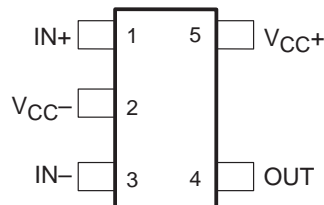


# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

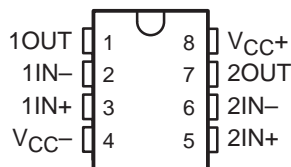
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- **Low Supply-Voltage Operation** . . .  $V_{CC} = \pm 1$  V Min
- **Wide Bandwidth** . . . 7 MHz Typ at  $V_{CC\pm} = \pm 2.5$  V
- **High Slew Rate** . . . 3 V/ $\mu$ s Typ at  $V_{CC\pm} = \pm 2.5$  V
- **Wide Output Voltage Swing** . . .  $\pm 2.4$  V Typ at  $V_{CC\pm} = \pm 2.5$  V,  $R_L = 10$  k $\Omega$
- **Low Noise** . . . 8 nV/ $\sqrt{\text{Hz}}$  Typ at  $f = 1$  kHz
- **Package Options Include SOT-23 (DBV) Package for the TLV2361 and Plastic Small-Outline (D), Thin Shrink Small-Outline (PW), and Dual-In-Line (P) Packages for the TLV2362**

TLV2361 . . . DBV PACKAGE  
(TOP VIEW)



TLV2362 . . . D, P, OR PW PACKAGE  
(TOP VIEW)



## description

The TLV236x devices are high-performance dual operational amplifiers built using an original Texas Instruments bipolar process. These devices can be operated at a very low supply voltage ( $\pm 1$  V), while maintaining a wide output swing. The TLV236x devices offer a dramatically improved dynamic range of signal conditioning in low-voltage systems. The TLV236x devices also provide higher performance than other general-purpose operational amplifiers by combining higher unity-gain bandwidth and faster slew rate. With their low distortion and low-noise performance, these devices are well suited for audio applications.

The C-suffix devices are characterized for operation from 0°C to 70°C and the I-suffix devices are characterized for operation from -40°C to 85°C.

TLV2361 AVAILABLE OPTIONS

| T <sub>A</sub> | PACKAGED DEVICES |  | SYMBOL | CHIP FORM‡ (Y) |
|----------------|------------------|--|--------|----------------|
|                | SOT-23 (DBV)†    |  |        |                |
| 0°C to 70°C    | TLV2361CDBV      |  | VAAC   | TLV2361Y       |
| -40°C to 85°C  | TLV2361IDBV      |  | VAAI   |                |

† The DBV packages are only available taped and reeled.

‡ Chip forms are specified for operation at 25°C only.

TLV2362 AVAILABLE OPTIONS

| T <sub>A</sub> | PACKAGED DEVICES   |                 |             | CHIP FORM‡ (Y) |
|----------------|--------------------|-----------------|-------------|----------------|
|                | SMALL OUTLINE§ (D) | PLASTIC DIP (P) | TSSOP¶ (PW) |                |
| -20°C to 85°C  | TLV2362ID          | TLV2362IP       | TLV2362IPWR | TLV2362Y       |

‡ Chip forms are specified for operation at 25°C only.

§ The D packages are available taped and reeled. Add an R to the package suffix (e.g., TLV2362IDR).

¶ The PW packages are available left-ended taped and reeled only, (e.g., TLV2362IPWR).



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**

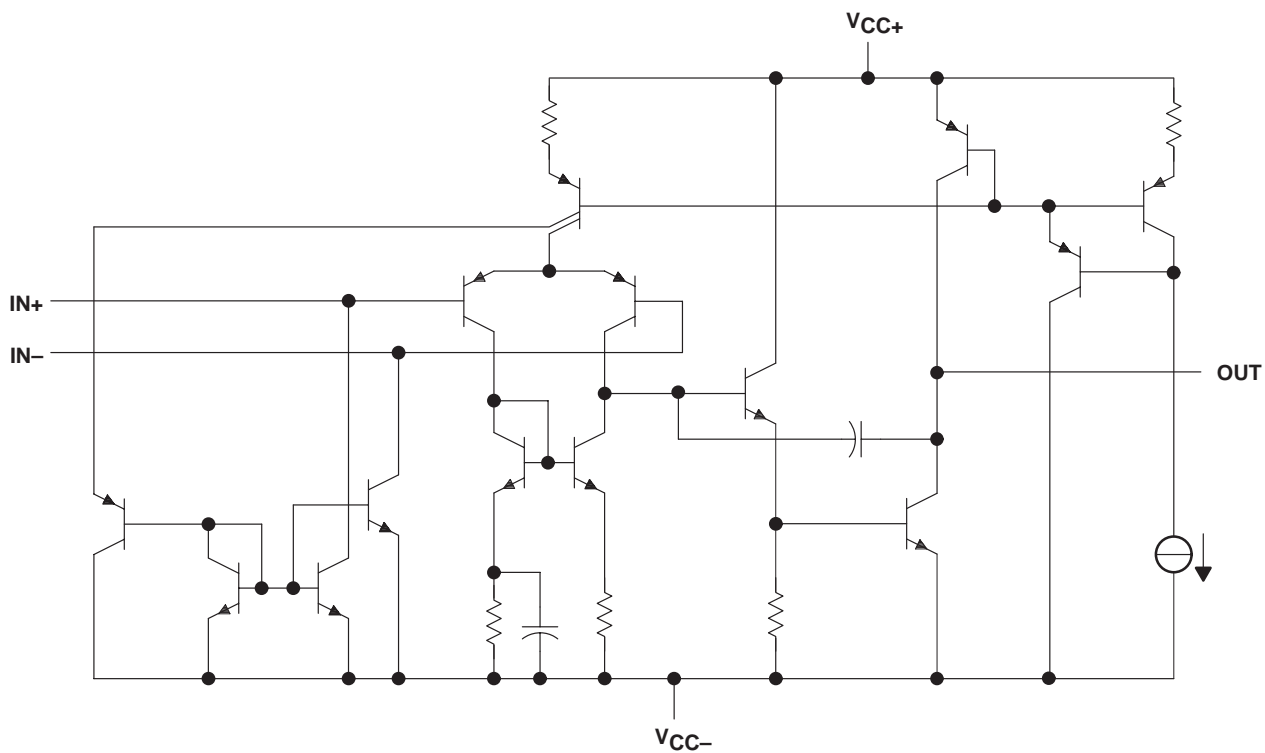
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# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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equivalent schematic (each amplifier)



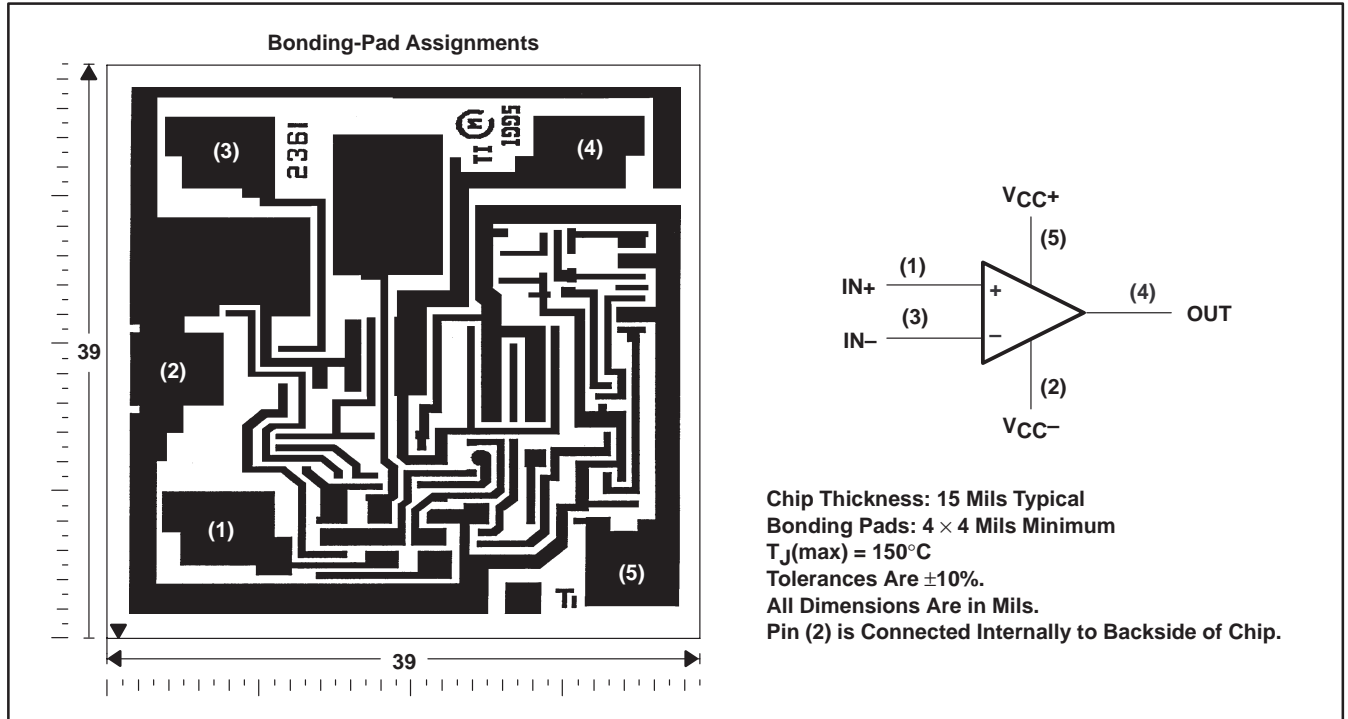
| ACTUAL DEVICE COMPONENT COUNT |         |         |
|-------------------------------|---------|---------|
| COMPONENT                     | TLV2361 | TLV2362 |
| Transistors                   | 30      | 46      |
| Resistors                     | 6       | 11      |
| Diodes                        | 1       | 1       |
| Capacitors                    | 2       | 4       |
| JFET                          | 1       | 1       |

# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TLV2361Y chip information

This chip, when properly assembled, has characteristics similar to the TLV2361. Thermal compression or ultrasonic bonding can be used on the doped-aluminum bonding pads. This chip can be mounted with conductive epoxy or a gold-silicon preform.

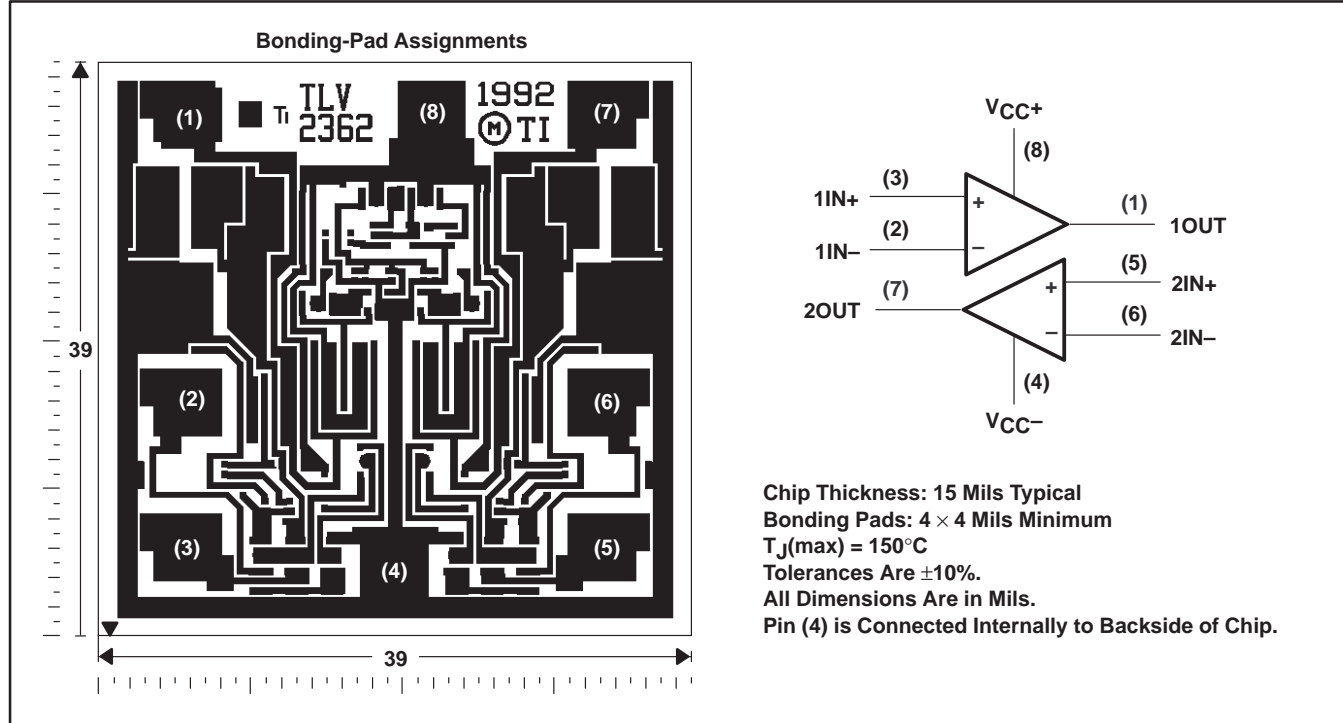


# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TLV2362Y chip information

This chip, when properly assembled, has characteristics similar to the TLV2362. Thermal compression or ultrasonic bonding can be used on the doped-aluminum bonding pads. Chips can be mounted with conductive epoxy or a gold-silicon preform.



# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

|  |                |
|--|----------------|
| Supply voltage, $V_{CC+}$ (see Note 1) .....                                       | 3.5 V          |
| Supply voltage, $V_{CC-}$ (see Note 1) .....                                       | –3.5 V         |
| Differential input voltage, $V_{ID}$ (see Note 2) .....                            | $\pm 3.5$ V    |
| Input voltage, $V_I$ (any input) (see Notes 1 and 3) .....                         | $V_{CC\pm}$    |
| Output voltage, $V_O$ .....  | $\pm 3.5$ V    |
| Output current, $I_O$ .....  | 20 mA          |
| Duration of short-circuit current at (or below) 25°C (output shorted to GND) ..... | Unlimited      |
| Package thermal impedance, $\theta_{JA}$ (see Note 4): D package .....             | 197°C/W        |
| DBV package .....  | 347°C/W        |
| P package .....  | 104°C/W        |
| PW package .....   | 243°C/W        |
| Storage temperature range, $T_{stg}$ .....   | –65°C to 150°C |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds .....                 | 260°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, are with respect to the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .
  2. Differential voltages are at  $IN+$  with respect to  $IN-$ .
  3. All input voltage values must not exceed  $V_{CC}$ .
  4. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

## recommended operating conditions

|                                       | C SUFFIX |           | I SUFFIX |           | UNIT |
|---------------------------------------|----------|-----------|----------|-----------|------|
|                                       | MIN      | MAX       | MIN      | MAX       |      |
| Supply voltage, $V_{CC}$              | $\pm 1$  | $\pm 2.5$ | $\pm 1$  | $\pm 2.5$ | V    |
| Operating free-air temperature, $T_A$ | 0        | 70        | –40      | 85        | °C   |



# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TLV2361C electrical characteristics, $V_{CC\pm} = \pm 1.5\text{ V}$ (unless otherwise noted)

| PARAMETER  | TEST CONDITIONS                                     | $T_A$       | TLV2361C  |      |      | UNIT |
|--|---|-------------|-----------|------|------|------|
|  |   |             | MIN       | TYP  | MAX  |      |
| $V_{IO}$ Input offset voltage                            | $V_O = 0, V_{IC} = 0$                               | 25°C        |           | 1    | 6    | mV   |
|  |   | 0°C to 70°C |           |      | 7.5  |      |
| $I_{IO}$ Input offset current                            | $V_O = 0, V_{IC} = 0$                               | 25°C        |           | 5    | 100  | nA   |
|  |   | 0°C to 70°C |           |      | 150  |      |
| $I_{IB}$ Input bias current                              | $V_O = 0, V_{IC} = 0$                               | 25°C        |           | 20   | 150  | nA   |
|  |   | 0°C to 70°C |           |      | 250  |      |
| $V_{IC}$ Common-mode input voltage                       | $ V_{IO}  \leq 7.5\text{ mV}$                       | 25°C        | $\pm 0.5$ |      | V    |      |
|  |   | 0°C to 70°C | $\pm 0.5$ |      |      |      |
| $V_{OM+}$ Maximum positive-peak output voltage           | $R_L = 10\text{ k}\Omega$                           | 25°C        | 1.2       | 1.4  | V    |      |
|  | $R_L \geq 10\text{ k}\Omega$                        | 0°C to 70°C | 1.2       |      |      |      |
| $V_{OM-}$ Maximum negative-peak output voltage           | $R_L = 10\text{ k}\Omega$                           | 25°C        | -1.2      | -1.4 | V    |      |
|  | $R_L \geq 10\text{ k}\Omega$                        | 0°C to 70°C | -1.2      |      |      |      |
| $I_{CC}$ Supply current (package)                        | $V_O = 0, \text{ No load}$                          | 25°C        |           | 1.4  | 2.25 | mA   |
|  |   | 0°C to 70°C |           |      | 2.75 |      |
| $A_{VD}$ Large-signal differential voltage amplification | $V_O = \pm 1\text{ V}, R_L = 10\text{ k}\Omega$     | 25°C        | 60        | 80   | dB   |      |
| CMRR Common-mode rejection ratio                         | $V_{IC} = \pm 0.5\text{ V}$                         | 25°C        | 75        |      | dB   |      |
| $k_{SVR}$ Supply-voltage rejection ratio                 | $V_{CC\pm} = \pm 1.5\text{ V to } \pm 2.5\text{ V}$ | 25°C        | 80        |      | dB   |      |

## TLV2361C operating characteristics, $V_{CC\pm} = \pm 1.5\text{ V}, T_A = 25^\circ\text{C}$

| PARAMETER                            | TEST CONDITIONS  | TLV2361C |     |     | UNIT                   |
|--------------------------------------|--|----------|-----|-----|------------------------|
|                                      |  | MIN      | TYP | MAX |                        |
| SR Slew rate                         | $A_V = 1, V_I = \pm 0.5\text{ V}$                              |          | 2.5 |     | V/ $\mu\text{s}$       |
| $B_1$ Unity-gain bandwidth           | $A_V = 40, R_L = 10\text{ k}\Omega, C_L = 100\text{ pF}$       |          | 6   |     | MHz                    |
| $V_n$ Equivalent input noise voltage | $R_S = 100\ \Omega, R_F = 10\text{ k}\Omega, f = 1\text{ kHz}$ |          | 9   |     | nV/ $\sqrt{\text{Hz}}$ |



# TLV2361, TLV2361Y, TLV2362, TLV2362Y

## HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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### TLV2361C electrical characteristics, $V_{CC\pm} = \pm 2.5$ V (unless otherwise noted)

| PARAMETER |   | TEST CONDITIONS                        | $T_A$       | TLV2361C  |      |     | UNIT |
|-----------|---|--|-------------|-----------|------|-----|------|
|           |   |  |             | MIN       | TYP  | MAX |      |
| $V_{IO}$  | Input offset voltage                            | $V_O = 0, V_{IC} = 0$                  | 25°C        | 1         | 6    | mV  |      |
|           |   |  | 0°C to 70°C | 7.5       |      |     |      |
| $I_{IO}$  | Input offset current                            | $V_O = 0, V_{IC} = 0$                  | 25°C        | 5         | 100  | nA  |      |
|           |   |  | 0°C to 70°C | 150       |      |     |      |
| $I_{IB}$  | Input bias current                              | $V_O = 0, V_{IC} = 0$                  | 25°C        | 20        | 150  | nA  |      |
|           |   |  | 0°C to 70°C | 250       |      |     |      |
| $V_{IC}$  | Common-mode input voltage                       | $ V_{IO}  \leq 7.5$ mV                 | 25°C        | $\pm 1.5$ |      | V   |      |
|           |   |  | 0°C to 70°C | $\pm 1.4$ |      |     |      |
| $V_{OM+}$ | Maximum positive-peak output voltage            | $R_L = 10$ k $\Omega$                  | 25°C        | 2         | 2.4  | V   |      |
|           |   | $R_L \geq 10$ k $\Omega$               | 0°C to 70°C | 2         |      |     |      |
| $V_{OM-}$ | Maximum negative-peak output voltage            | $R_L = 10$ k $\Omega$                  | 25°C        | -2        | -2.4 | V   |      |
|           |   | $R_L \geq 10$ k $\Omega$               | 0°C to 70°C | -2        |      |     |      |
| $I_{CC}$  | Supply current (package)                        | $V_O = 0, \text{ No load}$             | 25°C        | 1.75      | 2.5  | mA  |      |
|           |   |  | 0°C to 70°C | 3         |      |     |      |
| $A_{VD}$  | Large-signal differential voltage amplification | $V_O = \pm 1$ V, $R_L = 10$ k $\Omega$ | 25°C        | 60        | 80   | dB  |      |
| CMRR      | Common-mode rejection ratio                     | $V_{IC} = \pm 0.5$ V                   | 25°C        | 85        |      | dB  |      |
| kSVR      | Supply-voltage rejection ratio                  | $V_{CC\pm} = \pm 1.5$ V to $\pm 2.5$ V | 25°C        | 80        |      | dB  |      |

### TLV2361C operating characteristics, $V_{CC\pm} = \pm 2.5$ V, $T_A = 25^\circ\text{C}$

| PARAMETER |                                      | TEST CONDITIONS  | TLV2361C |     |     | UNIT                   |
|-----------|--------------------------------------|--|----------|-----|-----|------------------------|
|           |                                      |  | MIN      | TYP | MAX |                        |
| SR        | Slew rate                            | $A_V = 1, V_I = \pm 0.5$ V                                   | 3        |     |     | V/ $\mu$ s             |
| $B_1$     | Unity-gain bandwidth                 | $A_V = 40, R_L = 10$ k $\Omega, C_L = 100$ pF                | 7        |     |     | MHz                    |
| $V_n$     | Equivalent input noise voltage       | $R_S = 100$ $\Omega, R_F = 10$ k $\Omega, f = 1$ kHz         | 8        |     |     | nV/ $\sqrt{\text{Hz}}$ |
| THD + N   | Total harmonic distortion plus noise | $A_V = 1, V_O = \pm 1.2$ V, $R_L = 10$ k $\Omega, f = 3$ kHz | 0.004%   |     |     |                        |



# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TLV2361I electrical characteristics, $V_{CC\pm} = \pm 1.5\text{ V}$ (unless otherwise noted)

| PARAMETER  | TEST CONDITIONS                                     | $T_A$         | TLV2361I |           |      | UNIT |
|--|---|---------------|----------|-----------|------|------|
|  |   |               | MIN      | TYP       | MAX  |      |
| $V_{IO}$ Input offset voltage                            | $V_O = 0, V_{IC} = 0$                               | 25°C          |          | 1         | 6    | mV   |
|  |   | -40°C to 85°C |          |           | 7.5  |      |
| $I_{IO}$ Input offset current                            | $V_O = 0, V_{IC} = 0$                               | 25°C          |          | 5         | 100  | nA   |
|  |   | -40°C to 85°C |          |           | 150  |      |
| $I_{IB}$ Input bias current                              | $V_O = 0, V_{IC} = 0$                               | 25°C          |          | 20        | 150  | nA   |
|  |   | -40°C to 85°C |          |           | 250  |      |
| $V_{IC}$ Common-mode input voltage                       | $ V_{IO}  \leq 7.5\text{ mV}$                       | 25°C          |          | $\pm 0.5$ |      | V    |
|  |   | -40°C to 85°C |          | $\pm 0.5$ |      |      |
| $V_{OM+}$ Maximum positive-peak output voltage           | $R_L = 10\text{ k}\Omega$                           | 25°C          |          | 1.2       | 1.4  | V    |
|  | $R_L \geq 10\text{ k}\Omega$                        | -40°C to 85°C |          | 1.2       |      |      |
| $V_{OM-}$ Maximum negative-peak output voltage           | $R_L = 10\text{ k}\Omega$                           | 25°C          |          | -1.2      | -1.4 | V    |
|  | $R_L \geq 10\text{ k}\Omega$                        | -40°C to 85°C |          | -1.2      |      |      |
| $I_{CC}$ Supply current (package)                        | $V_O = 0, \text{ No load}$                          | 25°C          |          | 1.4       | 2.25 | mA   |
|  |   | -40°C to 85°C |          |           | 2.75 |      |
| $A_{VD}$ Large-signal differential voltage amplification | $V_O = \pm 1\text{ V}, R_L = 10\text{ k}\Omega$     | 25°C          |          | 60        | 80   | dB   |
| CMRR Common-mode rejection ratio                         | $V_{IC} = \pm 0.5\text{ V}$                         | 25°C          |          | 75        |      | dB   |
| $k_{SVR}$ Supply-voltage rejection ratio                 | $V_{CC\pm} = \pm 1.5\text{ V to } \pm 2.5\text{ V}$ | 25°C          |          | 80        |      | dB   |

## TLV2361I operating characteristics, $V_{CC\pm} = \pm 1.5\text{ V}, T_A = 25^\circ\text{C}$

| PARAMETER                            | TEST CONDITIONS  | TLV2361I |     |     | UNIT                   |
|--------------------------------------|--|----------|-----|-----|------------------------|
|                                      |  | MIN      | TYP | MAX |                        |
| SR Slew rate                         | $A_V = 1, V_I = \pm 0.5\text{ V}$                              |          | 2.5 |     | V/ $\mu\text{s}$       |
| $B_1$ Unity-gain bandwidth           | $A_V = 40, R_L = 10\text{ k}\Omega, C_L = 100\text{ pF}$       |          | 6   |     | MHz                    |
| $V_n$ Equivalent input noise voltage | $R_S = 100\ \Omega, R_F = 10\text{ k}\Omega, f = 1\text{ kHz}$ |          | 9   |     | nV/ $\sqrt{\text{Hz}}$ |





# TLV2361, TLV2361Y, TLV2362, TLV2362Y

## HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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### TLV2361I electrical characteristics, $V_{CC\pm} = \pm 2.5\text{ V}$ (unless otherwise noted)

| PARAMETER |   | TEST CONDITIONS                                     | $T_A$         | TLV2361I  |      |     | UNIT |
|-----------|---|---|---------------|-----------|------|-----|------|
|           |   |   |               | MIN       | TYP  | MAX |      |
| $V_{IO}$  | Input offset voltage                            | $V_O = 0, V_{IC} = 0$                               | 25°C          | 1         | 6    | mV  |      |
|           |   |   | -40°C to 85°C | 7.5       |      |     |      |
| $I_{IO}$  | Input offset current                            | $V_O = 0, V_{IC} = 0$                               | 25°C          | 5         | 100  | nA  |      |
|           |   |   | -40°C to 85°C | 150       |      |     |      |
| $I_{IB}$  | Input bias current                              | $V_O = 0, V_{IC} = 0$                               | 25°C          | 20        | 150  | nA  |      |
|           |   |   | -40°C to 85°C | 250       |      |     |      |
| $V_{IC}$  | Common-mode input voltage                       | $ V_{IO}  \leq 7.5\text{ mV}$                       | 25°C          | $\pm 1.5$ |      | V   |      |
|           |   |   | -40°C to 85°C | $\pm 1.4$ |      |     |      |
| $V_{OM+}$ | Maximum positive-peak output voltage            | $R_L = 10\text{ k}\Omega$                           | 25°C          | 2         | 2.4  | V   |      |
|           |   | $R_L \geq 10\text{ k}\Omega$                        | -40°C to 85°C | 2         |      |     |      |
| $V_{OM-}$ | Maximum negative-peak output voltage            | $R_L = 10\text{ k}\Omega$                           | 25°C          | -2        | -2.4 | V   |      |
|           |   | $R_L \geq 10\text{ k}\Omega$                        | -40°C to 85°C | -2        |      |     |      |
| $I_{CC}$  | Supply current (package)                        | $V_O = 0, \text{ No load}$                          | 25°C          | 1.75      | 2.5  | mA  |      |
|           |   |   | -40°C to 85°C | 3         |      |     |      |
| $A_{VD}$  | Large-signal differential voltage amplification | $V_O = \pm 1\text{ V}, R_L = 10\text{ k}\Omega$     | 25°C          | 60        | 80   | dB  |      |
| CMRR      | Common-mode rejection ratio                     | $V_{IC} = \pm 0.5\text{ V}$                         | 25°C          | 85        |      | dB  |      |
| kSVR      | Supply-voltage rejection ratio                  | $V_{CC\pm} = \pm 1.5\text{ V to } \pm 2.5\text{ V}$ | 25°C          | 80        |      | dB  |      |

### TLV2361I operating characteristics, $V_{CC\pm} = \pm 2.5\text{ V}, T_A = 25^\circ\text{C}$

| PARAMETER |                                | TEST CONDITIONS  | TLV2361I |     |     | UNIT                   |
|-----------|--------------------------------|--|----------|-----|-----|------------------------|
|           |                                |  | MIN      | TYP | MAX |                        |
| SR        | Slew rate                      | $A_V = 1, V_I = \pm 0.5\text{ V}$                              | 3        |     |     | V/ $\mu\text{s}$       |
| $B_1$     | Unity-gain bandwidth           | $A_V = 40, R_L = 10\text{ k}\Omega, C_L = 100\text{ pF}$       | 7        |     |     | MHz                    |
| $V_n$     | Equivalent input noise voltage | $R_S = 100\ \Omega, R_F = 10\text{ k}\Omega, f = 1\text{ kHz}$ | 8        |     |     | nV/ $\sqrt{\text{Hz}}$ |



# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TLV2361Y electrical characteristics, $V_{CC\pm} = \pm 1.5\text{ V}$ , $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER  | TEST CONDITIONS                                     | TLV2361Y |     |     | UNIT |
|--|---|----------|-----|-----|------|
|  |   | MIN      | TYP | MAX |      |
| $V_{IO}$ Input offset voltage                            | $V_O = 0$ , $V_{IC} = 0$                            | 1        |     |     | mV   |
| $I_{IO}$ Input offset current                            | $V_O = 0$ , $V_{IC} = 0$                            | 5        |     |     | nA   |
| $I_{IB}$ Input bias current                              | $V_O = 0$ , $V_{IC} = 0$                            | 20       |     |     | nA   |
| $V_{OM+}$ Maximum positive-peak output voltage           | $R_L = 10\text{ k}\Omega$                           | 1.4      |     |     | V    |
| $V_{OM-}$ Maximum negative-peak output voltage           | $R_L = 10\text{ k}\Omega$                           | -1.4     |     |     | V    |
| $I_{CC}$ Supply current                                  | $V_O = 0$ , No load                                 | 1.4      |     |     | mA   |
| $A_{VD}$ Large-signal differential voltage amplification | $V_O = \pm 1\text{ V}$ , $R_L = 10\text{ k}\Omega$  | 80       |     |     | dB   |
| CMRR Common-mode rejection ratio                         | $V_{IC} = \pm 0.5\text{ V}$                         | 75       |     |     | dB   |
| $k_{SVR}$ Supply-voltage rejection ratio                 | $V_{CC\pm} = \pm 1.5\text{ V to } \pm 2.5\text{ V}$ | 80       |     |     | dB   |

## TLV2361Y operating characteristics, $V_{CC\pm} = \pm 1.5\text{ V}$ , $T_A = 25^\circ\text{C}$

| PARAMETER                            | TEST CONDITIONS  | TLV2361Y |     |     | UNIT                   |
|--------------------------------------|--|----------|-----|-----|------------------------|
|                                      |  | MIN      | TYP | MAX |                        |
| SR Slew rate                         | $A_V = 1$ , $V_I = \pm 0.5\text{ V}$                                 | 2.5      |     |     | V/ $\mu\text{s}$       |
| $B_1$ Unity-gain bandwidth           | $A_V = 40$ , $R_L = 10\text{ k}\Omega$ , $C_L = 100\text{ pF}$       | 6        |     |     | MHz                    |
| $V_n$ Equivalent input noise voltage | $R_S = 100\ \Omega$ , $R_F = 10\text{ k}\Omega$ , $f = 1\text{ kHz}$ | 9        |     |     | nV/ $\sqrt{\text{Hz}}$ |

## TLV2361Y electrical characteristics, $V_{CC\pm} = \pm 2.5\text{ V}$ , $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER  | TEST CONDITIONS                                     | TLV2361Y |     |     | UNIT |
|--|---|----------|-----|-----|------|
|  |   | MIN      | TYP | MAX |      |
| $V_{IO}$ Input offset voltage                            | $V_O = 0$ , $V_{IC} = 0$                            | 1        |     |     | mV   |
| $I_{IO}$ Input offset current                            | $V_O = 0$ , $V_{IC} = 0$                            | 5        |     |     | nA   |
| $I_{IB}$ Input bias current                              | $V_O = 0$ , $V_{IC} = 0$                            | 20       |     |     | nA   |
| $V_{OM+}$ Maximum positive-peak output voltage           | $R_L = 10\text{ k}\Omega$                           | 2.4      |     |     | V    |
| $V_{OM-}$ Maximum negative-peak output voltage           | $R_L = 10\text{ k}\Omega$                           | -2.4     |     |     | V    |
| $I_{CC}$ Supply current                                  | $V_O = 0$ , No load                                 | 1.75     |     |     | mA   |
| $A_{VD}$ Large-signal differential voltage amplification | $V_O = \pm 1\text{ V}$ , $R_L = 10\text{ k}\Omega$  | 80       |     |     | dB   |
| CMRR Common-mode rejection ratio                         | $V_{IC} = \pm 0.5\text{ V}$                         | 85       |     |     | dB   |
| $k_{SVR}$ Supply-voltage rejection ratio                 | $V_{CC\pm} = \pm 1.5\text{ V to } \pm 2.5\text{ V}$ | 80       |     |     | dB   |

## TLV2361Y operating characteristics, $V_{CC\pm} = \pm 2.5\text{ V}$ , $T_A = 25^\circ\text{C}$

| PARAMETER                            | TEST CONDITIONS  | TLV2361Y |     |     | UNIT                   |
|--------------------------------------|--|----------|-----|-----|------------------------|
|                                      |  | MIN      | TYP | MAX |                        |
| SR Slew rate                         | $A_V = 1$ , $V_I = \pm 0.5\text{ V}$                                 | 3        |     |     | V/ $\mu\text{s}$       |
| $B_1$ Unity-gain bandwidth           | $A_V = 40$ , $R_L = 10\text{ k}\Omega$ , $C_L = 100\text{ pF}$       | 7        |     |     | MHz                    |
| $V_n$ Equivalent input noise voltage | $R_S = 100\ \Omega$ , $R_F = 10\text{ k}\Omega$ , $f = 1\text{ kHz}$ | 8        |     |     | nV/ $\sqrt{\text{Hz}}$ |



# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TLV2362I electrical characteristics, $V_{CC\pm} = \pm 1.5\text{ V}$ (unless otherwise noted)

| PARAMETER |   | TEST CONDITIONS                                     | $T_A$         | TLV2362I  |      |     | UNIT |
|-----------|---|---|---------------|-----------|------|-----|------|
|           |   |   |               | MIN       | TYP  | MAX |      |
| $V_{IO}$  | Input offset voltage                            | $V_O = 0, V_{IC} = 0$                               | 25°C          | 1         | 6    | mV  |      |
|           |   |   | -20°C to 85°C |           | 7.5  |     |      |
| $I_{IO}$  | Input offset current                            | $V_O = 0, V_{IC} = 0$                               | 25°C          | 5         | 100  | nA  |      |
|           |   |   | -20°C to 85°C |           | 150  |     |      |
| $I_{IB}$  | Input bias current                              | $V_O = 0, V_{IC} = 0$                               | 25°C          | 20        | 150  | nA  |      |
|           |   |   | -20°C to 85°C |           | 250  |     |      |
| $V_{ICR}$ | Common-mode input voltage                       | $ V_{IO}  \leq 3.75\text{ mV}$                      | 25°C          | $\pm 0.5$ |      | V   |      |
|           |   |   | -20°C to 85°C | $\pm 0.5$ |      |     |      |
| $V_{OM+}$ | Maximum positive-peak output voltage            | $R_L = 10\text{ k}\Omega$                           | 25°C          | 1.2       | 1.4  | V   |      |
|           |   | $R_L \geq 10\text{ k}\Omega$                        | -20°C to 85°C | 1.2       |      |     |      |
| $V_{OM-}$ | Maximum negative-peak output voltage            | $R_L = 10\text{ k}\Omega$                           | 25°C          | -1.2      | -1.4 | V   |      |
|           |   | $R_L \geq 10\text{ k}\Omega$                        | -20°C to 85°C | -1.2      |      |     |      |
| $I_{CC}$  | Supply current (both amplifiers)                | $V_O = 0, \text{ No load}$                          | 25°C          | 2.8       | 4.5  | mA  |      |
|           |   |   | -20°C to 85°C |           | 5.5  |     |      |
| $A_{VD}$  | Large-signal differential voltage amplification | $V_O = \pm 1\text{ V}, R_L = 10\text{ k}\Omega$     | 25°C          | 55        |      | dB  |      |
| CMRR      | Common-mode rejection ratio                     | $V_{IC} = \pm 0.5\text{ V}$                         | 25°C          | 75        |      | dB  |      |
| $k_{SVR}$ | Supply-voltage rejection ratio                  | $V_{CC\pm} = \pm 1.5\text{ V to } \pm 2.5\text{ V}$ | 25°C          | 80        |      | dB  |      |

## TLV2362I operating characteristics, $V_{CC\pm} = \pm 1.5\text{ V}, T_A = 25^\circ\text{C}$

| PARAMETER |                                | TEST CONDITIONS  | TLV2362I |     |     | UNIT                   |
|-----------|--------------------------------|--|----------|-----|-----|------------------------|
|           |                                |  | MIN      | TYP | MAX |                        |
| SR        | Slew rate                      | $A_V = 1, V_I = \pm 0.5\text{ V}$                              | 2.5      |     |     | V/ $\mu\text{s}$       |
| $B_1$     | Unity-gain bandwidth           | $A_V = 40, R_L = 10\text{ k}\Omega, C_L = 100\text{ pF}$       | 6        |     |     | MHz                    |
| $V_n$     | Equivalent input noise voltage | $R_S = 100\ \Omega, R_F = 10\text{ k}\Omega, f = 1\text{ kHz}$ | 9        |     |     | nV/ $\sqrt{\text{Hz}}$ |



# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TLV2362I electrical characteristics, $V_{CC\pm} = \pm 2.5$ V (unless otherwise noted)

| PARAMETER  | TEST CONDITIONS                        | $T_A$         | TLV2362I |           |      | UNIT |
|--|--|---------------|----------|-----------|------|------|
|  |  |               | MIN      | TYP       | MAX  |      |
| $V_{IO}$ Input offset voltage                            | $V_O = 0, V_{IC} = 0$                  | 25°C          |          | 1         | 6    | mV   |
|  |  | -20°C to 85°C |          |           | 7.5  |      |
| $I_{IO}$ Input offset current                            | $V_O = 0, V_{IC} = 0$                  | 25°C          |          | 5         | 100  | nA   |
|  |  | -20°C to 85°C |          |           | 150  |      |
| $I_{IB}$ Input bias current                              | $V_O = 0, V_{IC} = 0$                  | 25°C          |          | 20        | 150  | nA   |
|  |  | -20°C to 85°C |          |           | 250  |      |
| $V_{ICR}$ Common-mode input voltage                      | $ V_{IO}  \leq 7.5$ mV                 | 25°C          |          | $\pm 1.5$ |      | V    |
|  |  | -20°C to 85°C |          | $\pm 1.4$ |      |      |
| $V_{OM+}$ Maximum positive-peak output voltage           | $R_L = 10$ k $\Omega$                  | 25°C          |          | 2         | 2.4  | V    |
|  | $R_L \geq 10$ k $\Omega$               | -20°C to 85°C |          | 2         |      |      |
| $V_{OM-}$ Maximum negative-peak output voltage           | $R_L = 10$ k $\Omega$                  | 25°C          |          | -2        | -2.4 | V    |
|  | $R_L \geq 10$ k $\Omega$               | -20°C to 85°C |          | -2        |      |      |
| $I_{CC}$ Supply current (both amplifiers)                | $V_O = 0, \text{ No load}$             | 25°C          |          | 3.5       | 5    | mA   |
|  |  | -20°C to 85°C |          |           | 6    |      |
| $A_{VD}$ Large-signal differential voltage amplification | $V_O = \pm 1$ V, $R_L = 10$ k $\Omega$ | 25°C          |          | 60        |      | dB   |
| CMRR Common-mode rejection ratio                         | $V_{IC} = \pm 0.5$ V                   | 25°C          |          | 85        |      | dB   |
| $k_{SVR}$ Supply-voltage rejection ratio                 | $V_{CC\pm} = \pm 1.5$ V to $\pm 2.5$ V | 25°C          |          | 80        |      | dB   |

## TLV2362I operating characteristics, $V_{CC\pm} = \pm 2.5$ V, $T_A = 25^\circ\text{C}$

| PARAMETER                            | TEST CONDITIONS                                      | TLV2362I |     |     | UNIT                   |
|--------------------------------------|--|----------|-----|-----|------------------------|
|                                      |  | MIN      | TYP | MAX |                        |
| SR Slew rate                         | $A_V = 1, V_I = \pm 0.5$ V                           |          | 3   |     | V/ $\mu$ s             |
| $B_1$ Unity-gain bandwidth           | $A_V = 40, R_L = 10$ k $\Omega, C_L = 100$ pF        |          | 7   |     | MHz                    |
| $V_n$ Equivalent input noise voltage | $R_S = 100$ $\Omega, R_F = 10$ k $\Omega, f = 1$ kHz |          | 8   |     | nV/ $\sqrt{\text{Hz}}$ |



# TLV2361, TLV2361Y, TLV2362, TLV2362Y

## HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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### TLV2362Y electrical characteristics, $V_{CC\pm} = \pm 1.5\text{ V}$ , $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER |   | TEST CONDITIONS                                     |                           | TLV2362Y |     |     | UNIT |
|-----------|---|---|---------------------------|----------|-----|-----|------|
|           |   |   |                           | MIN      | TYP | MAX |      |
| $V_{IO}$  | Input offset voltage                            | $V_O = 0$ ,   | $V_{IC} = 0$              | 1        |     |     | mV   |
| $I_{IO}$  | Input offset current                            | $V_O = 0$ ,   | $V_{IC} = 0$              | 5        |     |     | nA   |
| $I_{IB}$  | Input bias current                              | $V_O = 0$ ,   | $V_{IC} = 0$              | 20       |     |     | nA   |
| $V_{OM+}$ | Maximum positive-peak output voltage            | $R_L = 10\text{ k}\Omega$                           |                           | 1.4      |     |     | V    |
| $V_{OM-}$ | Maximum negative-peak output voltage            | $R_L = 10\text{ k}\Omega$                           |                           | -1.4     |     |     | V    |
| $I_{CC}$  | Supply current (both amplifiers)                | $V_O = 0$ ,   | No load                   | 2.8      |     |     | mA   |
| $A_{VD}$  | Large-signal differential voltage amplification | $V_O = \pm 1\text{ V}$ ,                            | $R_L = 10\text{ k}\Omega$ | 55       |     |     | dB   |
| CMRR      | Common-mode rejection ratio                     | $V_{IC} = \pm 0.5\text{ V}$                         |                           | 75       |     |     | dB   |
| $k_{SVR}$ | Supply-voltage rejection ratio                  | $V_{CC\pm} = \pm 1.5\text{ V to } \pm 2.5\text{ V}$ |                           | 80       |     |     | dB   |

### TLV2362Y operating characteristics, $V_{CC\pm} = \pm 1.5\text{ V}$ , $T_A = 25^\circ\text{C}$

| PARAMETER |                                | TEST CONDITIONS       |                             |                       | TLV2362Y |     |     | UNIT                   |
|-----------|--------------------------------|-----------------------|-----------------------------|-----------------------|----------|-----|-----|------------------------|
|           |                                |                       |                             |                       | MIN      | TYP | MAX |                        |
| SR        | Slew rate                      | $A_V = 1$ ,           | $V_I = \pm 0.5\text{ V}$    |                       | 2.5      |     |     | V/ $\mu\text{s}$       |
| $B_1$     | Unity-gain bandwidth           | $A_V = 40$ ,          | $R_L = 10\text{ k}\Omega$ , | $C_L = 100\text{ pF}$ | 6        |     |     | MHz                    |
| $V_n$     | Equivalent input noise voltage | $R_S = 100\ \Omega$ , | $R_F = 10\text{ k}\Omega$ , | $f = 1\text{ kHz}$    | 9        |     |     | nV/ $\sqrt{\text{Hz}}$ |

### TLV2362Y electrical characteristics, $V_{CC\pm} = \pm 2.5\text{ V}$ , $T_A = 25^\circ\text{C}$ (unless otherwise noted)

| PARAMETER |   | TEST CONDITIONS                                     |                           | TLV2362Y |     |     | UNIT |
|-----------|---|---|---------------------------|----------|-----|-----|------|
|           |   |   |                           | MIN      | TYP | MAX |      |
| $V_{IO}$  | Input offset voltage                            | $V_O = 0$ ,   | $V_{IC} = 0$              | 1        |     |     | mV   |
| $I_{IO}$  | Input offset current                            | $V_O = 0$ ,   | $V_{IC} = 0$              | 5        |     |     | nA   |
| $I_{IB}$  | Input bias current                              | $V_O = 0$ ,   | $V_{IC} = 0$              | 20       |     |     | nA   |
| $V_{OM+}$ | Maximum positive-peak output voltage            | $R_L = 10\text{ k}\Omega$                           |                           | 2.4      |     |     | V    |
| $V_{OM-}$ | Maximum negative-peak output voltage            | $R_L = 10\text{ k}\Omega$                           |                           | -2.4     |     |     | V    |
| $I_{CC}$  | Supply current (both amplifiers)                | $V_O = 0$ ,   | No load                   | 3.5      |     |     | mA   |
| $A_{VD}$  | Large-signal differential voltage amplification | $V_O = \pm 1\text{ V}$ ,                            | $R_L = 10\text{ k}\Omega$ | 60       |     |     | dB   |
| CMRR      | Common-mode rejection ratio                     | $V_{IC} = \pm 0.5\text{ V}$                         |                           | 85       |     |     | dB   |
| $k_{SVR}$ | Supply-voltage rejection ratio                  | $V_{CC\pm} = \pm 1.5\text{ V to } \pm 2.5\text{ V}$ |                           | 80       |     |     | dB   |

### TLV2362Y operating characteristics, $V_{CC\pm} = \pm 2.5\text{ V}$ , $T_A = 25^\circ\text{C}$

| PARAMETER |                                | TEST CONDITIONS       |                             |                       | TLV2362Y |     |     | UNIT                   |
|-----------|--------------------------------|-----------------------|-----------------------------|-----------------------|----------|-----|-----|------------------------|
|           |                                |                       |                             |                       | MIN      | TYP | MAX |                        |
| SR        | Slew rate                      | $A_V = 1$ ,           | $V_I = \pm 0.5\text{ V}$    |                       | 3        |     |     | V/ $\mu\text{s}$       |
| $B_1$     | Unity-gain bandwidth           | $A_V = 40$ ,          | $R_L = 10\text{ k}\Omega$ , | $C_L = 100\text{ pF}$ | 7        |     |     | MHz                    |
| $V_n$     | Equivalent input noise voltage | $R_S = 100\ \Omega$ , | $R_F = 10\text{ k}\Omega$ , | $f = 1\text{ kHz}$    | 8        |     |     | nV/ $\sqrt{\text{Hz}}$ |



# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

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| Maximum negative output voltage vs Output current | 4      |
| Maximum peak-to-peak output voltage vs Frequency  | 5      |
| Equivalent input noise voltage vs Frequency       | 6      |
| Total harmonic distortion vs Frequency            | 7      |
| Total harmonic distortion vs Output voltage       | 8      |



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# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

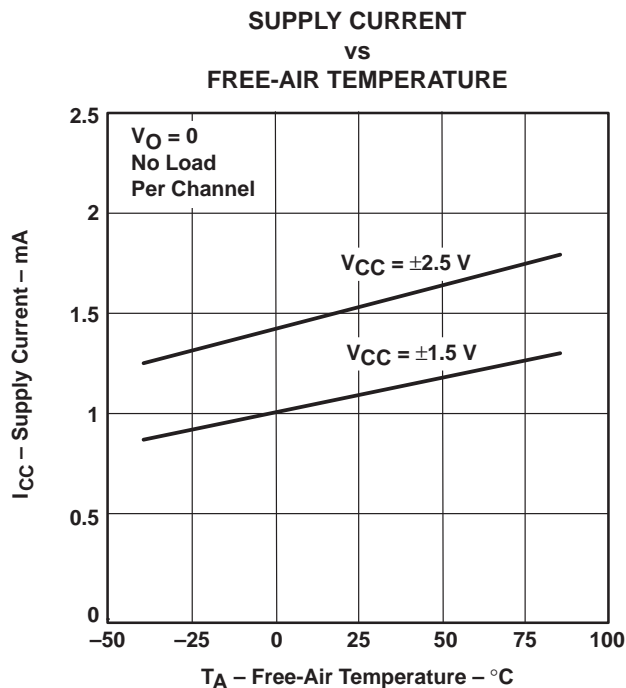


Figure 1

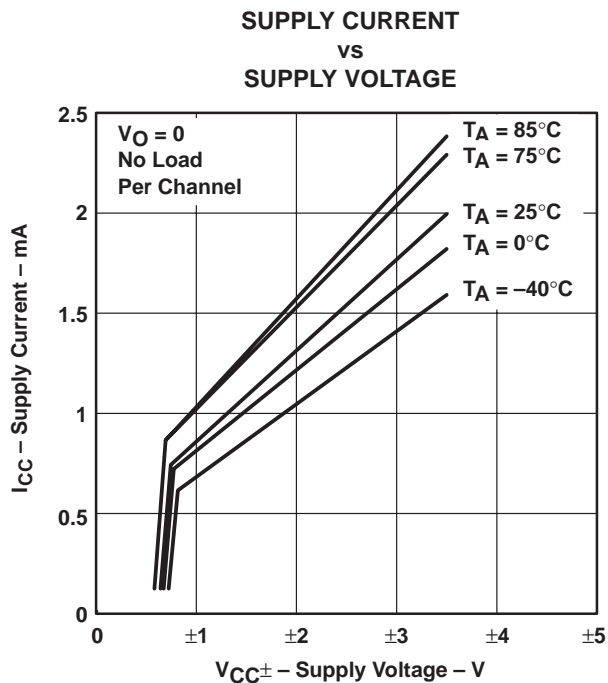


Figure 2

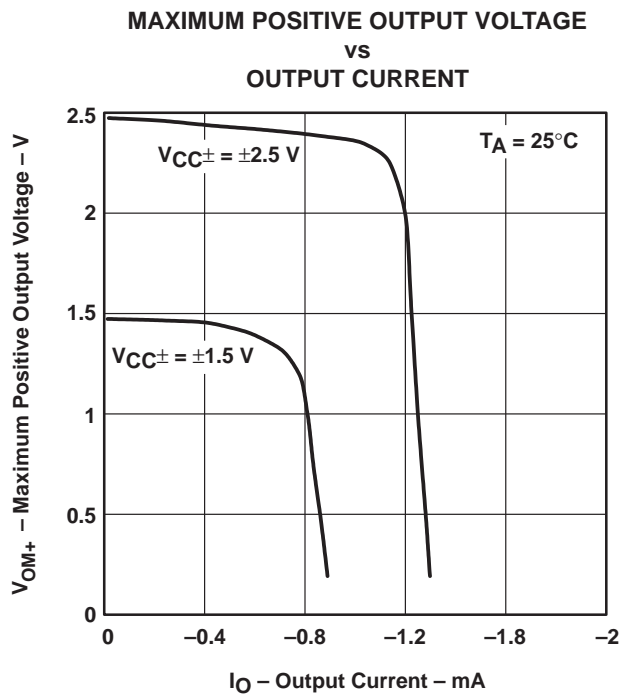


Figure 3

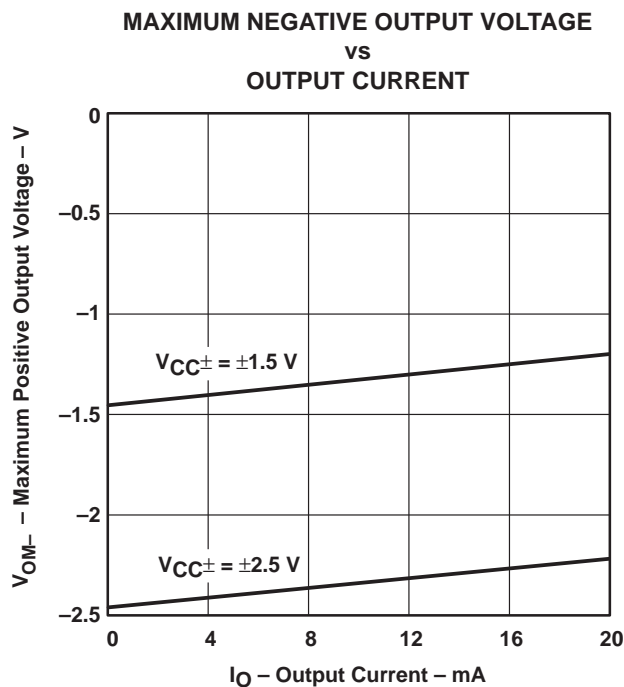


Figure 4



# TLV2361, TLV2361Y, TLV2362, TLV2362Y HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

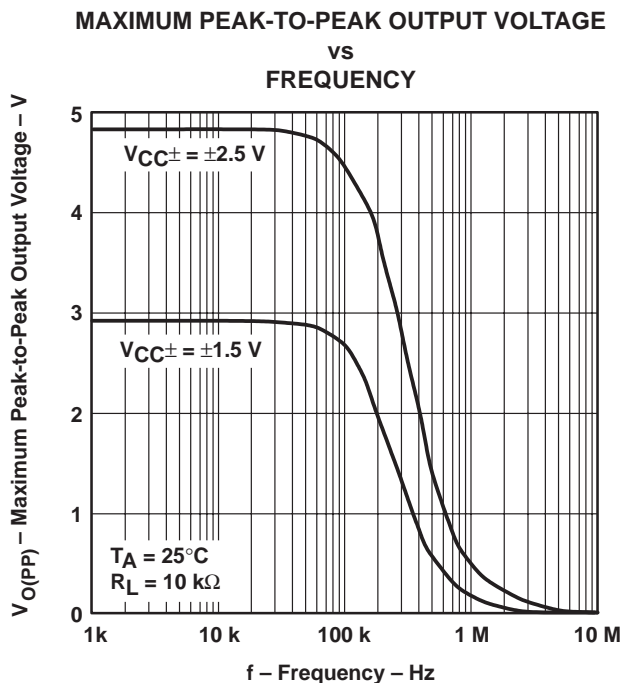


Figure 5

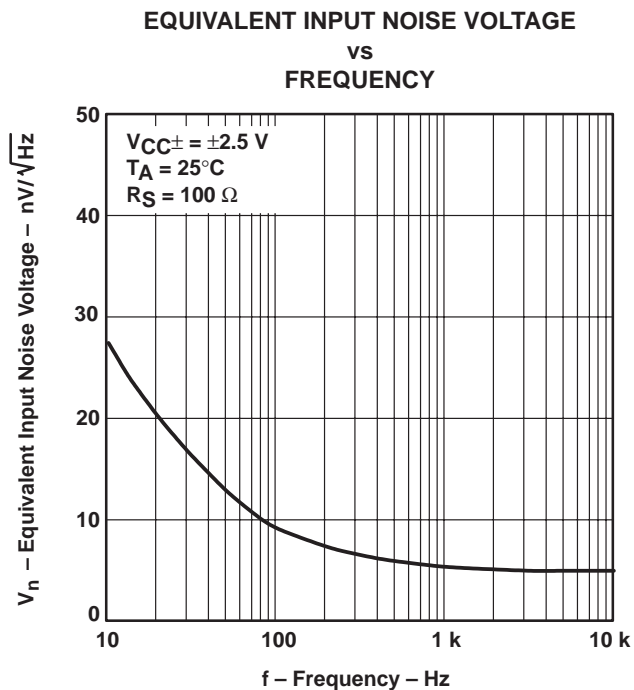


Figure 6

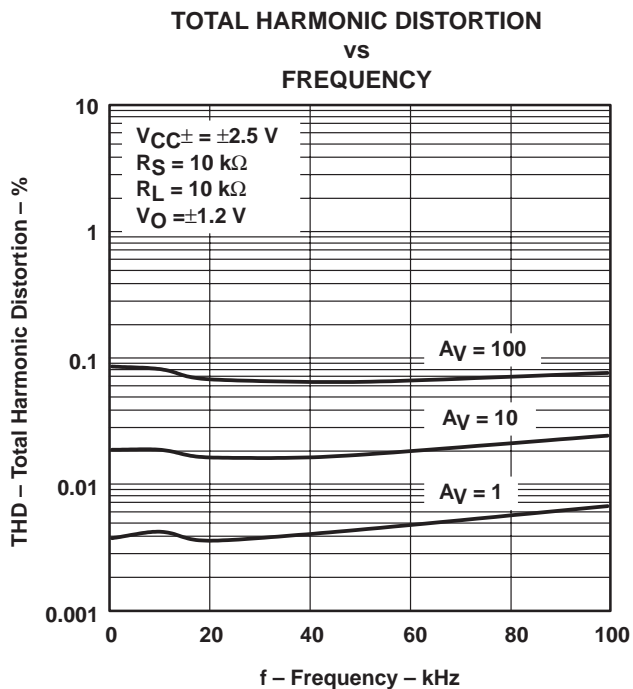


Figure 7

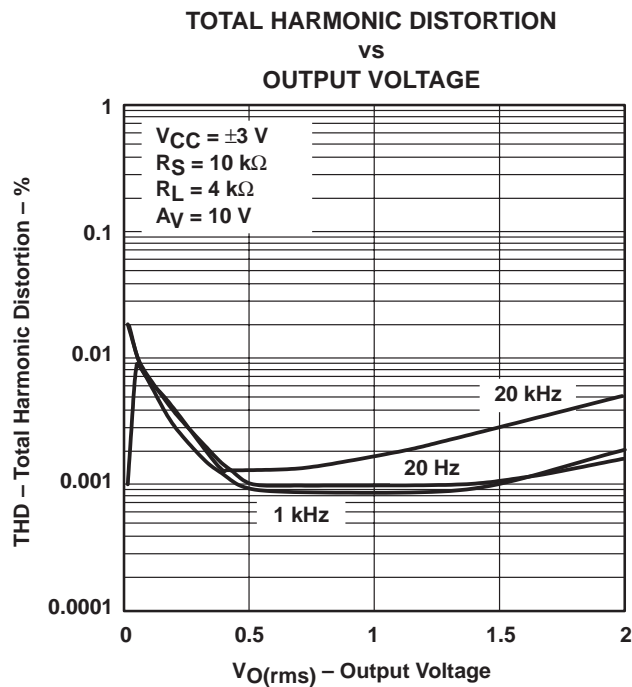


Figure 8



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