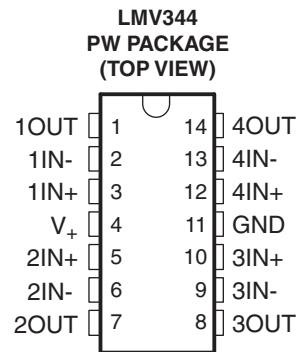
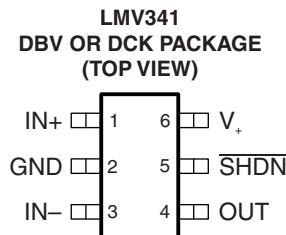


## RAIL-TO-RAIL OUTPUT CMOS OPERATIONAL AMPLIFIERS

### FEATURES

- Qualified for Automotive Applications
- 2.7-V and 5-V Performance
- Rail-to-Rail Output Swing
- Input Bias Current: 1 pA Typ
- Input Offset Voltage: 0.25 mV Typ
- Low Supply Current: 100  $\mu$ A Typ
- Gain Bandwidth: 1 MHz Typ
- Slew Rate: 1 V/ $\mu$ s Typ
- Turn-On Time From Shutdown: 5  $\mu$ s Typ
- Input Referred Voltage Noise (at 10 kHz): 20 nV/ $\sqrt{\text{Hz}}$



### DESCRIPTION/ORDERING INFORMATION

The LMV341 and LMV344 devices are single and quad CMOS operational amplifiers, respectively, with low voltage, low power, and rail-to-rail output swing capabilities. The PMOS input stage offers an ultra-low input bias current of 1 pA (typ) and an offset voltage of 0.25 mV (typ). The single supply amplifier is designed specifically for low-voltage (2.7 V to 5 V) operation, with a wide common-mode input voltage range that typically extends from  $-0.2$  V to 0.8 V from the positive supply rail. Additional features are a 20-nV/ $\sqrt{\text{Hz}}$  voltage noise at 10 kHz, 1-MHz unity-gain bandwidth, 1-V/ $\mu$ s slew rate, and 100- $\mu$ A current consumption per channel.

An extended industrial temperature range from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  makes this device suitable for automotive applications.

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

| $T_A$                                          | PACKAGE <sup>(2)</sup> |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING <sup>(3)</sup> |
|------------------------------------------------|------------------------|--------------|-----------------------|---------------------------------|
| $-40^{\circ}\text{C}$ to $125^{\circ}\text{C}$ | SC-70 – DCK            | Reel of 3000 | LMV341QDCKRQ1         | RR_                             |
|                                                | SOT-23 – DBV           | Reel of 3000 | LMV341QDBVRQ1         | RCH_                            |
|                                                | TSSOP – PW             | Reel of 2000 | LMV344IPWRQ1          | LMV344Q                         |

(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).

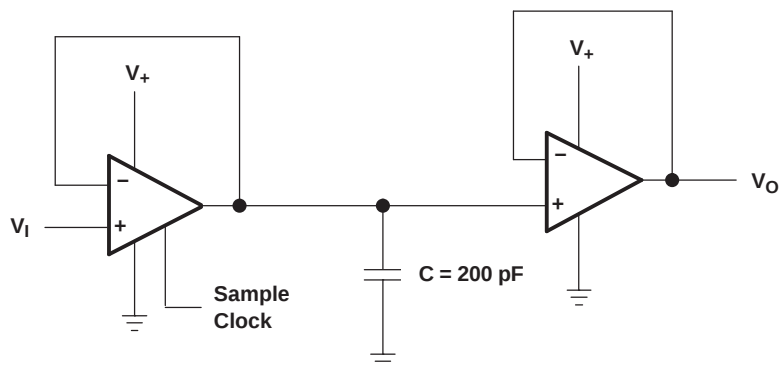
(2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).

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



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.

## APPLICATION CIRCUIT: SAMPLE-AND-HOLD CIRCUIT



## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

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

|                  |                                             |             |                |
|------------------|---------------------------------------------|-------------|----------------|
| V <sub>+</sub>   | Supply voltage <sup>(2)</sup>               |             | 5.5 V          |
| V <sub>ID</sub>  | Differential input voltage <sup>(3)</sup>   |             | ±5.5 V         |
| V <sub>I</sub>   | Input voltage range (either input)          |             | 0 to 5.5 V     |
| θ <sub>JA</sub>  | Package thermal impedance <sup>(4)(5)</sup> | DBV package | 165°C/W        |
|                  |                                             | DCK package | 259°C/W        |
|                  |                                             | PW package  | 113°C/W        |
| T <sub>J</sub>   | Operating virtual junction temperature      |             | 150°C          |
| T <sub>stg</sub> | Storage temperature range                   |             | –65°C to 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<sub>+</sub> specified for the measurement of I<sub>OQ</sub>) are with respect to the network GND.
- (3) Differential voltages are at IN+ with respect to IN–.
- (4) Maximum power dissipation is a function of T<sub>J</sub>(max), θ<sub>JA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any allowable ambient temperature is P<sub>D</sub> = (T<sub>J</sub>(max) – T<sub>A</sub>)/θ<sub>JA</sub>. Operating at the absolute maximum T<sub>J</sub> of 150°C can affect reliability.
- (5) The package thermal impedance is calculated in accordance with JESD 51-7.

## RECOMMENDED OPERATING CONDITIONS

|                |                                          | MIN | MAX | UNIT |
|----------------|------------------------------------------|-----|-----|------|
| V <sub>+</sub> | Supply voltage (single-supply operation) | 2.5 | 5.5 | V    |
| T <sub>A</sub> | Operating free-air temperature           | −40 | 125 | °C   |

## ESD PROTECTION

| TEST CONDITIONS        | TYP  | UNIT |
|------------------------|------|------|
| Human-Body Model (HBM) | 2000 | V    |
| Machine Model (MM)     | 200  | V    |

## ELECTRICAL CHARACTERISTICS

 $V_+ = 2.7\text{ V}$ ,  $\text{GND} = 0\text{ V}$ ,  $V_{IC} = V_O = V_+/2$ ,  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER        |                                                         | TEST CONDITIONS                                                                           |            | T <sub>A</sub> | LMV341 |                    |     | LMV344 |                    |     | UNIT   |
|------------------|---------------------------------------------------------|-------------------------------------------------------------------------------------------|------------|----------------|--------|--------------------|-----|--------|--------------------|-----|--------|
|                  |                                                         |                                                                                           |            |                | MIN    | TYP <sup>(1)</sup> | MAX | MIN    | TYP <sup>(1)</sup> | MAX |        |
| V <sub>IO</sub>  | Input offset voltage                                    |                                                                                           |            | 25°C           | 0.25   |                    | 4   | 0.25   |                    | 4   | mV     |
|                  |                                                         |                                                                                           |            | Full range     | 4.5    |                    | 4.5 |        |                    |     |        |
| α <sub>VIO</sub> | Average temperature coefficient of input offset voltage |                                                                                           |            | Full range     | 1.7    |                    |     | 1.7    |                    |     | μV/°C  |
| I <sub>IB</sub>  | Input bias current                                      |                                                                                           |            | 25°C           | 1      | 120                |     | 1      | 120                |     | pA     |
|                  |                                                         |                                                                                           |            | −40°C to 85°C  | 250    |                    | 250 |        |                    |     |        |
|                  |                                                         |                                                                                           |            | −40°C to 125°C | 3      |                    | 3   |        |                    | nA  |        |
| I <sub>IO</sub>  | Input offset current                                    |                                                                                           |            | 25°C           | 6.6    |                    |     | 6.6    |                    |     | fA     |
| CMRR             | Common-mode rejection ratio                             | 0 ≤ V <sub>ICR</sub> ≤ 1.7 V                                                              |            | 25°C           | 40     | 80                 |     | 56     | 80                 |     | dB     |
|                  |                                                         | 0 ≤ V <sub>ICR</sub> ≤ 1.6 V                                                              |            | Full range     | 36     |                    | 50  |        |                    |     |        |
| k <sub>SVR</sub> | Supply-voltage rejection ratio                          | 2.7 V ≤ V <sub>+</sub> ≤ 5 V                                                              |            | 25°C           | 45     | 82                 |     | 65     | 82                 |     | dB     |
|                  |                                                         |                                                                                           |            | Full range     | 60     |                    | 60  |        |                    |     |        |
| V <sub>ICR</sub> | Common-mode input voltage range                         | CMRR ≥ 50 dB                                                                              |            | 25°C           | 0      | −0.2 to 1.9        | 1.7 | 0      | −0.2 to 1.9        | 1.7 | V      |
| A <sub>V</sub>   | Large-signal voltage gain <sup>(2)</sup>                | R <sub>L</sub> = 10 kΩ to 1.35 V                                                          |            | 25°C           | 73     | 113                |     | 78     | 113                |     | dB     |
|                  |                                                         |                                                                                           |            | Full range     | 66     |                    | 70  |        |                    |     |        |
|                  |                                                         | R <sub>L</sub> = 2 kΩ to 1.35 V                                                           |            | 25°C           | 70     | 103                |     | 72     | 103                |     |        |
|                  |                                                         |                                                                                           |            | Full range     | 63     |                    | 64  |        |                    |     |        |
| V <sub>O</sub>   | Output swing (delta from supply rails)                  | R <sub>L</sub> = 2 kΩ to 1.35 V                                                           | Low level  | 25°C           | 24     | 60                 |     | 24     | 60                 |     | mV     |
|                  |                                                         |                                                                                           |            | Full range     | 95     |                    | 95  |        |                    |     |        |
|                  |                                                         |                                                                                           | High level | 25°C           | 26     | 60                 |     | 26     | 60                 |     |        |
|                  |                                                         |                                                                                           |            | Full range     | 95     |                    | 95  |        |                    |     |        |
|                  |                                                         | R <sub>L</sub> = 10 kΩ to 1.35 V                                                          | Low level  | 25°C           | 5      | 30                 |     | 5      | 30                 |     |        |
|                  |                                                         |                                                                                           |            | Full range     | 40     |                    | 40  |        |                    |     |        |
|                  |                                                         |                                                                                           | High level | 25°C           | 5.3    | 30                 |     | 5.3    | 30                 |     |        |
|                  |                                                         |                                                                                           |            | Full range     | 40     |                    | 40  |        |                    |     |        |
| I <sub>CC</sub>  | Supply current (per channel)                            |                                                                                           |            | 25°C           | 100    | 170                |     | 100    | 170                |     | μA     |
|                  |                                                         |                                                                                           |            | Full range     | 230    |                    | 230 |        |                    |     |        |
| I <sub>OS</sub>  | Output short-circuit current                            | Sourcing                                                                                  |            | 25°C           | 20     | 32                 |     | 18     | 24                 |     | mA     |
|                  |                                                         | Sinking                                                                                   |            |                | 15     | 24                 |     | 15     | 24                 |     |        |
| SR               | Slew rate                                               | R <sub>L</sub> = 10 kΩ <sup>(3)</sup>                                                     |            | 25°C           | 1      |                    |     | 1      |                    |     | V/μs   |
| GBM              | Unity-gain bandwidth                                    | R <sub>L</sub> = 10 kΩ, C <sub>L</sub> = 200 pF                                           |            | 25°C           | 1      |                    |     | 1      |                    |     | MHz    |
| Φ <sub>m</sub>   | Phase margin                                            | R <sub>L</sub> = 100 kΩ                                                                   |            | 25°C           | 72     |                    |     | 72     |                    |     | deg    |
| G <sub>m</sub>   | Gain margin                                             | R <sub>L</sub> = 100 kΩ                                                                   |            | 25°C           | 20     |                    |     | 20     |                    |     | dB     |
| V <sub>n</sub>   | Equivalent input noise voltage                          | f = 1 kHz                                                                                 |            | 25°C           | 40     |                    |     | 40     |                    |     | nV/√Hz |
| I <sub>n</sub>   | Equivalent input noise current                          | f = 1 kHz                                                                                 |            | 25°C           | 0.001  |                    |     | 0.001  |                    |     | pA/√Hz |
| THD              | Total harmonic distortion                               | f = 1 kHz, A <sub>V</sub> = 1, R <sub>L</sub> = 600 Ω, V <sub>I</sub> = 1 V <sub>PP</sub> |            | 25°C           | 0.017  |                    |     | 0.017  |                    |     | %      |

(1) Typical values represent the most likely parametric norm.

(2)  $\text{GND} + 0.2\text{ V} \leq V_O \leq V_+ - 0.2\text{ V}$ 

(3) Connected as voltage follower with  $2\text{-}V_{PP}$  step input. Number specified is the slower of the positive and negative slew rates.

## SHUTDOWN CHARACTERISTICS

$V_+ = 2.7\text{ V}$ ,  $GND = 0\text{ V}$ ,  $V_{IC} = V_O = V_+/2$ ,  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER      |                                               | TEST CONDITIONS       | $T_A$      | MIN        | TYP        | MAX  | UNIT          |
|----------------|-----------------------------------------------|-----------------------|------------|------------|------------|------|---------------|
| $I_{CC(SHDN)}$ | Supply current in shutdown mode (per channel) | $V_{SD} = 0\text{ V}$ | 25°C       |            | 0.045      | 1000 | nA            |
|                |                                               |                       | Full range |            |            | 1.5  | $\mu\text{A}$ |
| $t_{(on)}$     | Amplifier turn-on time                        |                       | 25°C       |            | 5          |      | $\mu\text{s}$ |
| $V_{SD}$       | Shutdown pin voltage range                    | ON mode               | 25°C       | 1.7 to 2.7 | 2.4 to 2.7 |      | V             |
|                |                                               | Shutdown mode         |            | 0 to 1     | 0 to 0.8   |      |               |

## ELECTRICAL CHARACTERISTICS

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

| PARAMETER        |                                                         | TEST CONDITIONS                                                                           |            | T <sub>A</sub> | LMV341 |                    |     | LMV344 |                    |     | UNIT   |
|------------------|---------------------------------------------------------|-------------------------------------------------------------------------------------------|------------|----------------|--------|--------------------|-----|--------|--------------------|-----|--------|
|                  |                                                         |                                                                                           |            |                | MIN    | TYP <sup>(1)</sup> | MAX | MIN    | TYP <sup>(1)</sup> | MAX |        |
| V <sub>IO</sub>  | Input offset voltage                                    |                                                                                           |            | 25°C           | 0.25   |                    | 4   | 0.25   |                    | 4   | mV     |
|                  |                                                         |                                                                                           |            | Full range     | 4.5    |                    | 4.5 |        |                    |     |        |
| α <sub>VIO</sub> | Average temperature coefficient of input offset voltage |                                                                                           |            | Full range     | 1.9    |                    |     | 1.9    |                    |     | μV/°C  |
| I <sub>IB</sub>  | Input bias current                                      |                                                                                           |            | 25°C           | 1      | 200                |     | 1      | 200                |     | pA     |
|                  |                                                         |                                                                                           |            | −40°C to 85°C  | 375    |                    | 375 |        |                    |     |        |
|                  |                                                         |                                                                                           |            | −40°C to 125°C | 5      |                    | 5   |        | nA                 |     |        |
| I <sub>IO</sub>  | Input offset current                                    |                                                                                           |            | 25°C           | 6.6    |                    |     | 6.6    |                    |     | fA     |
| CMRR             | Common-mode rejection ratio                             | 0 ≤ V <sub>ICR</sub> ≤ 4 V                                                                |            | 25°C           | 46     | 86                 |     | 56     | 86                 |     | dB     |
|                  |                                                         | 0 ≤ V <sub>ICR</sub> ≤ 3.9 V                                                              |            | Full range     | 47     |                    | 50  |        |                    |     |        |
| k <sub>SVR</sub> | Supply-voltage rejection ratio                          | 2.7 V ≤ V <sub>+</sub> ≤ 5 V                                                              |            | 25°C           | 45     | 82                 |     | 65     | 82                 |     | dB     |
|                  |                                                         |                                                                                           |            | Full range     | 44     |                    | 60  |        |                    |     |        |
| V <sub>ICR</sub> | Common-mode input voltage range                         | CMRR ≥ 50 dB                                                                              |            | 25°C           | 0      | −0.2 to 4.2        | 4   | 0      | −0.2 to 4.2        | 4   | V      |
| A <sub>V</sub>   | Large-signal voltage gain <sup>(2)</sup>                | R <sub>L</sub> = 10 kΩ to 2.5 V                                                           |            | 25°C           | 78     | 116                |     | 78     | 116                |     | dB     |
|                  |                                                         |                                                                                           |            | Full range     | 70     |                    | 70  |        |                    |     |        |
|                  |                                                         | R <sub>L</sub> = 2 kΩ to 2.5 V                                                            |            | 25°C           | 72     | 107                |     | 72     | 107                |     |        |
|                  |                                                         |                                                                                           |            | Full range     | 64     |                    | 64  |        |                    |     |        |
| V <sub>O</sub>   | Output swing (delta from supply rails)                  | R <sub>L</sub> = 2 kΩ to 2.5 V                                                            | Low level  | 25°C           | 32     | 67                 |     | 32     | 60                 |     | mV     |
|                  |                                                         |                                                                                           |            | Full range     |        | 95                 |     | 95     |                    |     |        |
|                  |                                                         |                                                                                           | High level | 25°C           | 34     | 60                 |     | 34     | 60                 |     |        |
|                  |                                                         |                                                                                           |            | Full range     |        | 95                 |     | 95     |                    |     |        |
|                  |                                                         | R <sub>L</sub> = 10 kΩ to 2.5 V                                                           | Low level  | 25°C           | 7      | 30                 |     | 7      | 30                 |     |        |
|                  |                                                         |                                                                                           |            | Full range     |        | 45                 |     | 40     |                    |     |        |
|                  |                                                         |                                                                                           | High level | 25°C           | 7      | 30                 |     | 7      | 30                 |     |        |
|                  |                                                         |                                                                                           |            | Full range     |        | 40                 |     | 40     |                    |     |        |
| I <sub>CC</sub>  | Supply current (per channel)                            |                                                                                           |            | 25°C           | 107    | 200                |     | 107    | 200                |     | μA     |
|                  |                                                         |                                                                                           |            | Full range     |        | 260                |     | 260    |                    |     |        |
| I <sub>OS</sub>  | Output short-circuit current                            | Sourcing                                                                                  |            | 25°C           | 85     | 113                |     | 70     | 90                 |     | mA     |
|                  |                                                         | Sinking                                                                                   |            |                | 50     | 75                 |     | 50     | 75                 |     |        |
| SR               | Slew rate                                               | R <sub>L</sub> = 10 kΩ <sup>(3)</sup>                                                     |            | 25°C           | 1      |                    |     | 1      |                    |     | V/μs   |
| GBM              | Unity-gain bandwidth                                    | R <sub>L</sub> = 10 kΩ, C <sub>L</sub> = 200 pF                                           |            | 25°C           | 1      |                    |     | 1      |                    |     | MHz    |
| Φ <sub>m</sub>   | Phase margin                                            | R <sub>L</sub> = 100 kΩ                                                                   |            | 25°C           | 70     |                    |     | 70     |                    |     | deg    |
| G <sub>m</sub>   | Gain margin                                             | R <sub>L</sub> = 100 kΩ                                                                   |            | 25°C           | 20     |                    |     | 20     |                    |     | dB     |
| V <sub>n</sub>   | Equivalent input noise voltage                          | f = 1 kHz                                                                                 |            | 25°C           | 39     |                    |     | 39     |                    |     | nV/√Hz |
| I <sub>n</sub>   | Equivalent input noise current                          | f = 1 kHz                                                                                 |            | 25°C           | 0.001  |                    |     | 0.001  |                    |     | pA/√Hz |
| THD              | Total harmonic distortion                               | f = 1 kHz, A <sub>V</sub> = 1, R <sub>L</sub> = 600 Ω, V <sub>I</sub> = 1 V <sub>PP</sub> |            | 25°C           | 0.012  |                    |     | 0.012  |                    |     | %      |

(1) Typical values represent the most likely parametric norm.

(2)  $\text{GND} + 0.2\text{ V} \leq V_O \leq V_+ - 0.2\text{ V}$ 

(3) Connected as voltage follower with 2- $V_{PP}$  step input. Number specified is the slower of the positive and negative slew rates.

## SHUTDOWN CHARACTERISTICS

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

| PARAMETER      |                                               | TEST CONDITIONS       | $T_A$      | MIN | TYP      | MAX      | UNIT          |
|----------------|-----------------------------------------------|-----------------------|------------|-----|----------|----------|---------------|
| $I_{CC(SHDN)}$ | Supply current in shutdown mode (per channel) | $V_{SD} = 0\text{ V}$ | 25°C       |     | 0.033    | 1        | $\mu\text{A}$ |
|                |                                               |                       | Full range |     |          | 1.5      |               |
| $t_{(on)}$     | Amplifier turn-on time                        |                       | 25°C       |     | 5        |          | $\mu\text{s}$ |
| $V_{SD}$       | Shutdown pin voltage range                    | ON mode               | 25°C       |     | 3.1 to 5 | 4.5 to 5 | V             |
|                |                                               | Shutdown mode         |            |     | 0 to 1   | 0 to 0.8 |               |

## TYPICAL CHARACTERISTICS

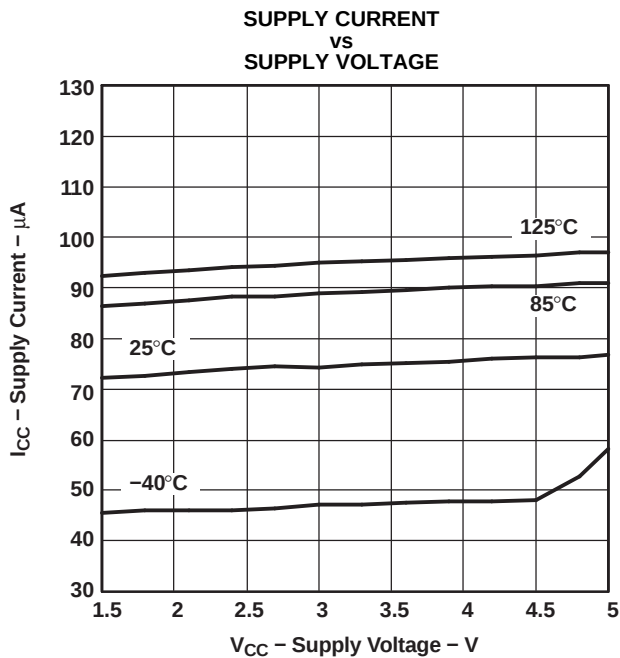


Figure 1.

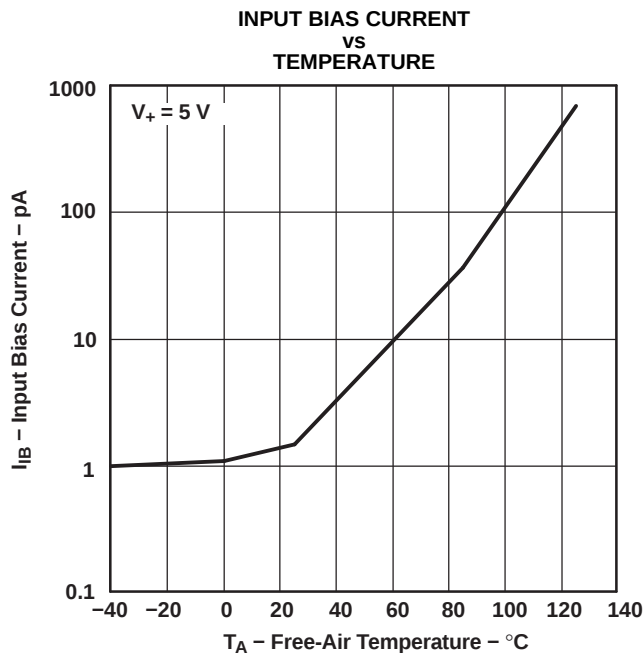


Figure 2.

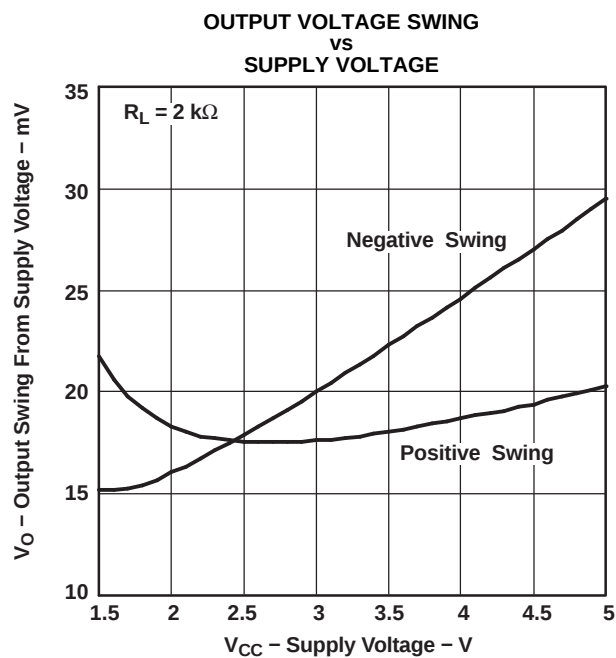


Figure 3.

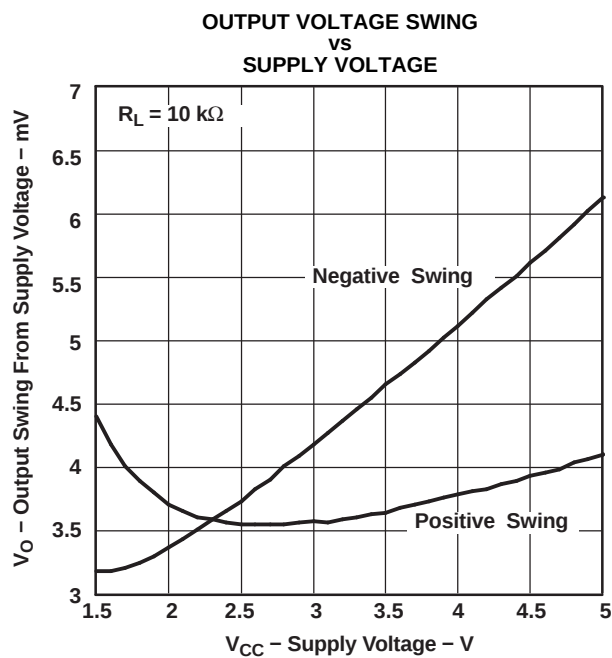


Figure 4.

## TYPICAL CHARACTERISTICS (continued)

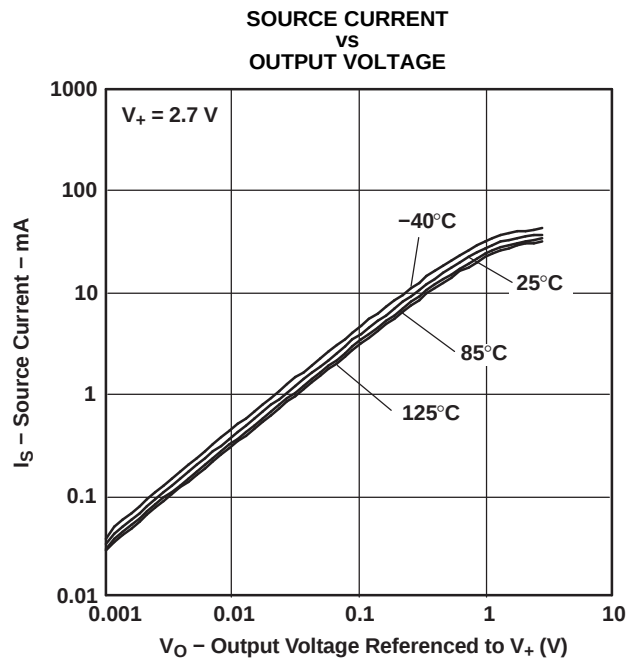


Figure 5.

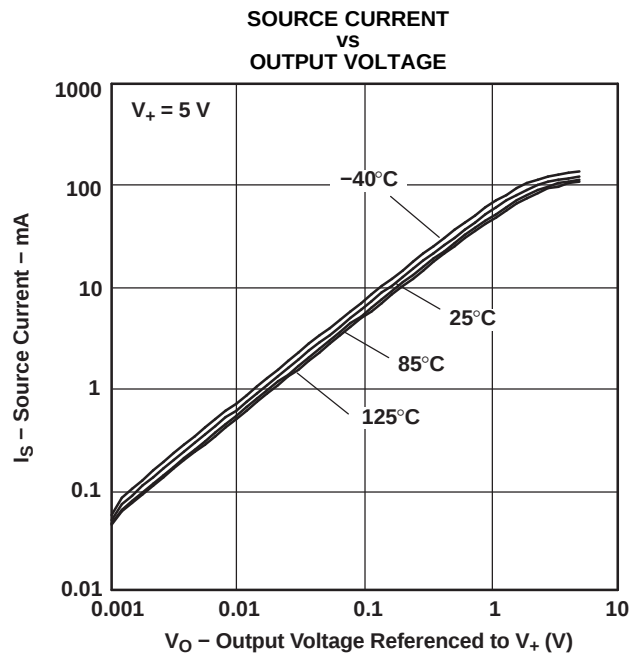


Figure 6.

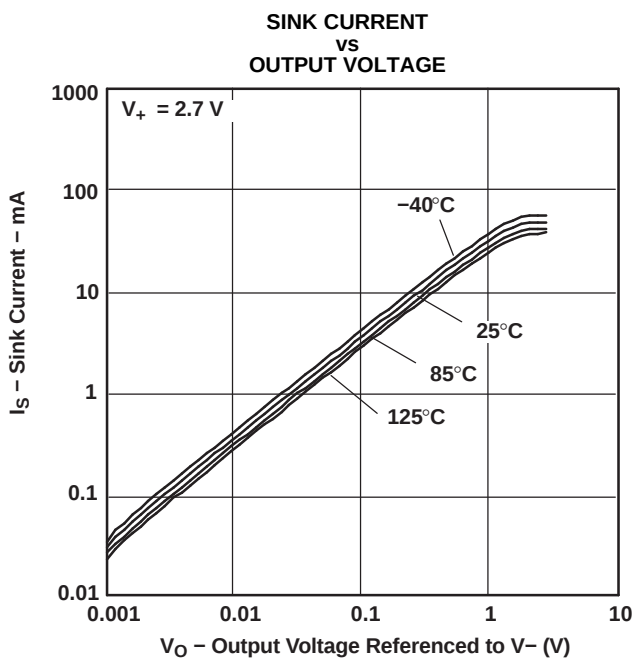


Figure 7.

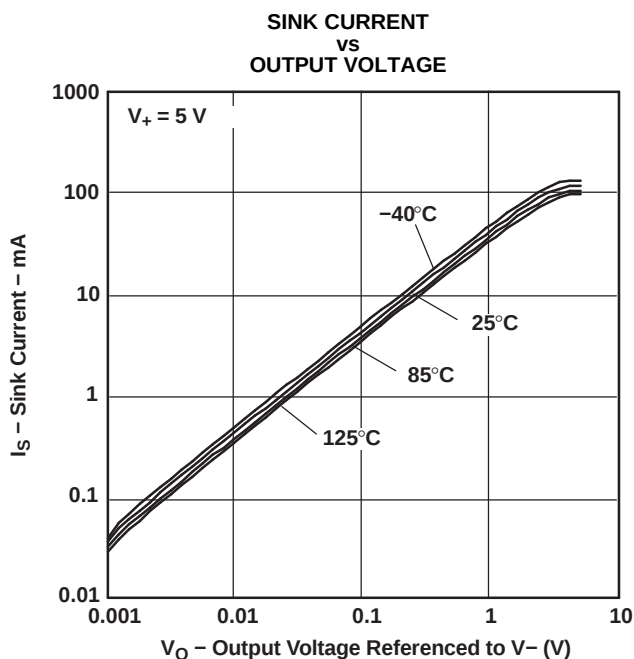


Figure 8.

## TYPICAL CHARACTERISTICS (continued)

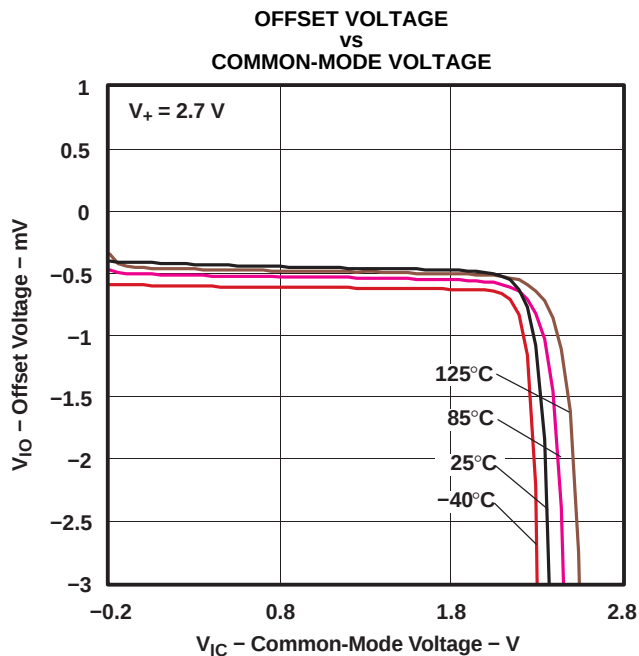


Figure 9.

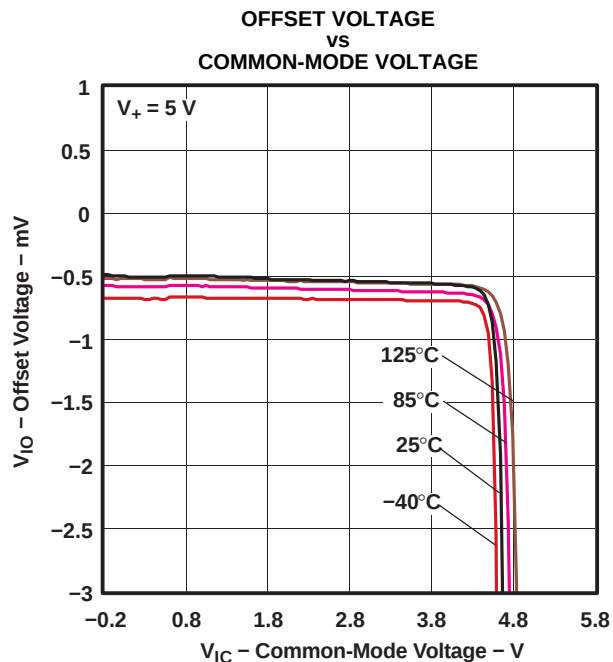


Figure 10.

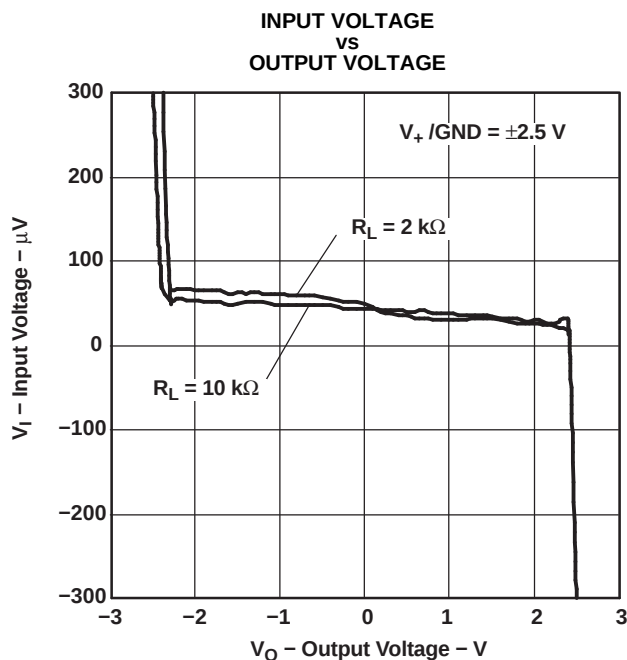


Figure 11.

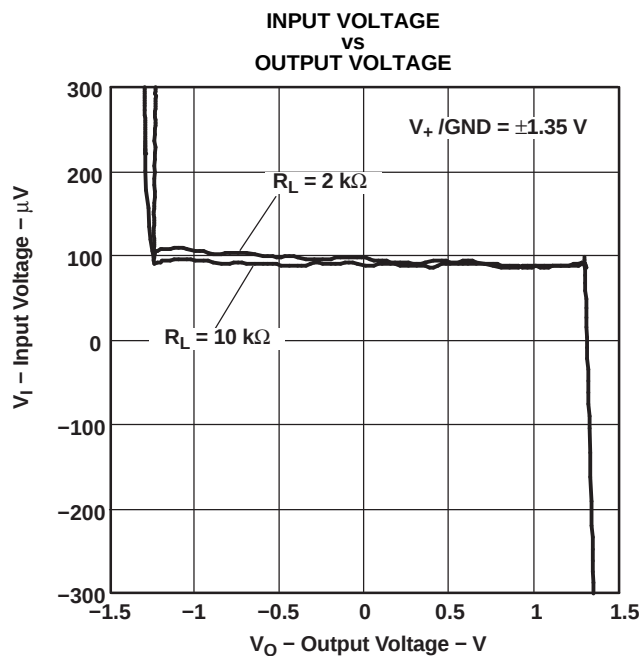


Figure 12.

# TYPICAL CHARACTERISTICS (continued)

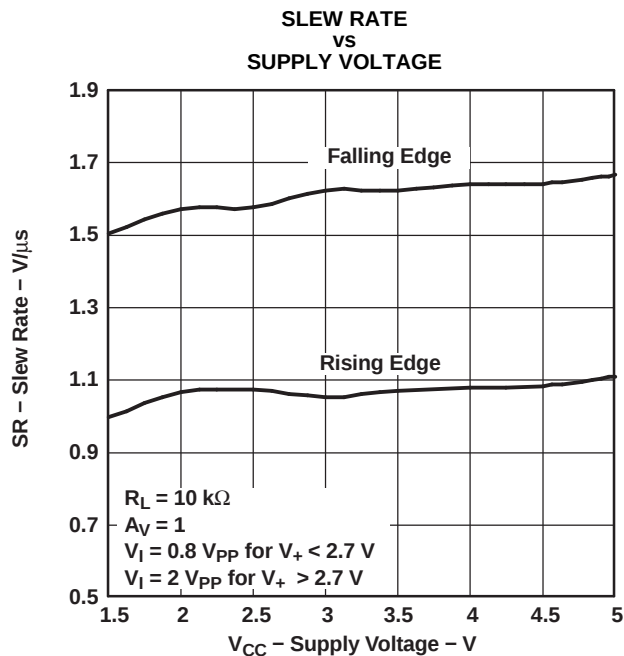


Figure 13.

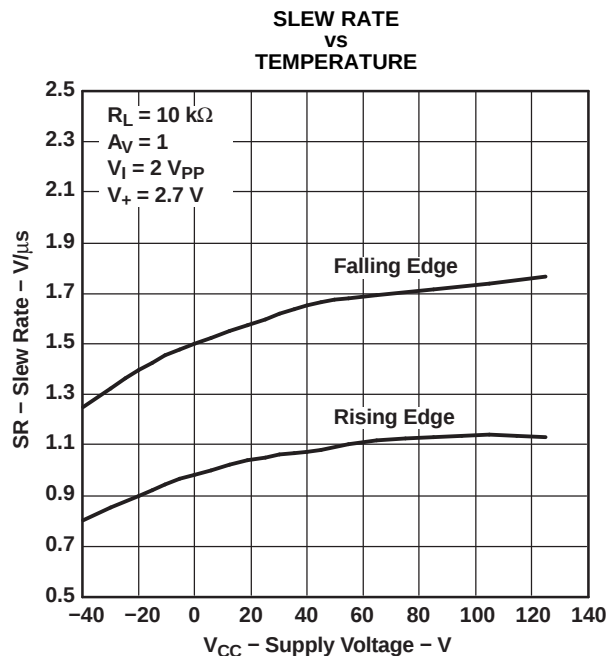


Figure 14.

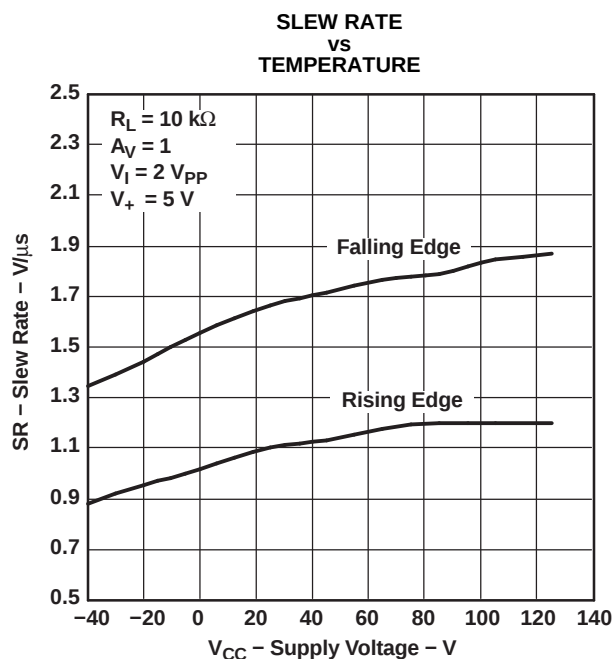


Figure 15.

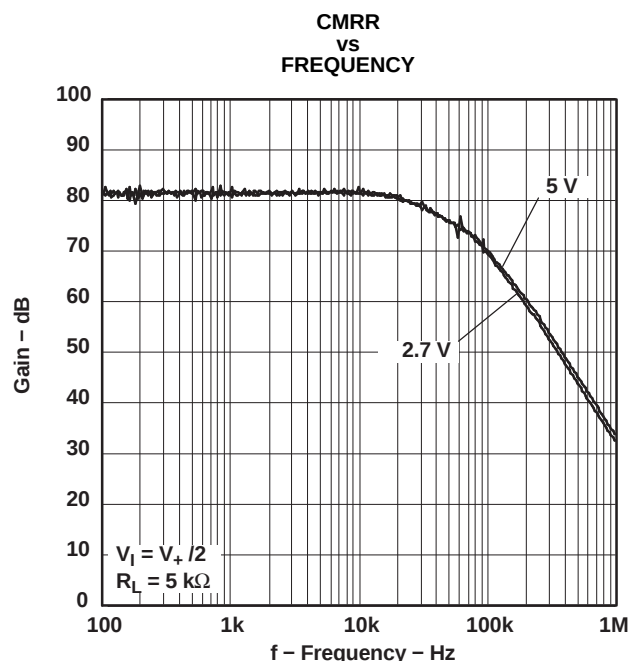


Figure 16.

## TYPICAL CHARACTERISTICS (continued)

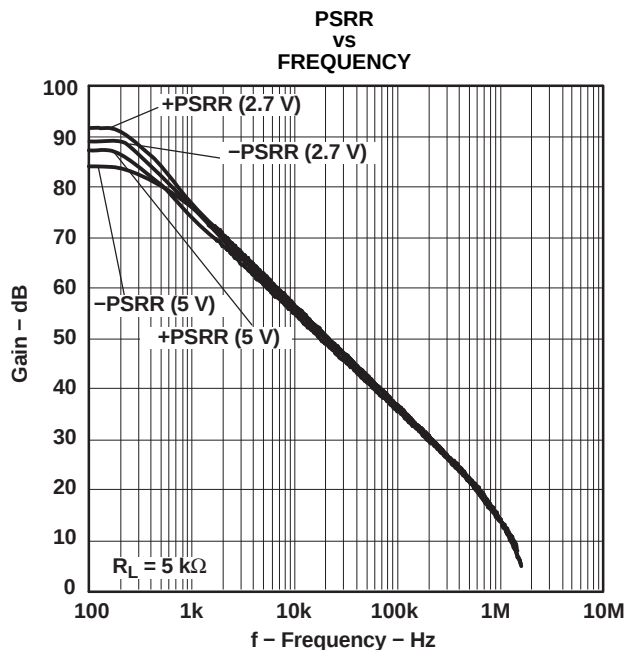


Figure 17.

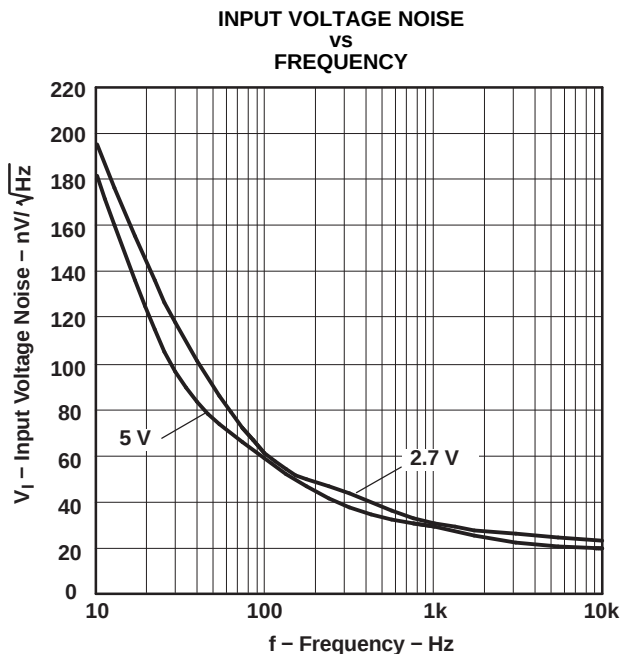


Figure 18.

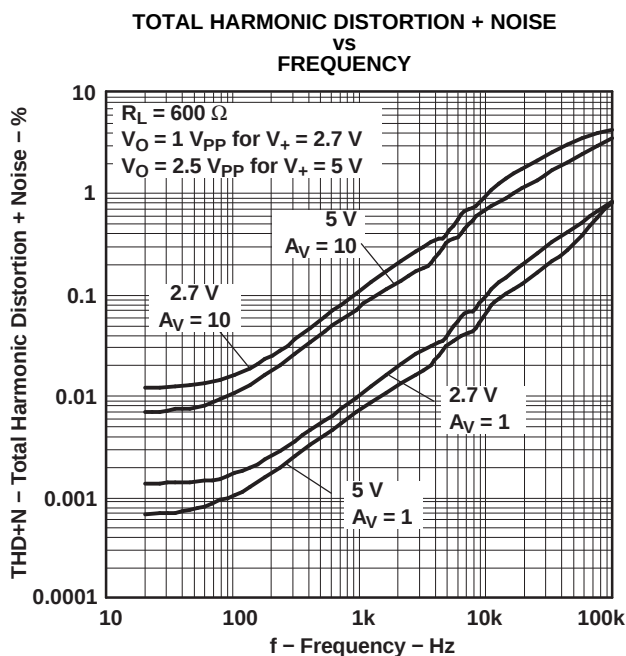


Figure 19.

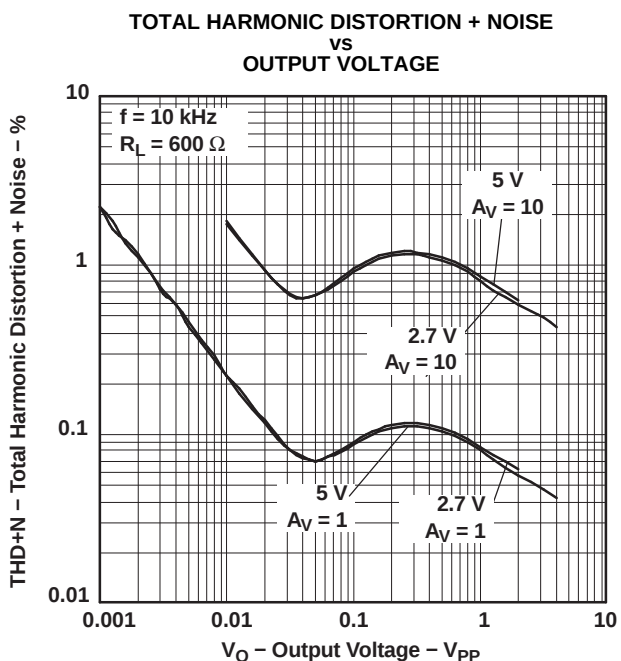
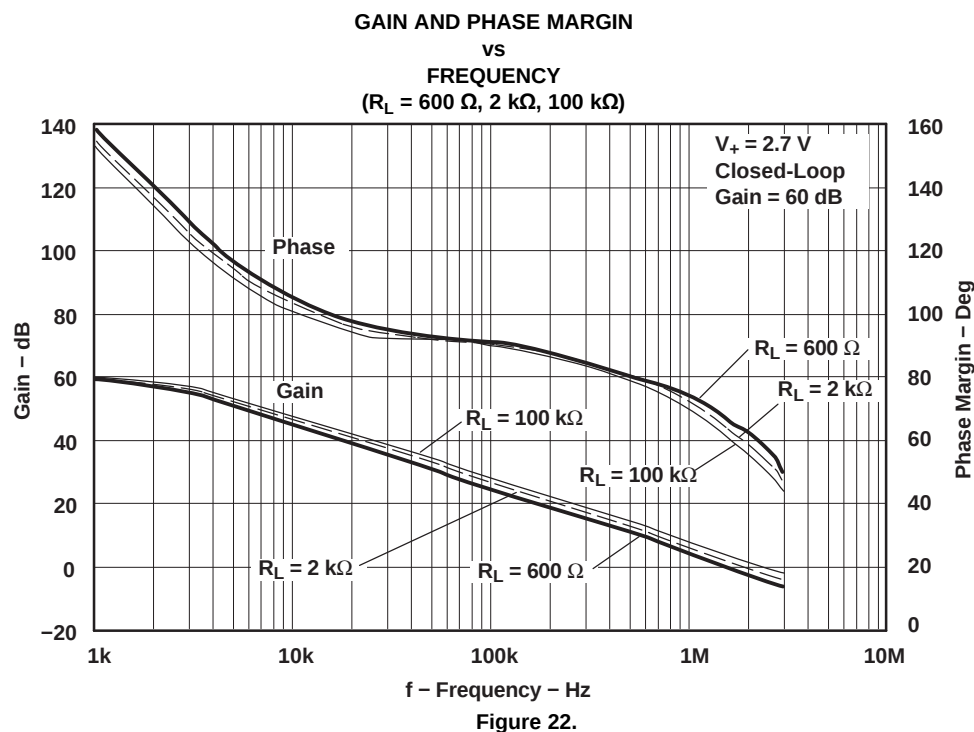
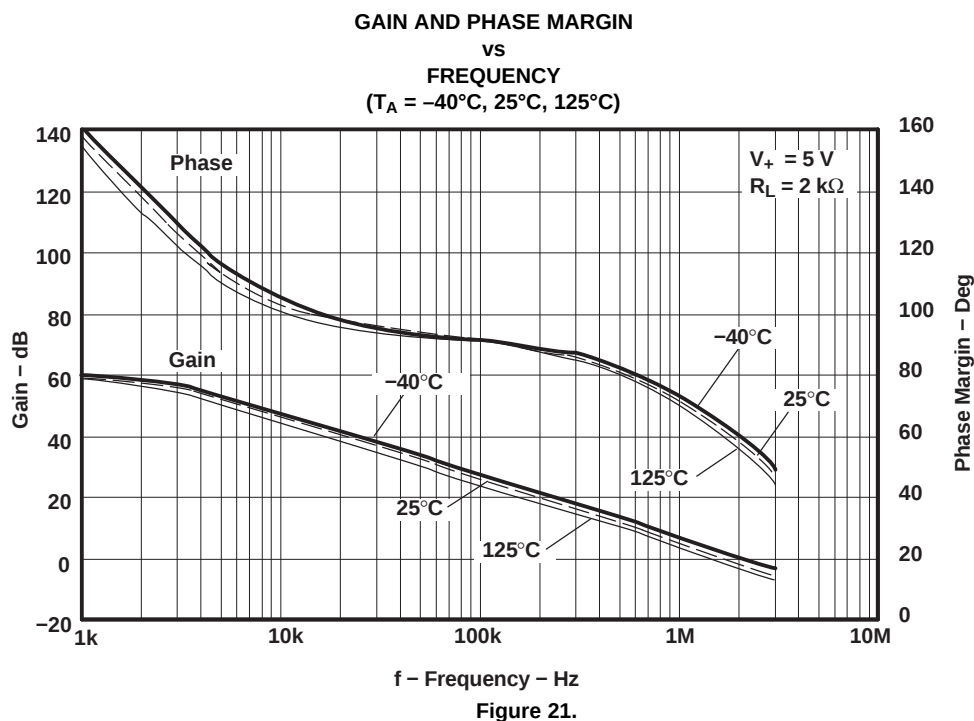


Figure 20.

## TYPICAL CHARACTERISTICS (continued)



## TYPICAL CHARACTERISTICS (continued)

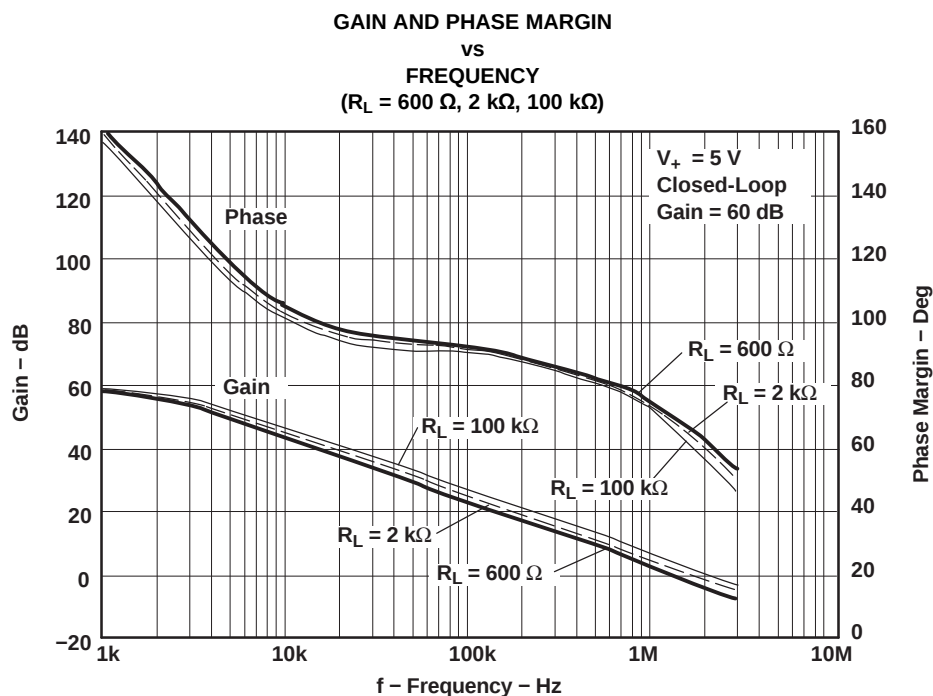


Figure 23.

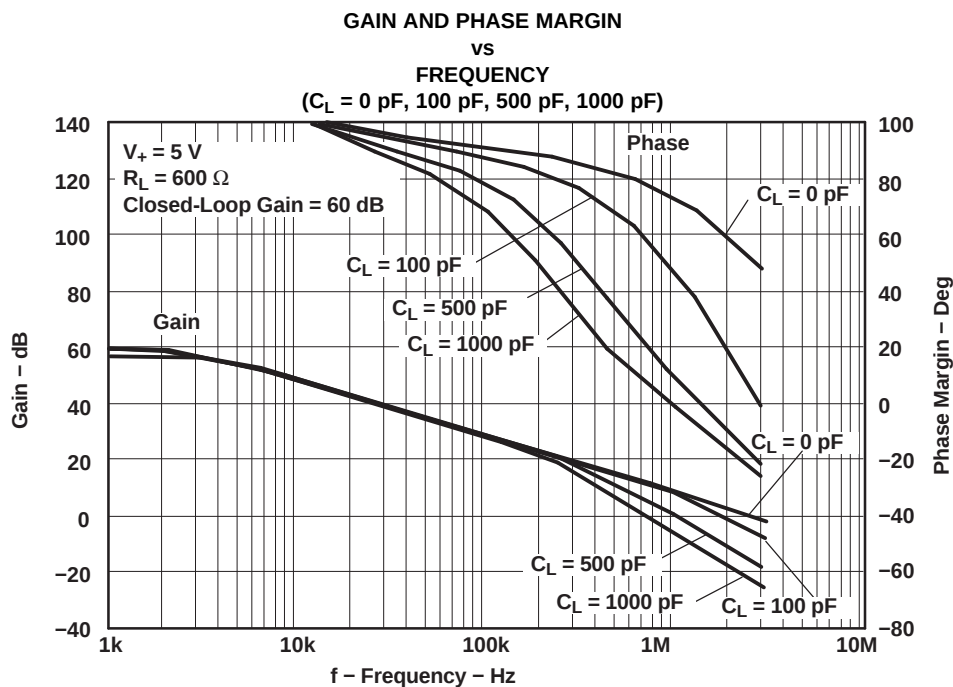


Figure 24.

## TYPICAL CHARACTERISTICS (continued)

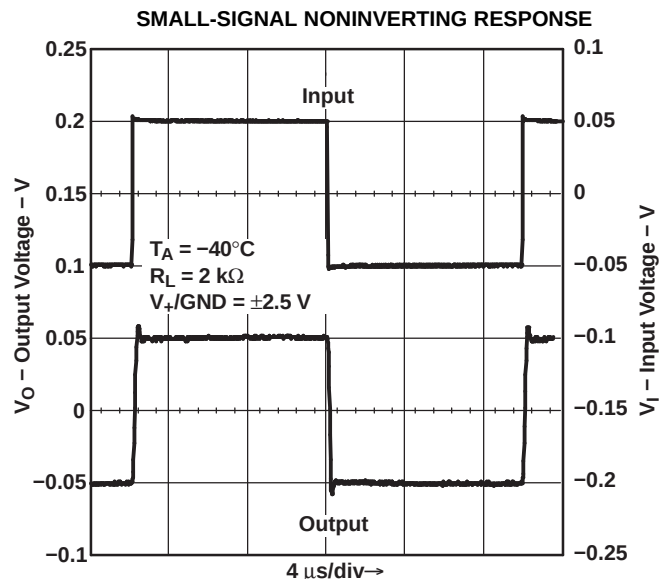


Figure 25.

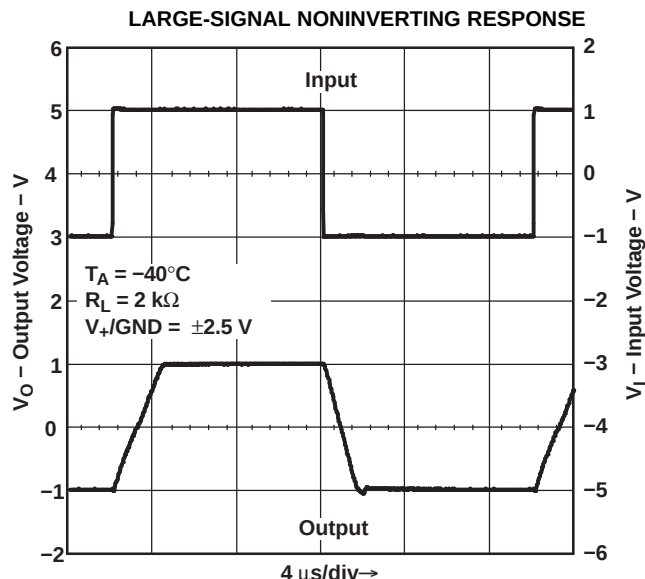


Figure 26.

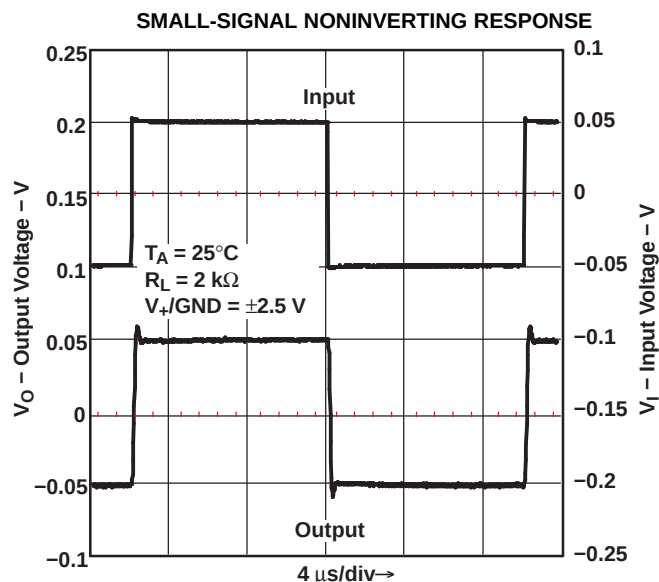


Figure 27.

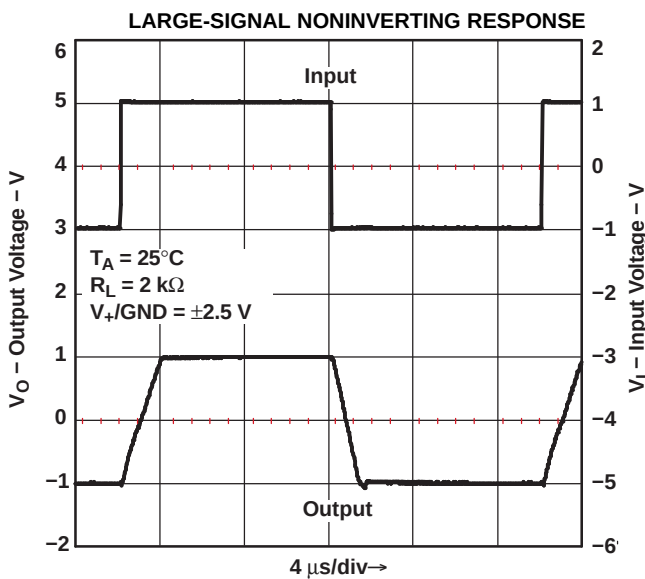


Figure 28.

## TYPICAL CHARACTERISTICS (continued)

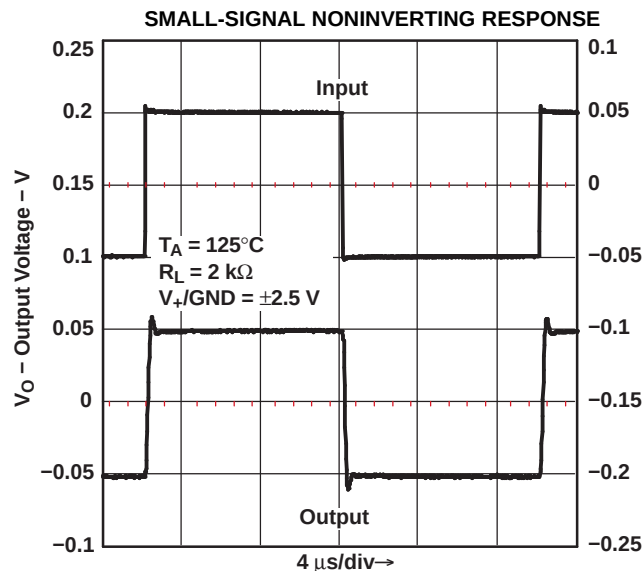


Figure 29.

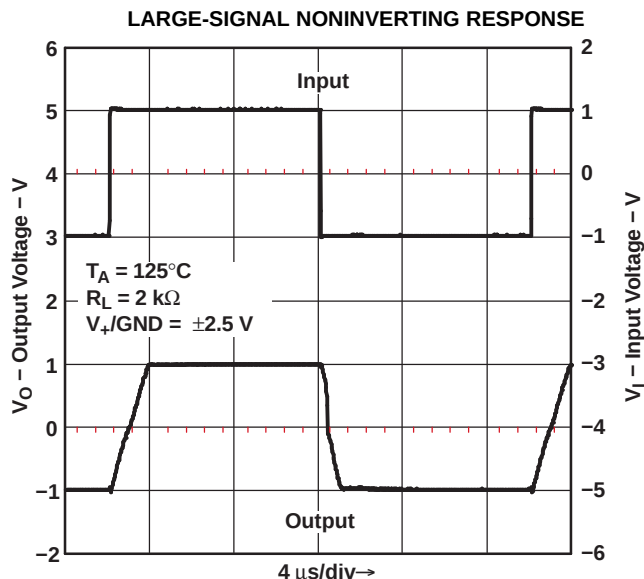


Figure 30.

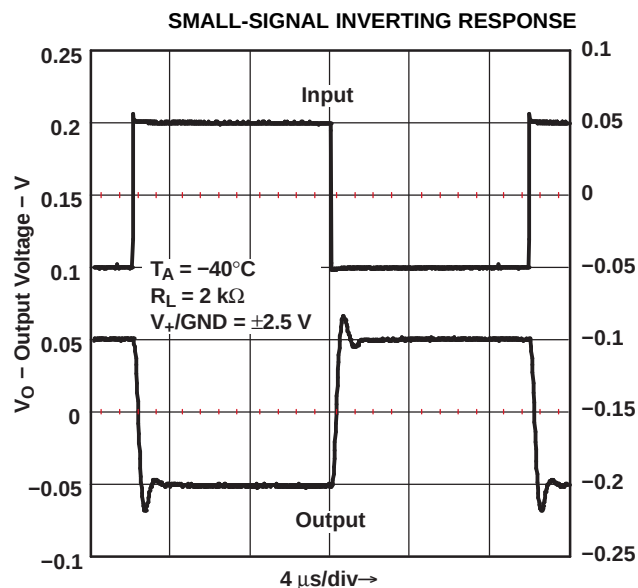


Figure 31.

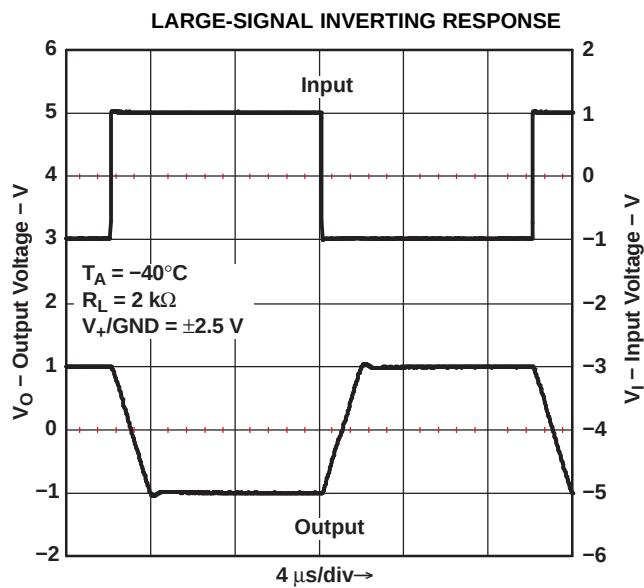


Figure 32.

## TYPICAL CHARACTERISTICS (continued)

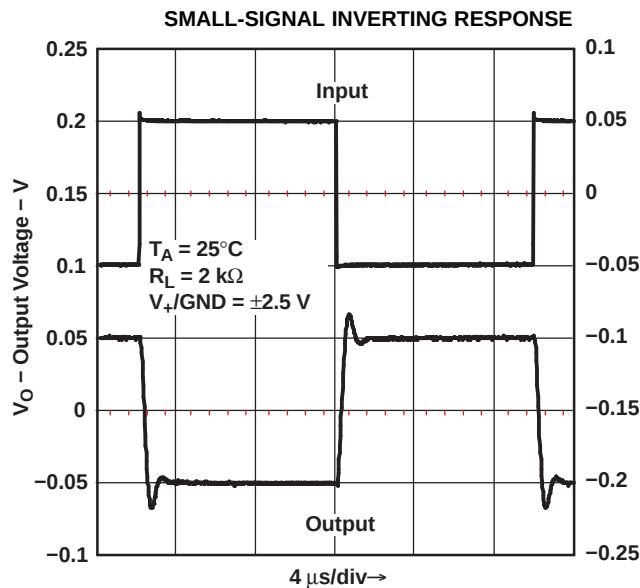


Figure 33.

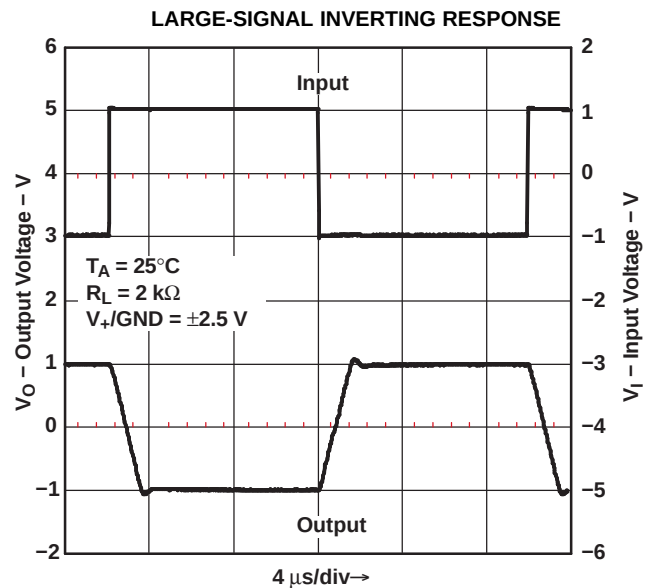


Figure 34.

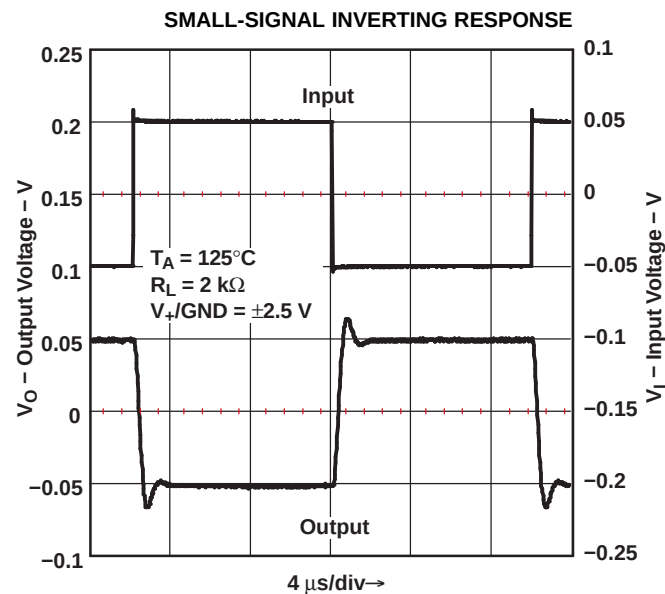


Figure 35.

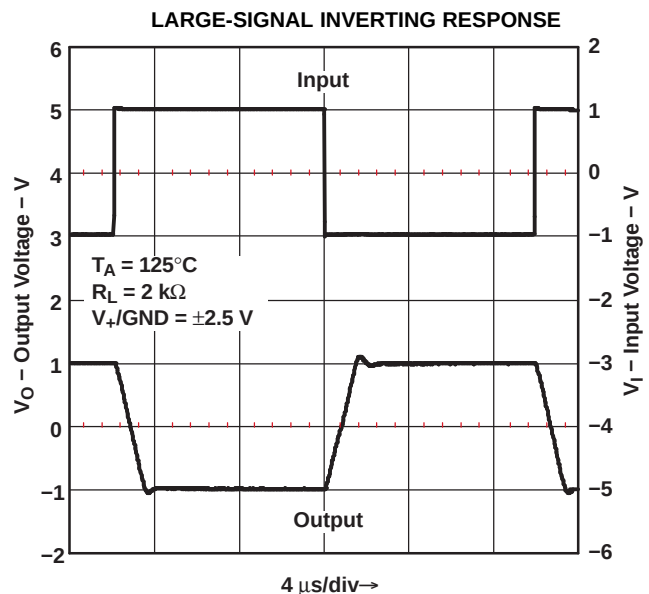


Figure 36.

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| LMV341QDBVRQ1    | ACTIVE        | SOT-23       | DBV                | 6    | 3000           | Green (RoHS<br>& no Sb/Br) | NIPDAU                  | Level-1-260C-UNLIM   | -40 to 125   | RCHE                    | <a href="#">Samples</a> |
| LMV341QDCKRQ1    | ACTIVE        | SC70         | DCK                | 6    | 3000           | Green (RoHS<br>& no Sb/Br) | NIPDAU                  | Level-1-260C-UNLIM   | -40 to 125   | RRE                     | <a href="#">Samples</a> |
| LMV344IPWRQ1     | ACTIVE        | TSSOP        | PW                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | NIPDAU                  | Level-1-260C-UNLIM   | -40 to 125   | LMV344Q                 | <a href="#">Samples</a> |

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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**OTHER QUALIFIED VERSIONS OF LMV341-Q1, LMV344-Q1 :**

- Catalog: [LMV341](#), [LMV344](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

**TAPE AND REEL INFORMATION**


\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LMV341QDBVRQ1 | SOT-23       | DBV             | 6    | 3000 | 179.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| LMV341QDCKRQ1 | SC70         | DCK             | 6    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LMV344IPWRQ1  | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LMV341QDBVRQ1 | SOT-23       | DBV             | 6    | 3000 | 203.0       | 203.0      | 35.0        |
| LMV341QDCKRQ1 | SC70         | DCK             | 6    | 3000 | 203.0       | 203.0      | 35.0        |
| LMV344IPWRQ1  | TSSOP        | PW              | 14   | 2000 | 367.0       | 367.0      | 35.0        |

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040064-3/G 02/11

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

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4211284-2/G 08/15

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

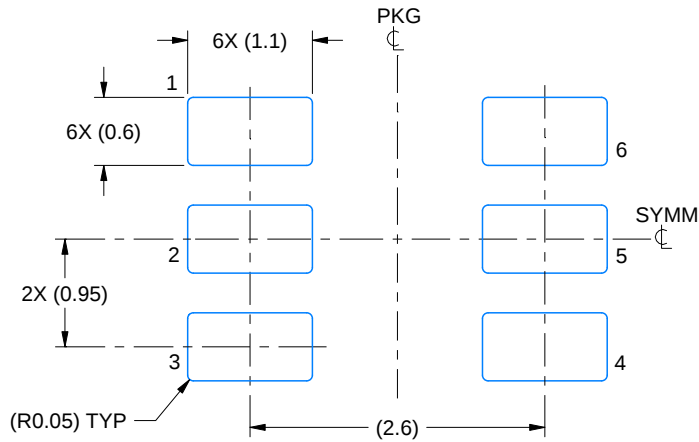


# EXAMPLE BOARD LAYOUT

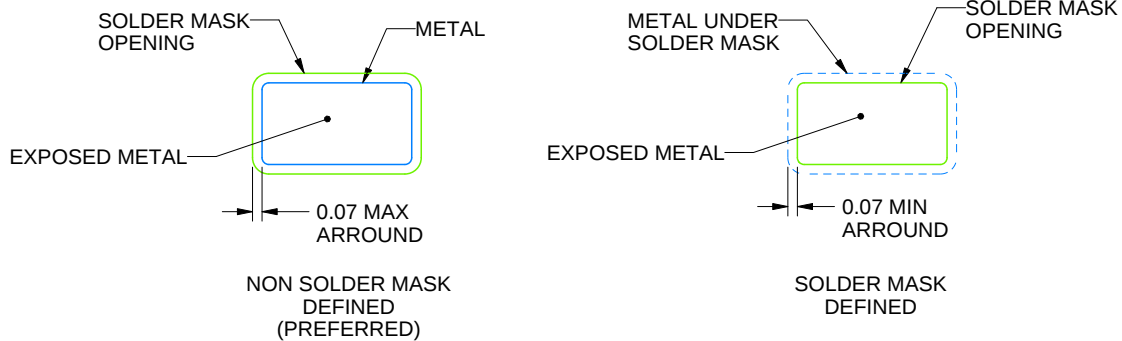
DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4214840/B 03/2018

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

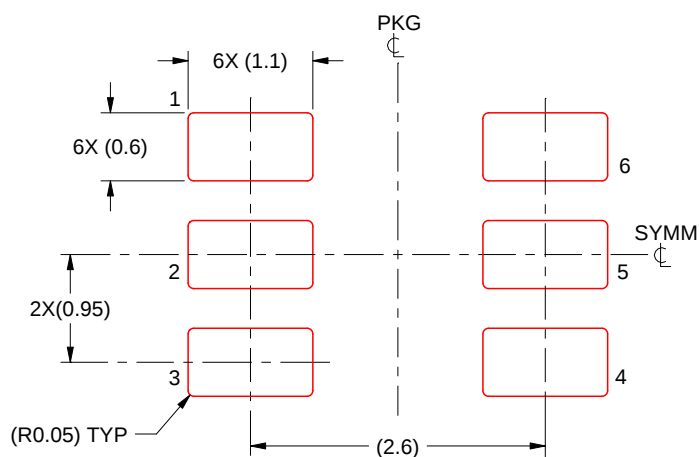
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:15X

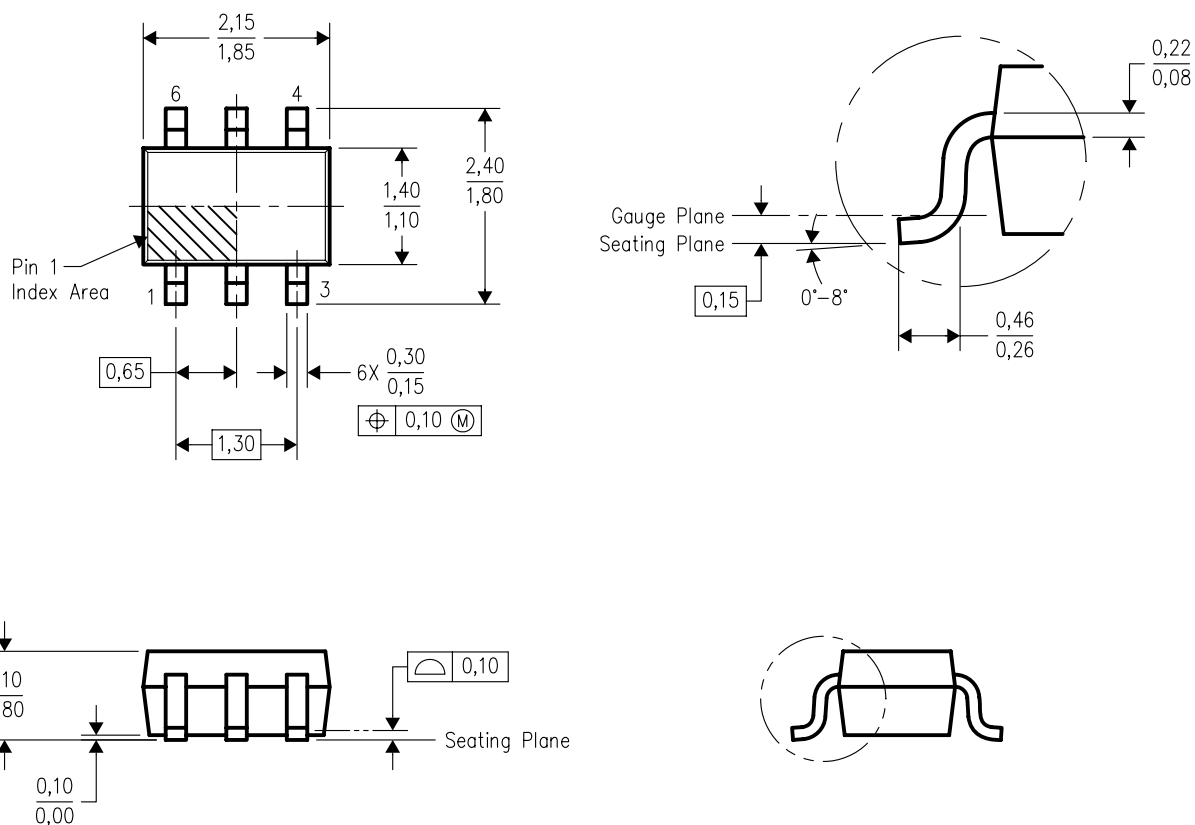
4214840/B 03/2018

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

## DCK (R-PDSO-G6)

## PLASTIC SMALL-OUTLINE PACKAGE

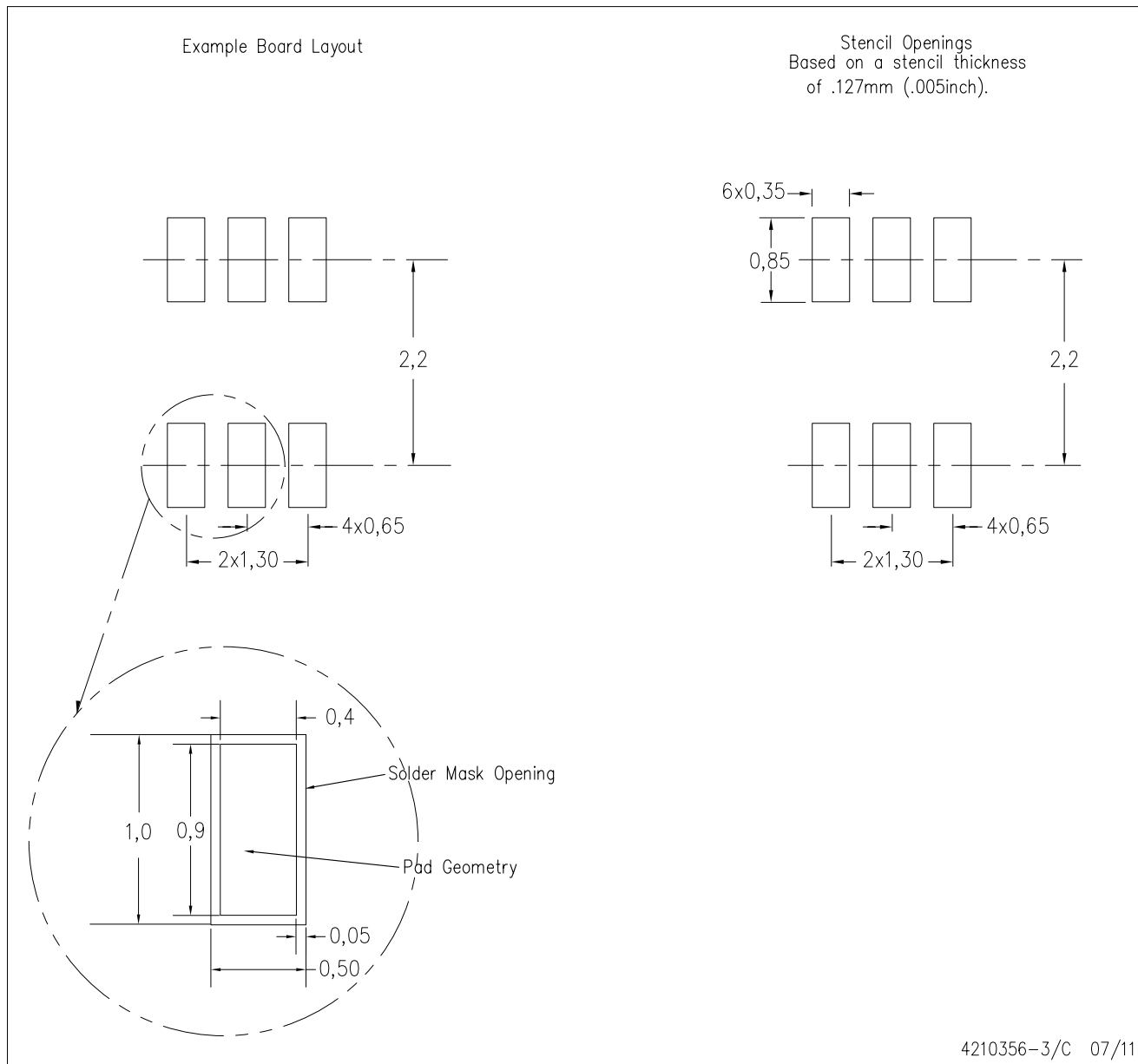


4093553-4/G 01/2007

- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - Falls within JEDEC MO-203 variation AB.

DCK (R-PDSO-G6)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - D. Publication IPC-7351 is recommended for alternate designs.
  - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

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