V = 1$, $R_L = 600\ \Omega$, $V_{ID} = 1\text{ V}_{PP}$ | | 25°C | | 0.023 | | % |
| | Amp-to-amp isolation | See Note 7 | | 25°C | | 123 | | dB |

- NOTES: 6. Number specified is the slower of the positive and negative slew rates.
7. Input referred, $V_{CC+} = 5\text{ V}$ and $R_L = 100\text{ k}\Omega$ connected to 2.5 V . Each amp is excited in turn with a 1-kHz signal to produce $V_O = 3\text{ V}_{PP}$.

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electrical characteristics at $T_A = 25^\circ\text{C}$, $V_{CC+} = 2.7\text{ V}$, $V_{CC-} = 0\text{ V}$, $V_{IC} = V_{CC+}/2$, $V_O = V_{CC+}/2$, $R_L > 1\text{ M}\Omega$, and SHDN tied to V_{CC+} (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | T _A | MIN | TYP | MAX | UNIT | |
|------------------|---|---|--|----------------|------------------------|------------------------|------------------------|-------|------------------------|
| V _{IO} | Input offset voltage | LMV981 (single) | | 25°C | | 1 | 4 | mV | |
| | | | | Full range | | | | | 6 |
| | | LMV982 (dual) | | 25°C | | 1 | 5.5 | | |
| | | | | Full range | | | | | 7.5 |
| α _{VIO} | Average temperature coefficient of input offset voltage | | | 25°C | | 5.5 | | μV/°C | |
| I _{IB} | Input bias current | V _{IC} = V _{CC+} − 0.8 V | | 25°C | | 15 | 35 | nA | |
| | | | | 25°C | | | 65 | | |
| | | | | Full range | | | | | 75 |
| I _{IO} | Input offset current | | | 25°C | | 8 | 25 | nA | |
| | | | | Full range | | | | | 40 |
| I _{CC} | Supply current (per channel) | | | 25°C | | 105 | 190 | μA | |
| | | | | Full range | | | | | 210 |
| | | In shutdown | LMV981 | 25°C | | 0.61 | 1 | | |
| | | | | Full range | | | | | 2 |
| | | | LM982 | 25°C | | 0.101 | 3.5 | | |
| | | | | Full range | | | | | 5 |
| CMRR | Common-mode rejection ratio | 0 ≤ V _{IC} ≤ 1.5 V, 2.3 V ≤ V _{IC} ≤ 2.7 V | | 25°C | 60 | 81 | dB | | |
| | | | | −40°C to 85°C | | 55 | | | |
| | | 0.2 ≤ V _{IC} ≤ 1.5 V, 2.3 V ≤ V _{IC} ≤ 2.5 V | | −40°C to 125°C | | 55 | | | |
| | | | | 25°C | 50 | 74 | | | |
| k _{SVR} | Supply-voltage rejection ratio | 1.8 V ≤ V _{CC+} ≤ 5 V, V _{IC} = 0.5 V | | 25°C | 75 | 100 | dB | | |
| | | | | Full range | | 70 | | | |
| V _{ICR} | Common-mode input voltage range | CMRR ≥ 50 dB | | 25°C | V _{CC−} − 0.2 | −0.2 to 3.0 | V _{CC+} + 0.2 | V | |
| | | | | −40°C to 85°C | | V _{CC−} | | | V _{CC+} |
| | | | | −40°C to 125°C | | V _{CC−} + 0.2 | | | V _{CC+} − 0.2 |
| A _V | Large-signal voltage gain | LMV981 | R _L = 600 Ω to 1.35 V, V _O = 0.2 V to 2.5 V | 25°C | 87 | 104 | dB | | |
| | | | | Full range | | 86 | | | |
| | | | R _L = 2 kΩ to 1.35 V, V _O = 0.2 V to 2.5 V | 25°C | 92 | 110 | | | |
| | | | | Full range | | 91 | | | |
| | | LMV982 | R _L = 600 Ω to 1.35 V, V _O = 0.2 V to 2.5 V | 25°C | 78 | 90 | | | |
| | | | | Full range | | 75 | | | |
| | | | R _L = 2 kΩ to 1.35 V, V _O = 0.2 V to 2.5 V | 25°C | 81 | 100 | | | |
| | | | | Full range | | 78 | | | |

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characteristics at $T_A = 25^\circ\text{C}$, $V_{CC+} = 2.7\text{ V}$, $V_{CC-} = 0\text{ V}$, $V_{IC} = V_{CC+}/2$, $V_O = V_{CC+}/2$, $R_L > 1\text{ M}\Omega$, and SHDN tied to V_{CC+} (unless otherwise noted) (continued)

| PARAMETER | | TEST CONDITIONS | | T_A | MIN | TYP | MAX | UNIT |
|------------|--------------------------------|--|------------|--------------------|------|-------|-------|------------------------------|
| V_O | Output swing | $R_L = 600\ \Omega$ to 1.35 V , $V_{ID} = \pm 100\text{ mV}$ | High level | 25°C | 2.55 | 2.62 | | V |
| | | | | Full range | 2.53 | | | |
| | | | Low level | 25°C | | 0.083 | 0.11 | |
| | | | | Full range | | | 0.13 | |
| | | $R_L = 2\text{ k}\Omega$ to 1.35 V , $V_{ID} = \pm 100\text{ mV}$ | High level | 25°C | 2.65 | 2.675 | | |
| | | | | Full range | 2.64 | | | |
| | | | Low level | 25°C | | 0.025 | 0.04 | |
| | | | | Full range | | | 0.045 | |
| I_{OS} | Output short-circuit current | $V_O = 0\text{ V}$, $V_{ID} = 100\text{ mV}$ | Sourcing | 25°C | 20 | 30 | | mA |
| | | | | Full range | 15 | | | |
| | | $V_O = 2.7\text{ V}$, $V_{ID} = -100\text{ mV}$ | Sinking | 25°C | 18 | 25 | | |
| | | | | Full range | 12 | | | |
| T_{on} | Turn-on time from shutdown | | | 25°C | | 12.5 | | μs |
| V_{SHDN} | Turn-on voltage to enable part | | | 25°C | | 1.9 | | V |
| | Turn-off voltage | | | | | 0.8 | | |
| GBW | Gain bandwidth product | | | 25°C | | 1.4 | | MHz |
| SR | Slew rate | See Note 6 | | 25°C | | 0.4 | | $\text{V}/\mu\text{s}$ |
| Φ_m | Phase margin | | | 25°C | | 70 | | deg |
| | Gain margin | | | 25°C | | 7.5 | | dB |
| V_n | Equivalent input noise voltage | $f = 1\text{ kHz}$, $V_{IC} = 0.5\text{ V}$ | | 25°C | | 57 | | $\text{nV}/\sqrt{\text{Hz}}$ |
| I_n | Equivalent input noise current | $f = 1\text{ kHz}$ | | 25°C | | 0.082 | | $\text{pA}/\sqrt{\text{Hz}}$ |
| THD | Total harmonic distortion | $f = 1\text{ kHz}$, $A_V = 1$, $R_L = 600\ \Omega$, $V_{ID} = 1\text{ V}_{PP}$ | | 25°C | | 0.022 | | % |
| | Amp-to-amp isolation | See Note 7 | | 25°C | | 123 | | dB |

- NOTES: 6. Number specified is the slower of the positive and negative slew rates.
7. Input referred, $V_{CC+} = 5\text{ V}$ and $R_L = 100\text{ k}\Omega$ connected to 2.5 V . Each amp is excited in turn with a 1-kHz signal to produce $V_O = 3\text{ V}_{PP}$.

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electrical characteristics at $T_A = 25^\circ\text{C}$, $V_{CC+} = 5\text{ V}$, $V_{CC-} = 0\text{ V}$, $V_{IC} = V_{CC+}/2$, $V_O = V_{CC+}/2$, $R_L > 1\text{ M}\Omega$, and SHDN tied to V_{CC+} (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | T _A | MIN | TYP | MAX | UNIT |
|-----------------------------|---|---|---|----------------|------------------------|---|------------------------|-------|
| V _{IO} | Input offset voltage | LMV981 (single) | | 25°C | | 1 | 4 | mV |
| | | | | Full range | | | 6 | |
| | | LMV982 (dual) | | 25°C | | 1 | 5.5 | |
| | | | | Full range | | | 7.5 | |
| α _{V_{IO}} | Average temperature coefficient of input offset voltage | | | 25°C | | 5.5 | | μV/°C |
| I _{IB} | Input bias current | V _{IC} = V _{CC+} – 0.8 V | | 25°C | | 15 | 35 | nA |
| | | | | 25°C | | 65 | | |
| | | | | Full range | | | | |
| I _{IO} | Input offset current | | | 25°C | | 9 | 25 | nA |
| | | | | Full range | | | 40 | |
| I _{CC} | Supply current (per channel) | | | 25°C | | 116 | 210 | μA |
| | | | | Full range | | | 230 | |
| | | In shutdown | LMV981 | 25°C | | 0.201 | 1 | |
| | | | | Full range | | | 2 | |
| | | | LM982 | 25°C | | 0.302 | 3.5 | |
| | | | | Full range | | | 5 | |
| CMRR | Common-mode rejection ratio | 0 ≤ V _{IC} ≤ 3.8 V, 4.6 V ≤ V _{IC} ≤ 5 V | | 25°C | 60 | 86 | dB | |
| | | | | –40°C to 85°C | | 55 | | |
| | | 0.3 ≤ V _{IC} ≤ 3.8 V, 4.6 V ≤ V _{IC} ≤ 4.7 V | | –40°C to 125°C | | 55 | | |
| | | | | 25°C | 50 | 78 | | |
| k _{SVR} | Supply-voltage rejection ratio | 1.8 V ≤ V _{CC+} ≤ 5 V, V _{IC} = 0.5 V | | 25°C | 75 | 100 | dB | |
| | | | | Full range | | 70 | | |
| V _{ICR} | Common-mode input voltage range | CMRR ≥ 50 dB | | 25°C | V _{CC–} – 0.2 | –0.2 to 5.3 | V _{CC+} + 0.2 | V |
| | | | | –40°C to 85°C | | V _{CC–} V _{CC+} | | |
| | | | | –40°C to 125°C | | V _{CC–} + 0.3 V _{CC+} – 0.3 | | |
| A _V | Large-signal voltage gain | LMV981 | R _L = 600 Ω to 2.5 V, V _O = 0.2 V to 4.8 V | 25°C | 88 | 102 | dB | |
| | | | | Full range | | 87 | | |
| | | | R _L = 2 kΩ to 2.5 V, V _O = 0.2 V to 4.8 V | 25°C | 94 | 113 | | |
| | | | | Full range | | 93 | | |
| | | LMV982 | R _L = 600 Ω to 2.5 V, V _O = 0.2 V to 4.8 V | 25°C | 81 | 90 | | |
| | | | | Full range | | 78 | | |
| | | | R _L = 2 kΩ to 2.5 V, V _O = 0.2 V to 4.8 V | 25°C | 85 | 100 | | |
| | | | | Full range | | 82 | | |

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electrical characteristics at $T_A = 25^\circ\text{C}$, $V_{CC+} = 5\text{ V}$, $V_{CC-} = 0\text{ V}$, $V_{IC} = V_{CC+}/2$, $V_O = V_{CC+}/2$, $R_L > 1\text{ M}\Omega$, and SHDN tied to V_{CC+} (unless otherwise noted) (continued)

| PARAMETER | | TEST CONDITIONS | | T_A | MIN | TYP | MAX | UNIT |
|------------|--------------------------------|--|------------|------------|-------|-------|-------|------------------------|
| V_O | Output swing | $R_L = 600\ \Omega$ to 2.5 V, $V_{ID} = \pm 100\text{ mV}$ | High level | 25°C | 4.855 | 4.89 | | V |
| | | | | Full range | 4.835 | | | |
| | | | Low level | 25°C | | 0.12 | 0.16 | |
| | | | | Full range | | | 0.18 | |
| | | $R_L = 2\text{ k}\Omega$ to 2.5 V, $V_{ID} = \pm 100\text{ mV}$ | High level | 25°C | 4.945 | 4.967 | | |
| | | | | Full range | 4.935 | | | |
| | | | Low level | 25°C | | 0.037 | 0.065 | |
| | | | | Full range | | | 0.075 | |
| I_{OS} | Output short-circuit current | LMV981: $V_O = 0\text{ V}$, $V_{ID} = 100\text{ mV}$ | Sourcing | 25°C | 80 | 100 | | mA |
| | | | | Full range | 68 | | | |
| | | $V_O = 5\text{ V}$, $V_{ID} = -100\text{ mV}$ | Sinking | 25°C | 58 | 65 | | |
| | | | | Full range | 45 | | | |
| T_{on} | Turn-on time from shutdown | | | 25°C | | 8.4 | | μs |
| V_{SHDN} | Turn-on voltage to enable part | | | 25°C | | 4.2 | | V |
| | Turn-off voltage | | | | | 0.8 | | |
| GBW | Gain bandwidth product | | | 25°C | | 1.5 | | MHz |
| SR | Slew rate | See Note 6 | | 25°C | | 0.42 | | V/ μs |
| Φ_m | Phase margin | | | 25°C | | 71 | | deg |
| | Gain margin | | | 25°C | | 8 | | dB |
| V_n | Equivalent input noise voltage | $f = 1\text{ kHz}$, $V_{IC} = 1\text{ V}$ | | 25°C | | 50 | | nV/ $\sqrt{\text{Hz}}$ |
| I_n | Equivalent input noise current | $f = 1\text{ kHz}$ | | 25°C | | 0.07 | | pA/ $\sqrt{\text{Hz}}$ |
| THD | Total harmonic distortion | $f = 1\text{ kHz}$, $A_V = 1$, $R_L = 600\ \Omega$, $V_{ID} = 1\text{ V}_{PP}$ | | 25°C | | 0.022 | | % |
| | Amp-to-amp isolation | See Note 7 | | 25°C | | 123 | | dB |

- NOTES: 6. Number specified is the slower of the positive and negative slew rates.
7. Input referred, $V_{CC+} = 5\text{ V}$ and $R_L = 100\text{ k}\Omega$ connected to 2.5 V. Each amp is excited in turn with a 1-kHz signal to produce $V_O = 3\text{ V}_{PP}$.

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TYPICAL PERFORMANCE CHARACTERISTICS

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

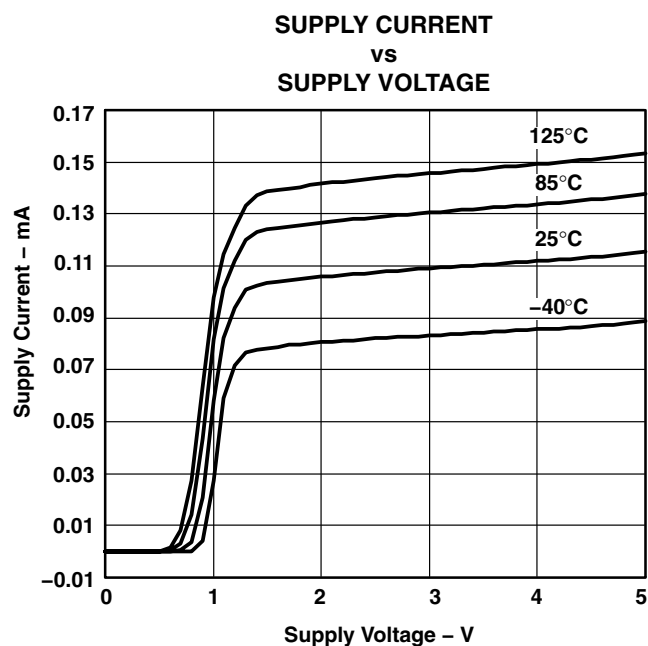


Figure 1

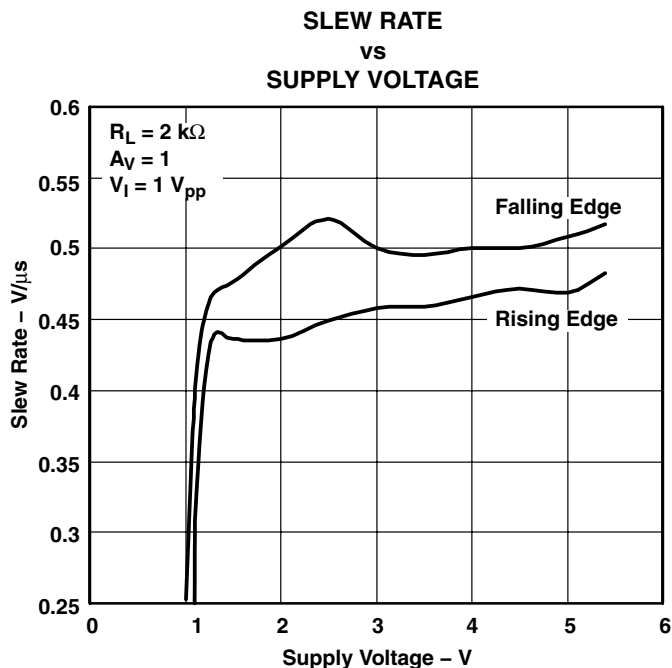


Figure 2

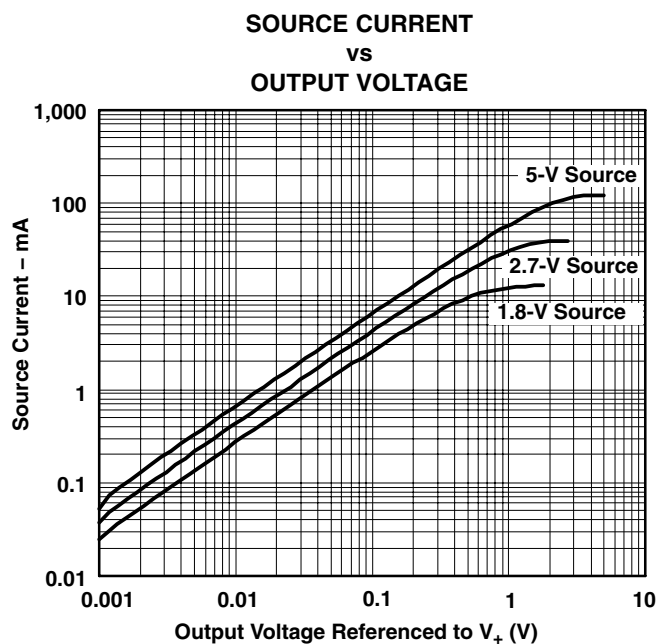


Figure 3

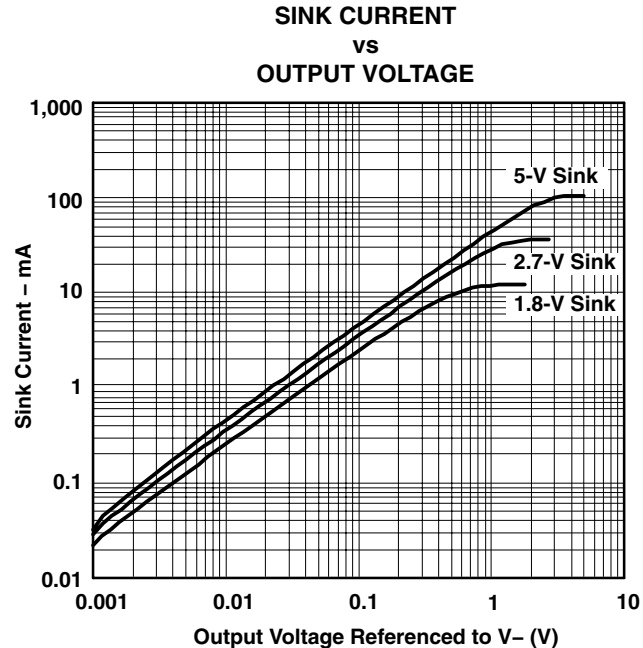


Figure 4

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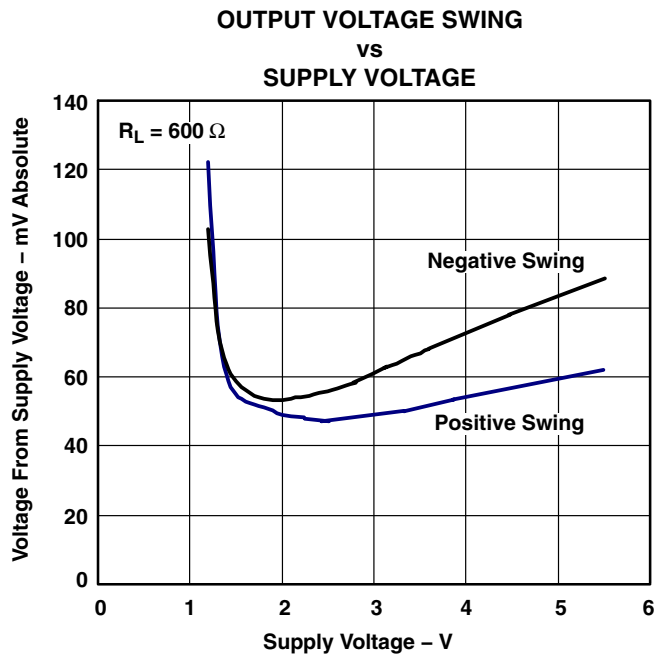


Figure 5

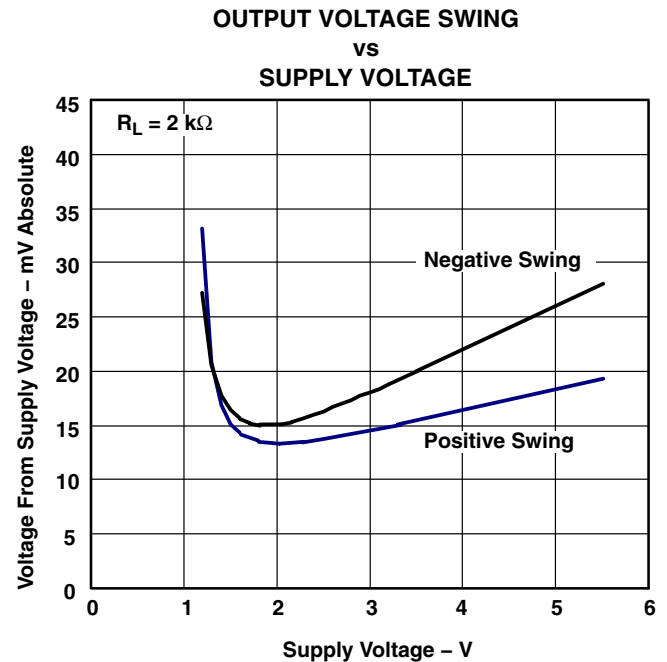


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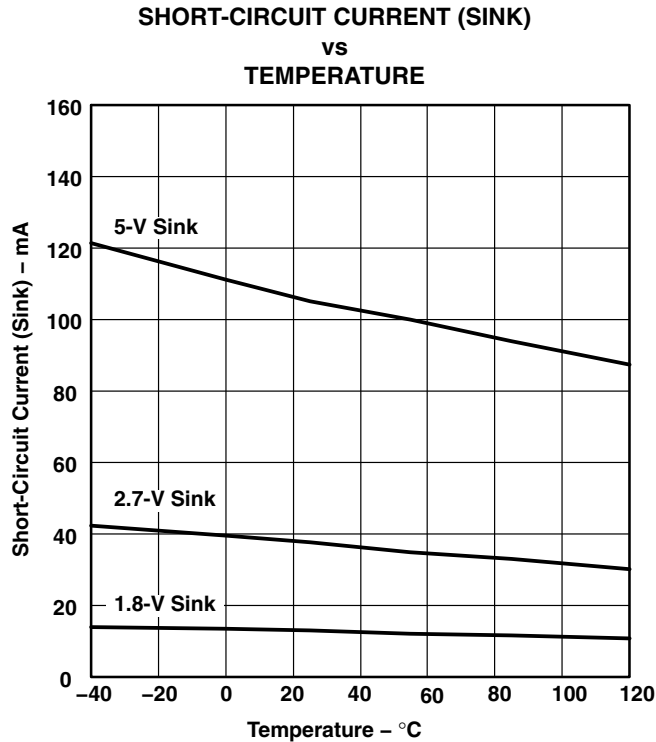


Figure 7

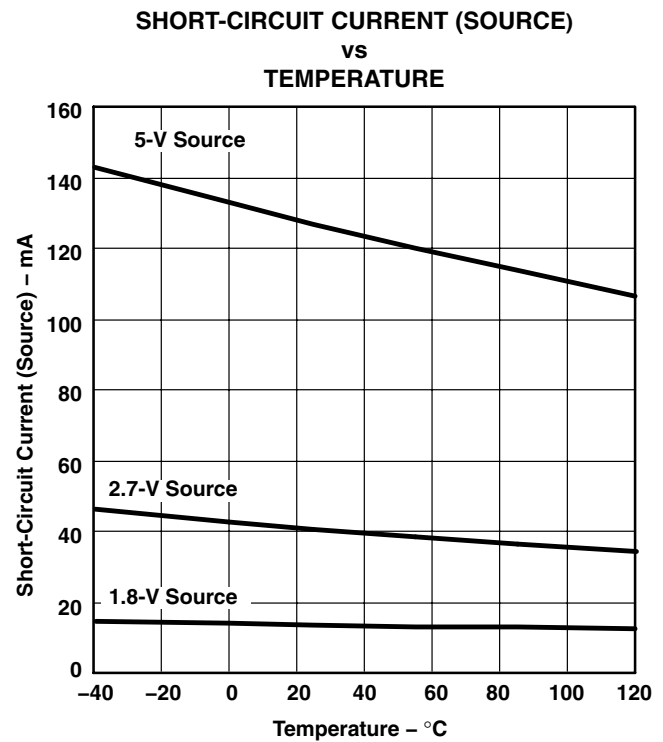


Figure 8

LMV981 SINGLE, LMV982 DUAL

1.8-V OPERATIONAL AMPLIFIERS

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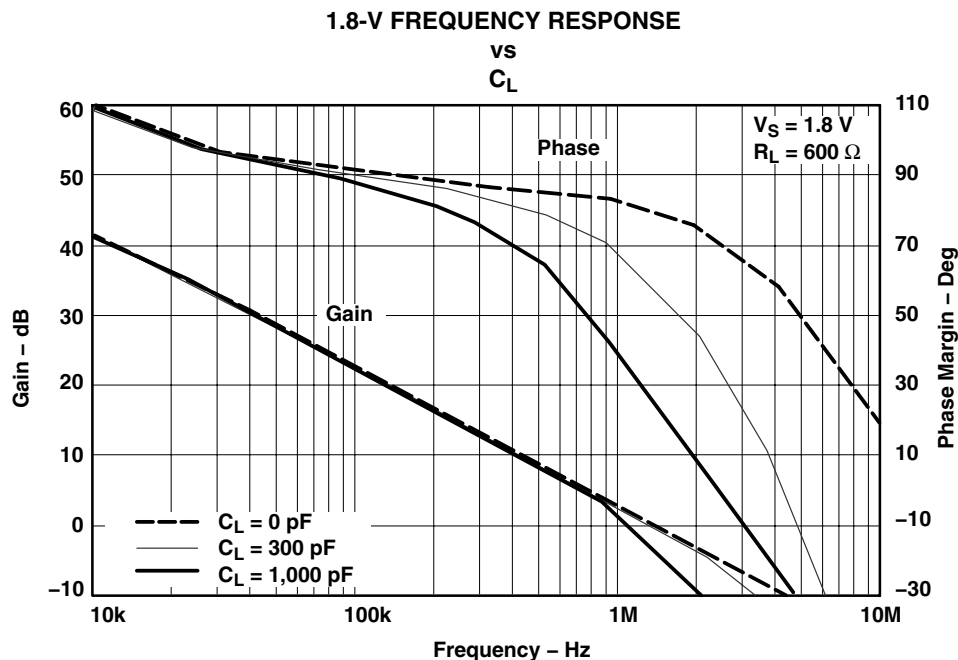


Figure 9

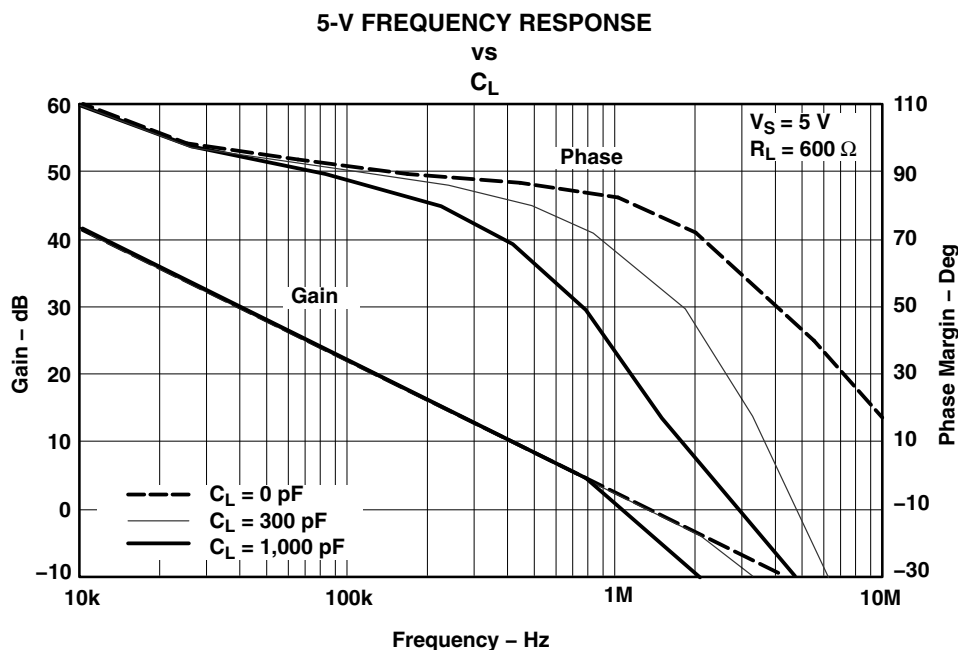


Figure 10

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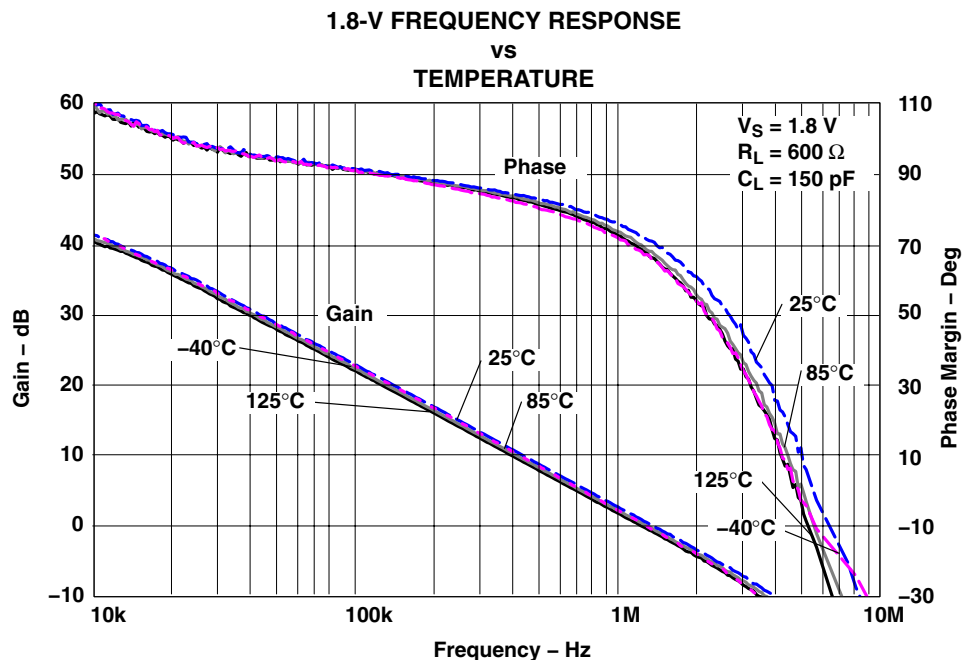


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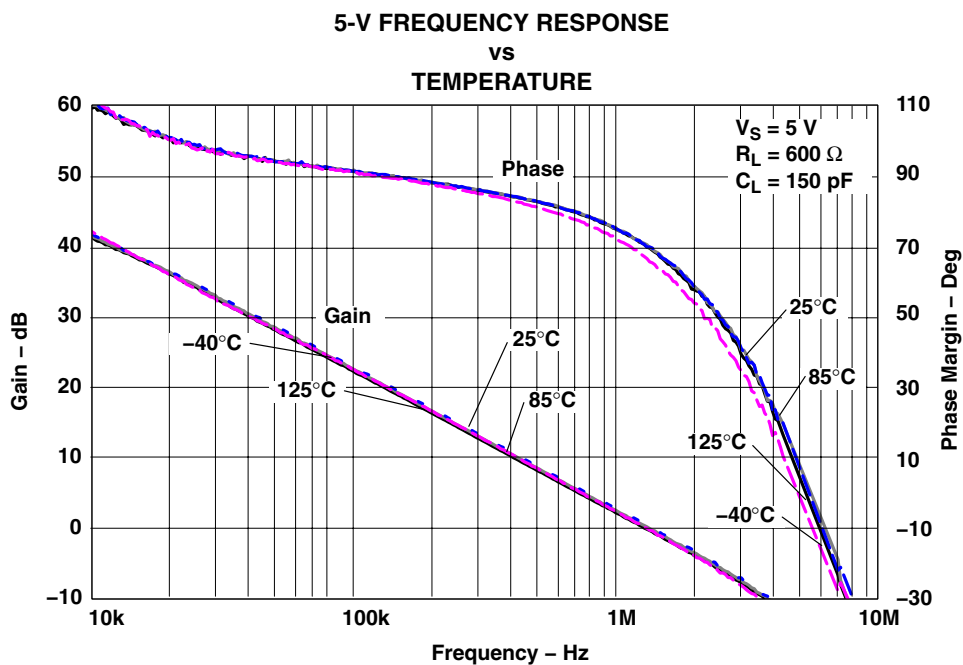


Figure 12

LMV981 SINGLE, LMV982 DUAL 1.8-V OPERATIONAL AMPLIFIERS WITH RAIL-TO-RAIL INPUT AND OUTPUT AND SHUTDOWN

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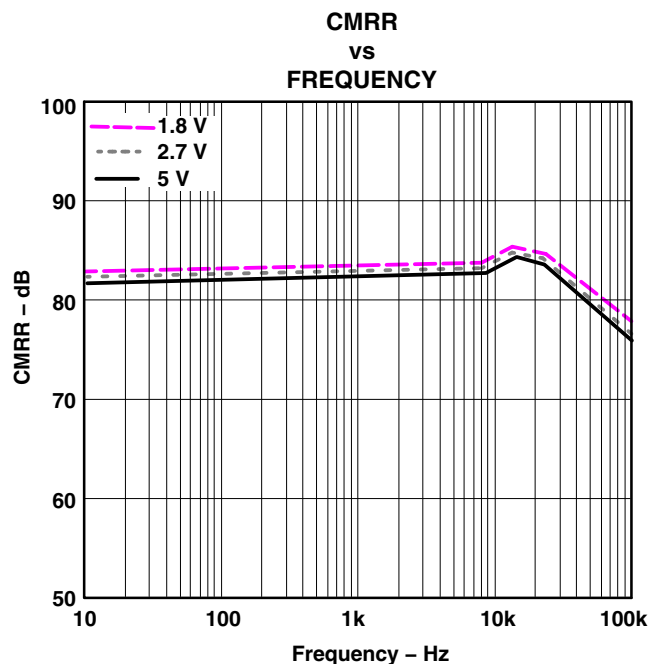


Figure 13

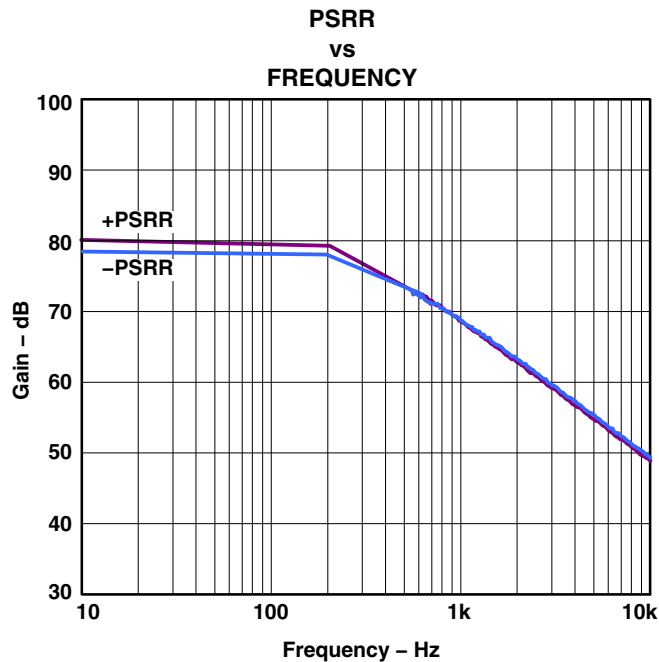


Figure 14

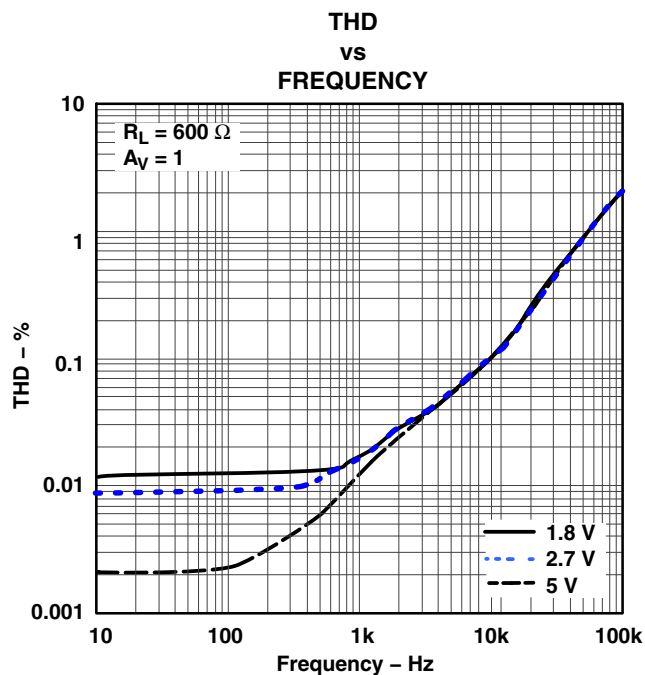


Figure 15

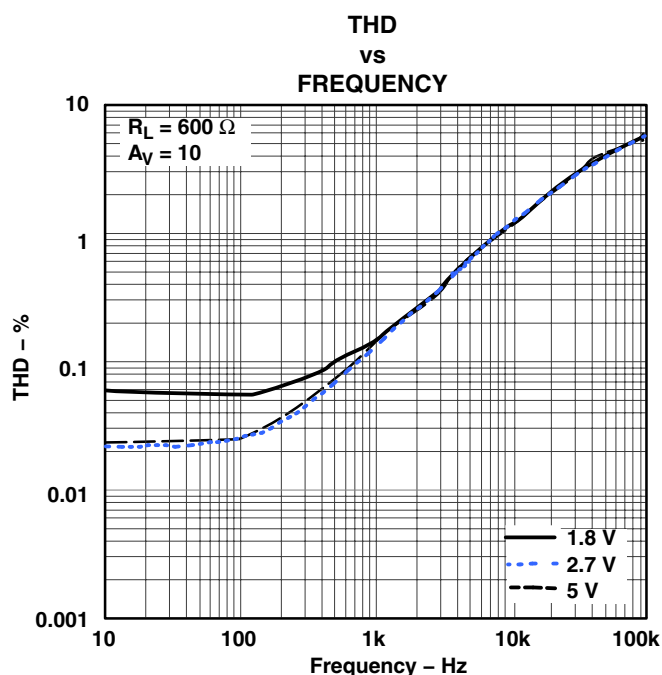


Figure 16

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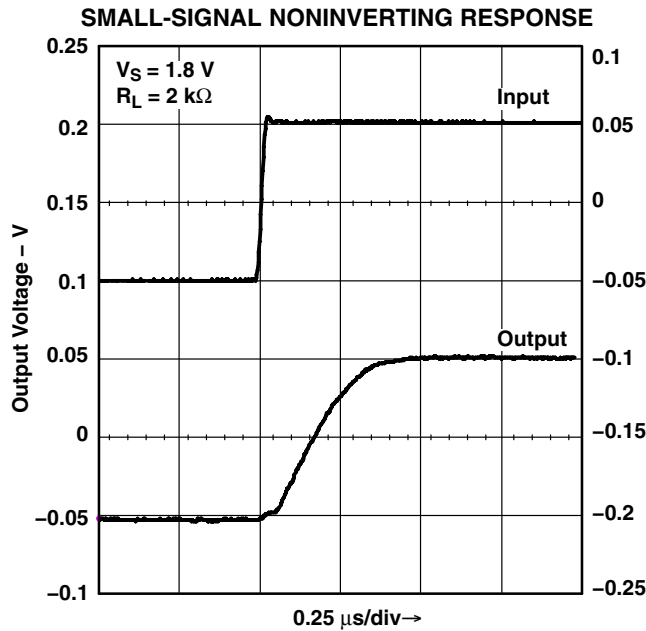


Figure 17

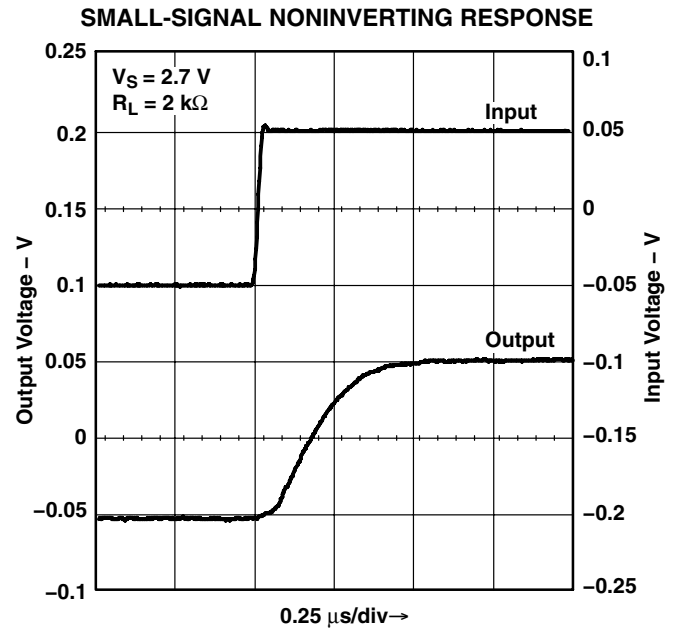


Figure 18

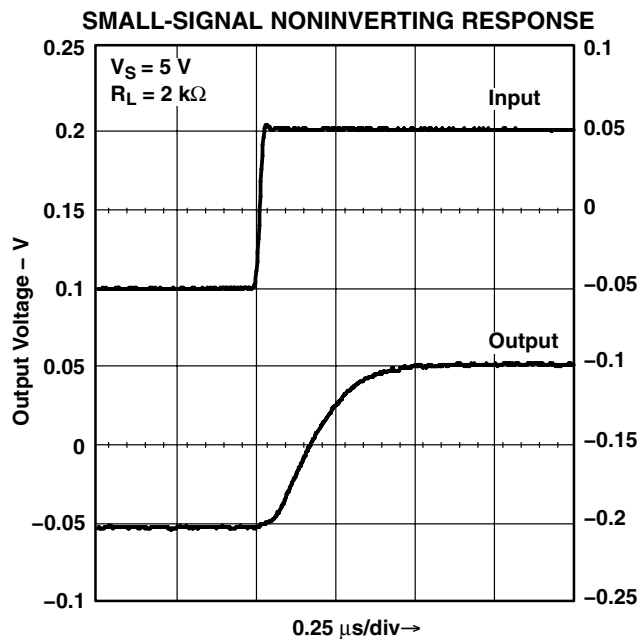


Figure 19

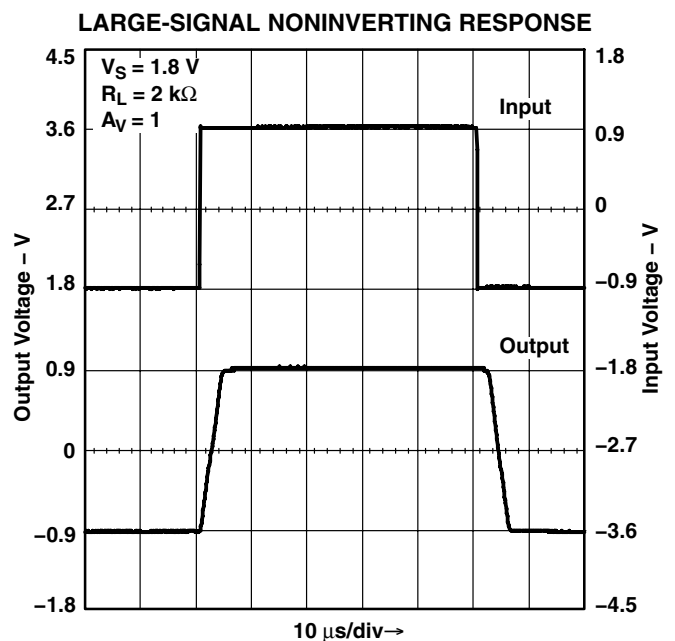


Figure 20

LMV981 SINGLE, LMV982 DUAL 1.8-V OPERATIONAL AMPLIFIERS WITH RAIL-TO-RAIL INPUT AND OUTPUT AND SHUTDOWN

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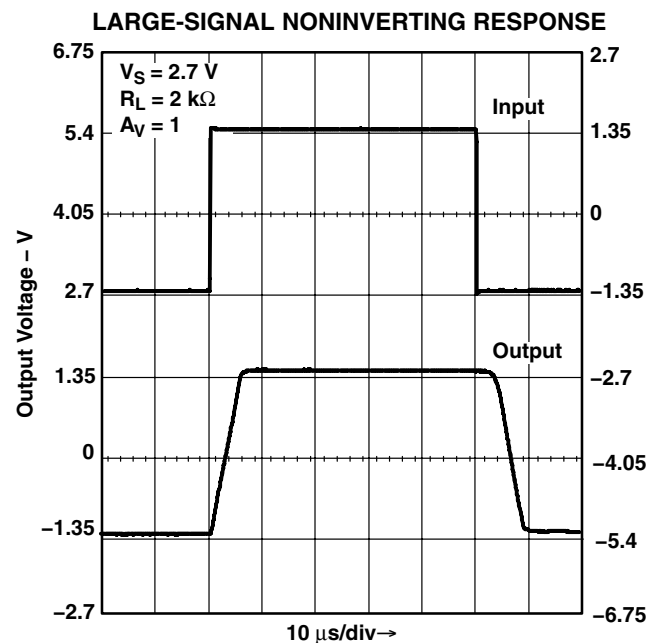


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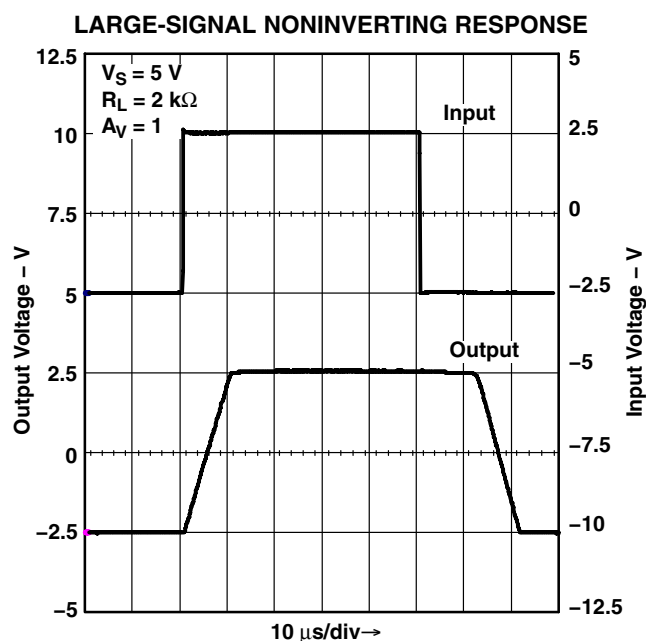


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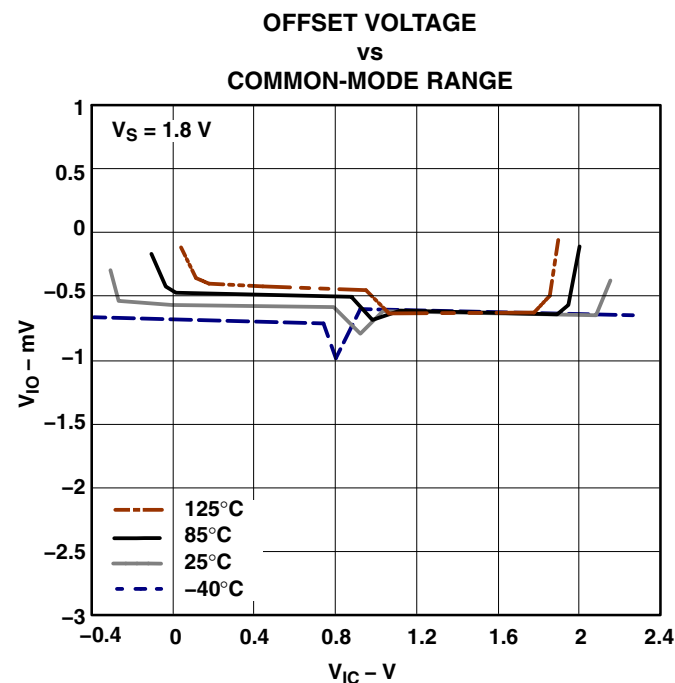


Figure 23

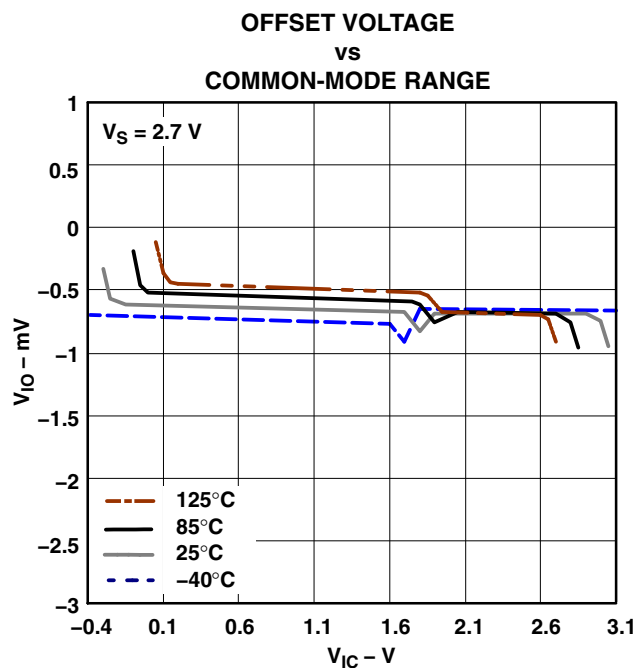


Figure 24

LMV981 SINGLE, LMV982 DUAL 1.8-V OPERATIONAL AMPLIFIERS WITH RAIL-TO-RAIL INPUT AND OUTPUT AND SHUTDOWN

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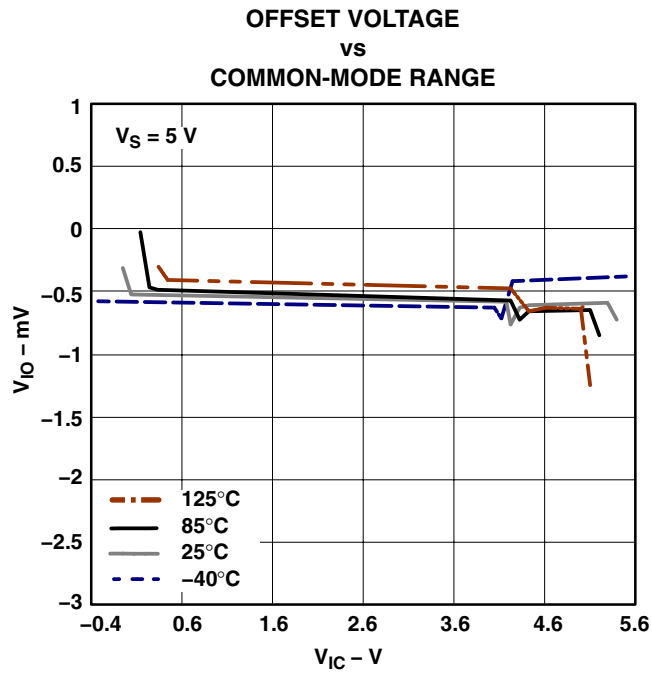


Figure 25

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) |
|------------------|---------------|--------------|--------------------|------|-------------|-----------------|------------------|----------------------|-----------------------------|
| LMV981IDBVR | OBSOLETE | SOT-23 | DBV | 6 | | TBD | Call TI | Call TI | |
| LMV981IDBVRE4 | OBSOLETE | SOT-23 | DBV | 6 | | TBD | Call TI | Call TI | |
| LMV981IDBVRG4 | OBSOLETE | SOT-23 | DBV | 6 | | TBD | Call TI | Call TI | |
| LMV981IDCKR | OBSOLETE | SC70 | DCK | 6 | | TBD | Call TI | Call TI | |
| LMV981IDCKRE4 | OBSOLETE | SC70 | DCK | 6 | | TBD | Call TI | Call TI | |
| LMV981IDCKRG4 | OBSOLETE | SC70 | DCK | 6 | | TBD | Call TI | Call TI | |
| LMV981IRUGR | OBSOLETE | X2QFN | RUG | 8 | | TBD | Call TI | Call TI | |
| LMV981IRUGRG4 | OBSOLETE | X2QFN | RUG | 8 | | TBD | Call TI | Call TI | |
| LMV982IDGSR | OBSOLETE | VSSOP | DGS | 10 | | TBD | Call TI | Call TI | |
| LMV982IDGSRE4 | OBSOLETE | VSSOP | DGS | 10 | | TBD | Call TI | Call TI | |
| LMV982IDGSRG4 | OBSOLETE | VSSOP | DGS | 10 | | TBD | Call TI | Call TI | |

(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)

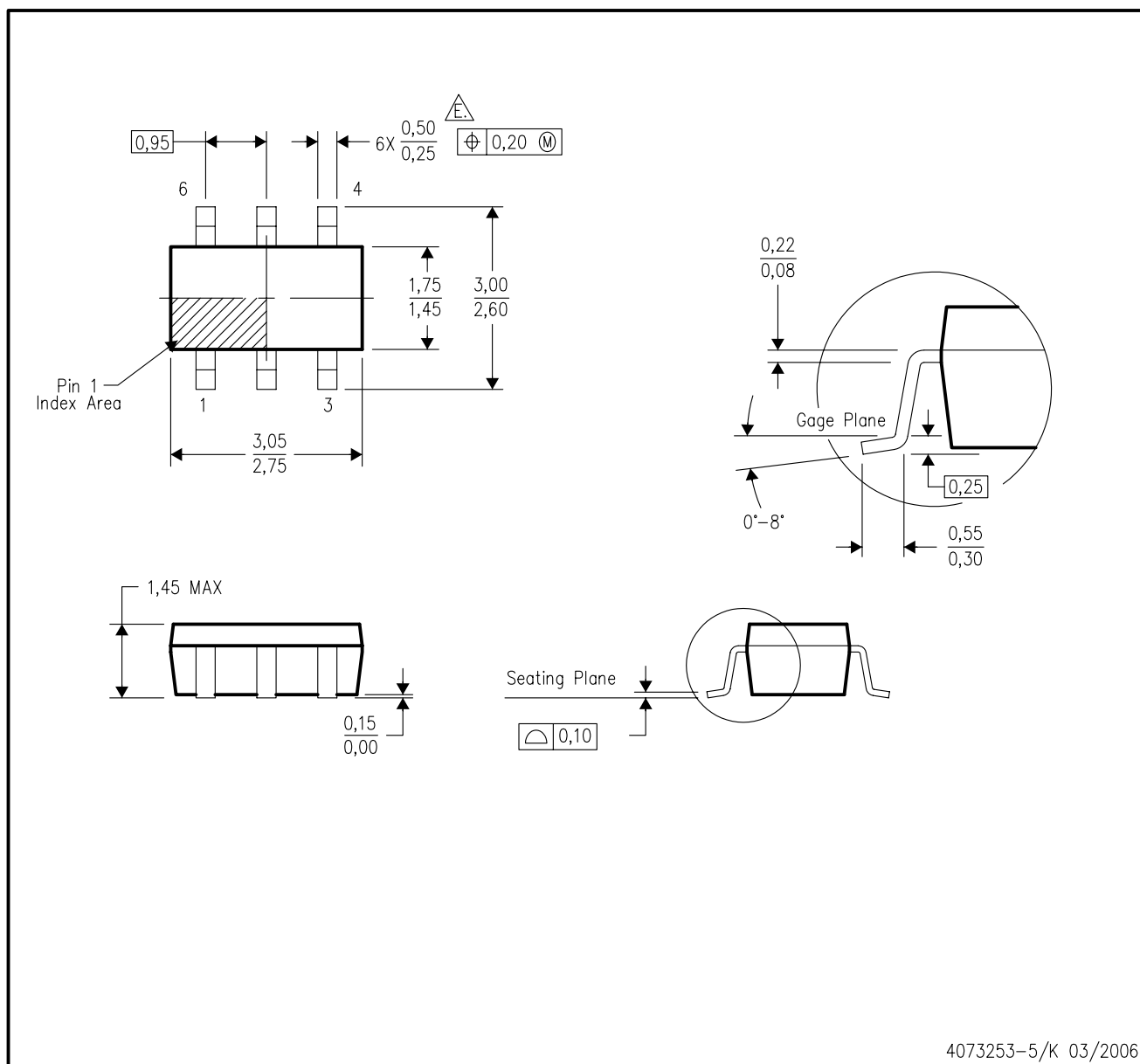
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



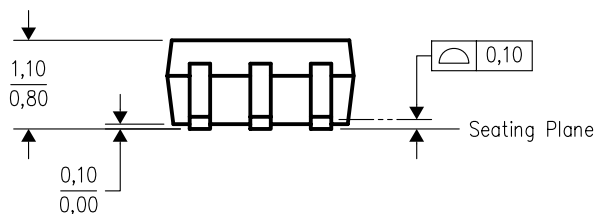
- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
- \triangle Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DGS (S-PDSO-G10)

PLASTIC SMALL-OUTLINE PACKAGE

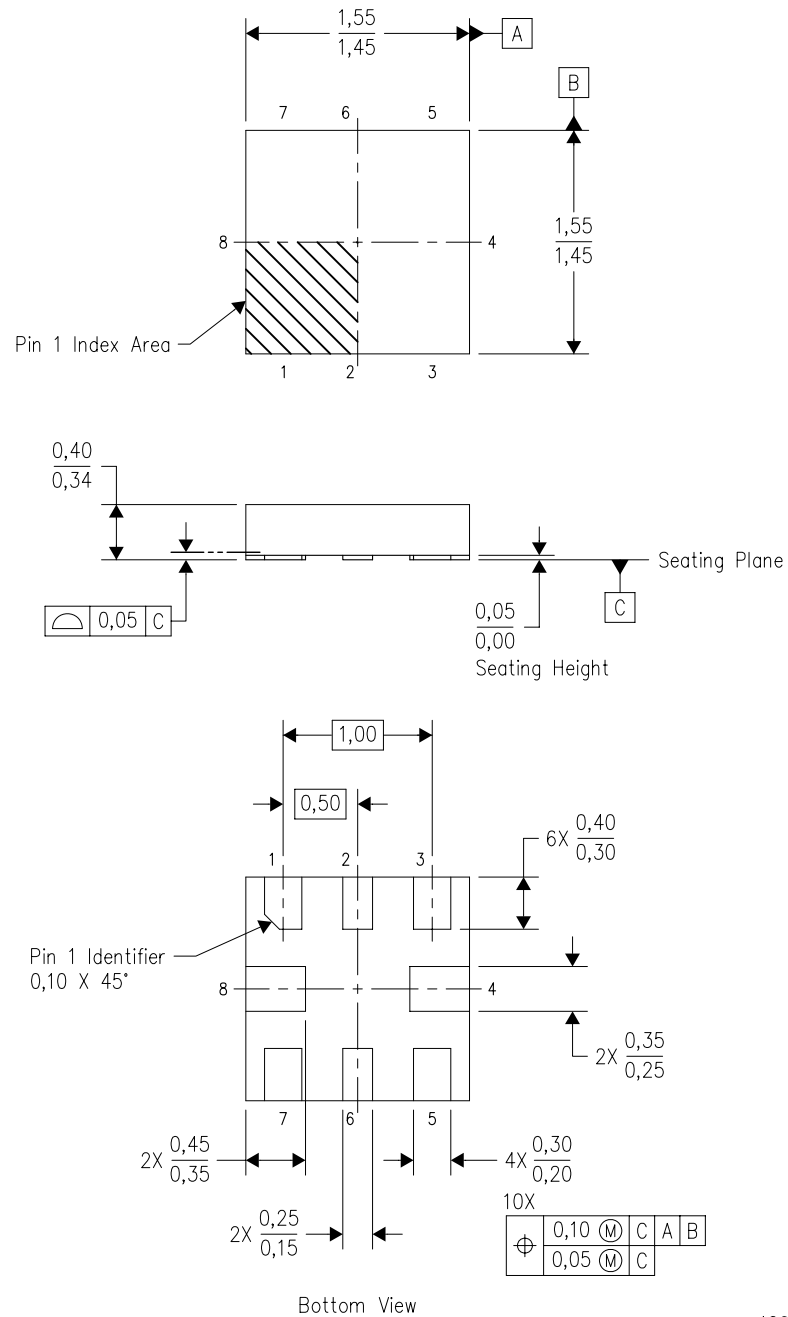


- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion.
 - Falls within JEDEC MO-187 variation BA.



RUG (S-PQFP-N8)

PLASTIC QUAD FLATPACK



4208528-2/B 04/2008

- 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. QFN (Quad Flatpack No-Lead) package configuration.
 - D. This package complies to JEDEC MO-288 variation X2ECD.

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