

## FAMILY OF NANOPOWER PUSH-PULL OUTPUT COMPARATORS

### FEATURES

- Low Supply Current . . . 560 nA/Per Channel
- Input Common-Mode Range Exceeds the Rails . . .  $-0.1\text{ V}$  to  $V_{CC} + 5\text{ V}$
- Supply Voltage Range . . . 2.5 V to 16 V
- Reverse Battery Protection Up to 18 V
- Push-Pull CMOS Output Stage
- Specified Temperature Range
  - $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$  – Commercial Grade
  - $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  – Industrial Grade
- Ultrasmall Packaging
  - 5-Pin SOT-23 (TLV3701)
  - 8-Pin MSOP (TLV3702)
- Universal Op-Amp EVM (Reference SLOU060 for more information)

### APPLICATIONS

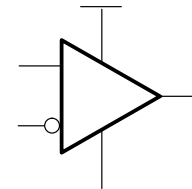
- Portable Battery Monitoring
- Consumer Medical Electronics
- Security Detection Systems

### DESCRIPTION

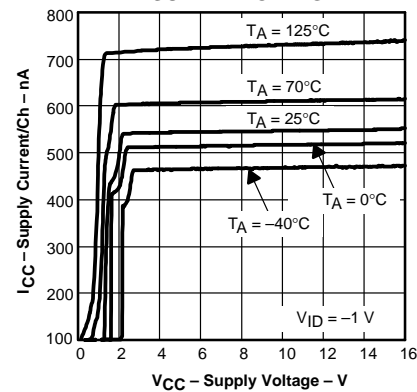
The TLV370x is Texas Instruments' first family of nanopower comparators with only 560 nA per channel supply current, which make this device ideal for battery power and wireless handset applications.

The TLV370x has a minimum operating supply voltage of 2.7 V over the extended industrial temperature range ( $T_A = -40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ), while having an input common-mode range of  $-0.1$  to  $V_{CC} + 5\text{ V}$ . The low supply current makes it an ideal choice for battery powered portable applications where quiescent current is the primary concern. Reverse battery protection guards the amplifier from an over-current condition due to improper battery installation. For harsh environments, the inputs can be taken 5 V above the positive supply rail without damage to the device.

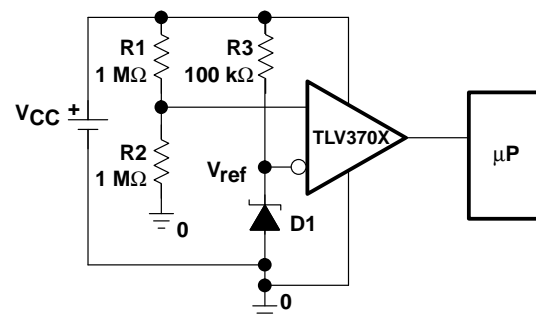
All members are available in PDIP and SOIC with the singles in the small SOT-23 package, duals in the MSOP, and quads in the TSSOP package.



SUPPLY CURRENT  
vs  
SUPPLY VOLTAGE



### high side voltage sense circuit



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.

**A SELECTION OF OUTPUT COMPARATORST**

| DEVICE     | V <sub>CC</sub> (V) | V <sub>IO</sub> (μV) | I <sub>CC/Ch</sub> (μA) | I <sub>B</sub> (pA) | t <sub>PLH</sub> (μs) | t <sub>PHL</sub> (μs) | t <sub>f</sub> (μs) | t <sub>r</sub> (μs) | RAIL-TO-RAIL | OUTPUT STAGE |
|------------|---------------------|----------------------|-------------------------|---------------------|-----------------------|-----------------------|---------------------|---------------------|--------------|--------------|
| TLV370x    | 2.5 – 16            | 250                  | 0.56                    | 80                  | 56                    | 83                    | 22                  | 8                   | I            | PP           |
| TLV340x    | 2.5 – 16            | 250                  | 0.47                    | 80                  | 55                    | 30                    | 5                   | –                   | I            | OD           |
| TLC3702/4  | 3 – 16              | 1200                 | 9                       | 5                   | 1.1                   | 0.65                  | 0.5                 | 0.125               | –            | PP           |
| TLC393/339 | 3 – 16              | 1400                 | 11                      | 5                   | 1.1                   | 0.55                  | 0.22                | –                   | –            | OD           |
| TLC372/4   | 3 – 16              | 1000                 | 75                      | 5                   | 0.65                  | 0.65                  | –                   | –                   | –            | OD           |

† All specifications are typical values measured at 5 V.

**TLV3701 AVAILABLE OPTIONS**

| T <sub>A</sub> | V <sub>IO</sub> max AT 25°C | PACKAGED DEVICES   |               |        |                 |
|----------------|-----------------------------|--------------------|---------------|--------|-----------------|
|                |                             | SMALL OUTLINE (D)† | SOT-23 (DBV)‡ | SYMBOL | PLASTIC DIP (P) |
| 0°C to 70°C    | 5000 μV                     | TLV3701CD          | TLV3701CDBV   | VBCC   | —               |
| –40°C to 125°C |                             | TLV3701ID          | TLV3701IDBV   | VBCI   | TLV3701IP       |

† This package is available taped and reeled. To order this packaging option, add an R suffix to the part number (e.g., TLV3701CDR).

‡ This package is only available taped and reeled. For standard quantities (3000 pieces per reel), add an R suffix (i.e., TLV3701CDBVR). For small quantities (250 pieces per mini-reel), add a T suffix to the part number (e.g., TLV3701CDBVT).

**TLV3702 AVAILABLE OPTIONS**

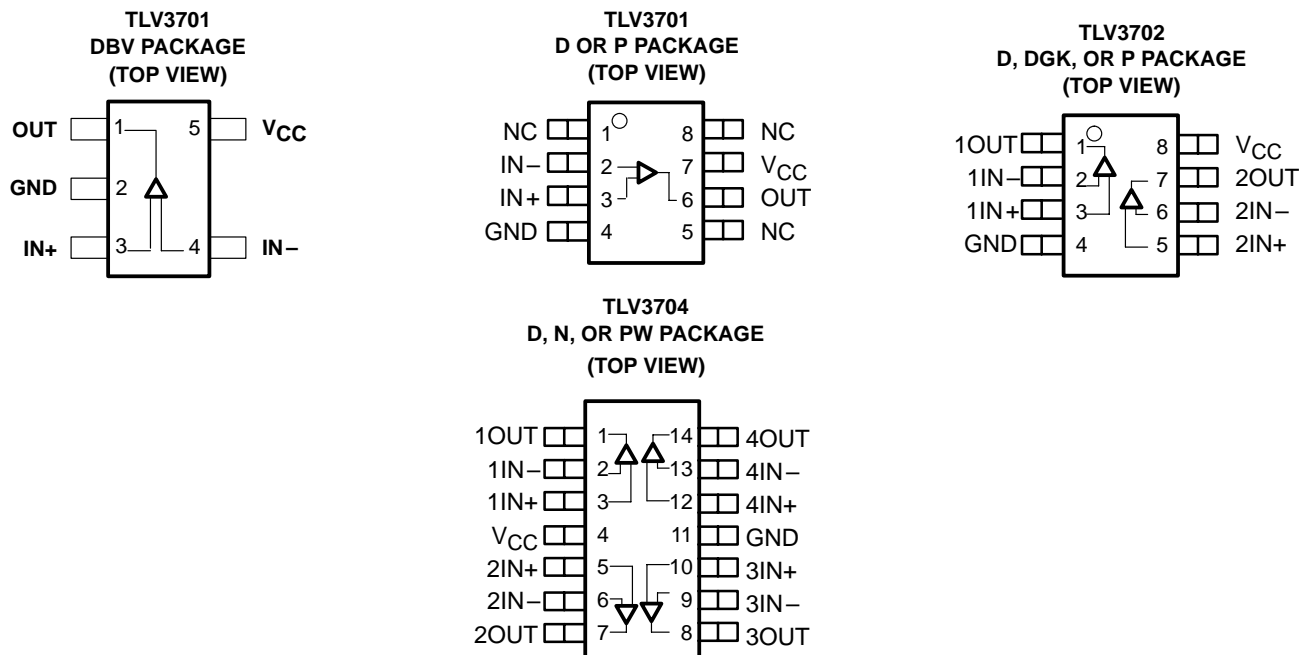
| T <sub>A</sub> | V <sub>IO</sub> max AT 25°C | PACKAGED DEVICES   |             |         |                 |
|----------------|-----------------------------|--------------------|-------------|---------|-----------------|
|                |                             | SMALL OUTLINE (D)† | MSOP (DGK)† | SYMBOL  | PLASTIC DIP (P) |
| 0°C to 70°C    | 5000 μV                     | TLV3702CD          | TLV3702CDGK | xxTIAKC | —               |
| –40°C to 125°C |                             | TLV3702ID          | TLV3702IDGK | xxTIAKD | TLV3702IP       |

† This package is available taped and reeled. To order this packaging option, add an R suffix to the part number (e.g., TLV3702CDR).

**TLV3704 AVAILABLE OPTIONS**

| T <sub>A</sub> | V <sub>IO</sub> max AT 25°C | PACKAGED DEVICES   |                 |            |
|----------------|-----------------------------|--------------------|-----------------|------------|
|                |                             | SMALL OUTLINE (D)† | PLASTIC DIP (N) | TSSOP (PW) |
| 0°C to 70°C    | 5000 μV                     | TLV3704CD          | —               | TLV3704CPW |
| –40°C to 125°C |                             | TLV3704ID          | TLV3704IN       | TLV3704IPW |

† This package is available taped and reeled. To order this packaging option, add an R suffix to the part number (e.g., TLV3704CDR).



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

|   |                              |
|---|------------------------------|
| Supply voltage, V <sub>CC</sub> (see Note 1)                    | 17 V                         |
| Differential input voltage, V <sub>ID</sub>                     | ±20 V                        |
| Input voltage range, V <sub>I</sub> (see Notes 1 and 2)         | 0 to V <sub>CC</sub> + 5 V   |
| Input current range, I <sub>I</sub>                             | ±10 mA                       |
| Output current range, I <sub>O</sub>                            | ±10 mA                       |
| Continuous total power dissipation                              | See Dissipation Rating Table |
| Operating free-air temperature range, T <sub>A</sub> : C suffix | 0°C to 70°C                  |
| I suffix  | -40°C to 125°C               |
| Maximum junction temperature, T <sub>J</sub>                    | 150°C                        |
| Storage temperature range, T <sub>stg</sub>                     | -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 GND.  
2. Input voltage range is limited to 20 V max or V<sub>CC</sub> + 5 V, whichever is smaller.

DISSIPATION RATING TABLE

| PACKAGE | $\theta_{JC}$<br>(°C/W) | $\theta_{JA}$<br>(°C/W) | $T_A \leq 25^\circ\text{C}$<br>POWER RATING | $T_A = 125^\circ\text{C}$<br>POWER RATING |
|---------|-------------------------|-------------------------|---|---|
| D (8)   | 38.3                    | 176                     | 710 mW                                      | 142 mW                                    |
| D (14)  | 26.9                    | 122.6                   | 1022 mW                                     | 204.4 mW                                  |
| DBV (5) | 55                      | 324.1                   | 385 mW                                      | 77.1 mW                                   |
| DGK (8) | 54.2                    | 259.9                   | 481 mW                                      | 96.2 mW                                   |
| N (14)  | 32                      | 78                      | 1600 mW                                     | 320.5 mW                                  |
| P (8)   | 41                      | 104                     | 1200 mW                                     | 240.4 mW                                  |
| PW (14) | 29.3                    | 173.6                   | 720 mW                                      | 144 mW                                    |

recommended operating conditions

|  |               |          | MIN        | MAX        | UNIT |
|--|---------------|----------|------------|------------|------|
| Supply voltage, $V_{CC}$                   | Single supply | C-suffix | 2.5        | 16         | V    |
|  |               | I-suffix | 2.7        | 16         |      |
|  | Split supply  | C-suffix | $\pm 1.25$ | $\pm 8$    |      |
|  |               | I-suffix | $\pm 1.35$ | $\pm 8$    |      |
| Common-mode input voltage range, $V_{ICR}$ |               |          | -0.1       | $V_{CC}+5$ | V    |
| Operating free-air temperature, $T_A$      | C-suffix      |          | 0          | 70         | °C   |
|  | I-suffix      |          | -40        | 125        |      |

electrical characteristics at specified operating free-air temperature,  $V_{CC} = 2.7\text{ V}, 5\text{ V}, 15\text{ V}$  (unless otherwise noted)

dc performance

| PARAMETER      |   | TEST CONDITIONS                                       | $T_A$ †    | MIN | TYP  | MAX  | UNIT                         |
|----------------|---|---|------------|-----|------|------|------------------------------|
| $V_{IO}$       | Input offset voltage                            | $V_{IC} = V_{CC}/2, R_S = 50\ \Omega$                 | 25°C       |     | 250  | 5000 | $\mu\text{V}$                |
|                |   |   | Full range |     |      | 7000 |                              |
| $\alpha_{VIO}$ | Offset voltage drift                            |   | 25°C       |     | 3    |      | $\mu\text{V}/^\circ\text{C}$ |
| CMRR           | Common-mode rejection ratio                     | $V_{IC} = 0\text{ to }2.7\text{ V}, R_S = 50\ \Omega$ | 25°C       | 55  | 72   | dB   |                              |
|                |   |   | Full range | 50  |      |      |                              |
|                |   | $V_{IC} = 0\text{ to }5\text{ V}, R_S = 50\ \Omega$   | 25°C       | 60  | 76   |      |                              |
|                |   |   | Full range | 55  |      |      |                              |
|                |   | $V_{IC} = 0\text{ to }15\text{ V}, R_S = 50\ \Omega$  | 25°C       | 65  | 88   |      |                              |
|                |   |   | Full range | 60  |      |      |                              |
| $A_{VD}$       | Large-signal differential voltage amplification |   | 25°C       |     | 1000 | V/mV |                              |

† Full range is 0°C to 70°C for C suffix and -40°C to 125°C for I suffix. If not specified, full range is -40°C to 125°C.

input/output characteristics

| PARAMETER  |                               | TEST CONDITIONS  | $T_A$ †        | MIN            | TYP             | MAX              | UNIT        |
|------------|-------------------------------|--|----------------|----------------|-----------------|------------------|-------------|
| $I_{IO}$   | Input offset current          | $V_{IC} = V_{CC}/2, R_S = 50\ \Omega$                              | 25°C           |                | 20              | 100              | $\text{pA}$ |
|            |                               |  | Full range     |                |                 | 1000             |             |
| $I_{IB}$   | Input bias current            |  | 25°C           |                | 80              | 250              | $\text{pA}$ |
|            |                               |  | Full range     |                |                 | 1500             |             |
| $r_{i(d)}$ | Differential input resistance |  | 25°C           |                | 300             | $\text{M}\Omega$ |             |
| $V_{OH}$   | High-level output voltage     | $V_{IC} = V_{CC}/2, I_{OH} = 2\ \mu\text{A}, V_{ID} = 1\text{ V}$  | 25°C           |                | $V_{CC} - 0.08$ | mV               |             |
|            |                               |  | 25°C           | $V_{CC} - 320$ |                 |                  |             |
|            |                               | Full range   | $V_{CC} - 450$ |                |                 |                  |             |
| $V_{OL}$   | Low-level output voltage      | $V_{IC} = V_{CC}/2, I_{OH} = 2\ \mu\text{A}, V_{ID} = -1\text{ V}$ | 25°C           |                | 8               | mV               |             |
|            |                               |  | 25°C           |                | 80              |                  | 200         |
|            |                               | Full range   |                |                | 300             |                  |             |

† Full range is 0°C to 70°C for C suffix and -40°C to 125°C for I suffix. If not specified, full range is -40°C to 125°C.

power supply

| PARAMETER |                              | TEST CONDITIONS                          | $T_A$ †                               | MIN        | TYP | MAX  | UNIT |
|-----------|------------------------------|--|---------------------------------------|------------|-----|------|------|
| $I_{CC}$  | Supply current (per channel) | Output state high                        | 25°C                                  |            | 560 | 800  | nA   |
|           |                              |  | Full range                            |            |     | 1000 |      |
| PSRR      | Power supply rejection ratio | $V_{IC} = V_{CC}/2\text{ V},$<br>No load | $V_{CC} = 2.7\text{ V to }5\text{ V}$ | 25°C       | 75  | 100  | dB   |
|           |                              |  |                                       | Full range | 70  |      |      |
|           |                              |  | $V_{CC} = 5\text{ V to }15\text{ V}$  | 25°C       | 85  | 105  |      |
|           |                              |  |                                       | Full range | 80  |      |      |

† Full range is 0°C to 70°C for C suffix and -40°C to 125°C for I suffix. If not specified, full range is -40°C to 125°C.

switching characteristics at recommended operating conditions,  $V_{CC} = 2.7\text{ V}, 5\text{ V}, 15\text{ V}, T_A = 25^\circ\text{C}$  (unless otherwise noted)

| PARAMETER   |  | TEST CONDITIONS  | MIN               | TYP | MAX | UNIT          |
|-------------|--|--|-------------------|-----|-----|---------------|
| $t_{(PLH)}$ | Propagation response time, low-to-high-level output (see Note 3) | f = 10 kHz,<br>VSTEP = 100 mV,<br>C <sub>L</sub> = 10 pF,<br>V <sub>CC</sub> = 2.7 V | Overdrive = 2 mV  | 240 |     | $\mu\text{s}$ |
|             |  |  | Overdrive = 10 mV | 64  |     |               |
|             |  |  | Overdrive = 50 mV | 36  |     |               |
| $t_{(PHL)}$ | Propagation response time, high-to-low-level output (see Note 3) |  | Overdrive = 2 mV  | 167 |     |               |
|             |  |  | Overdrive = 10 mV | 67  |     |               |
|             |  |  | Overdrive = 50 mV | 37  |     |               |
| $t_r$       | Rise time  | C <sub>L</sub> = 10 pF, V <sub>CC</sub> = 2.7 V                                      |                   | 7   |     | $\mu\text{s}$ |
| $t_f$       | Fall time  | C <sub>L</sub> = 10 pF, V <sub>CC</sub> = 2.7 V                                      |                   | 9   |     | $\mu\text{s}$ |

NOTE 3: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V. Propagation responses are longer at higher supply voltages, refer to Figures 12–17 for further details.

### TYPICAL CHARACTERISTICS

#### Table of Graphs

|  |                           |                              | FIGURE     |
|--|---------------------------|------------------------------|------------|
| Input bias/offset current                                      | vs Free-air temperature   |                              | 1          |
| Open collector leakage current                                 | vs Free-air temperature   |                              | 2          |
| V <sub>OL</sub>  | Low-level output voltage  | vs Low-level output current  | 3, 5, 7    |
| V <sub>OH</sub>  | High-level output voltage | vs High-level output current | 4, 6, 8    |
| I <sub>CC</sub>  | Supply current            | vs Supply voltage            | 9          |
|  |                           | vs Free-air temperature      | 10         |
| Output fall time/rise time                                     | vs Supply voltage         |                              | 11         |
| Low-to-high level output response for various input overdrives |                           |                              | 12, 14, 16 |
| High-to-low level output response for various input overdrives |                           |                              | 13, 15, 17 |

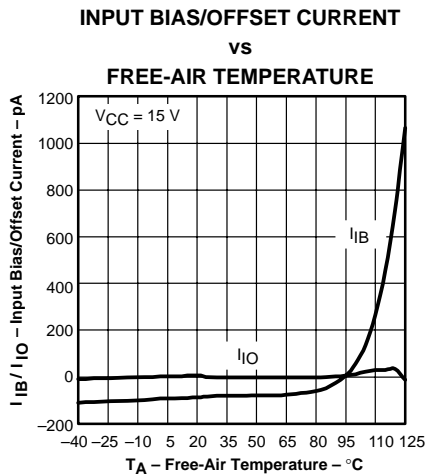


Figure 1

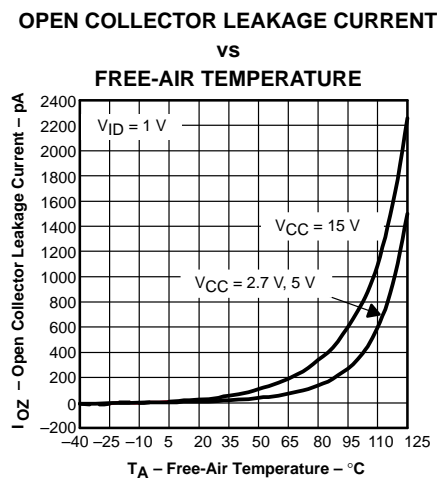


Figure 2

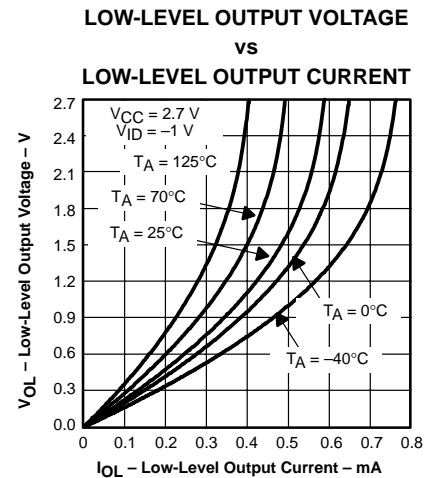


Figure 3

TYPICAL CHARACTERISTICS

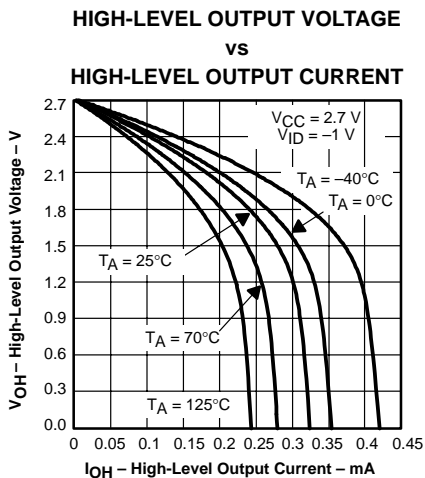


Figure 4

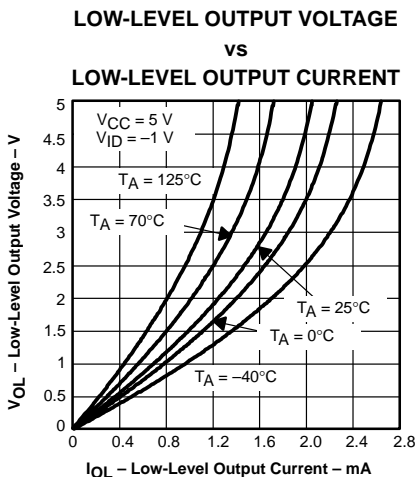


Figure 5

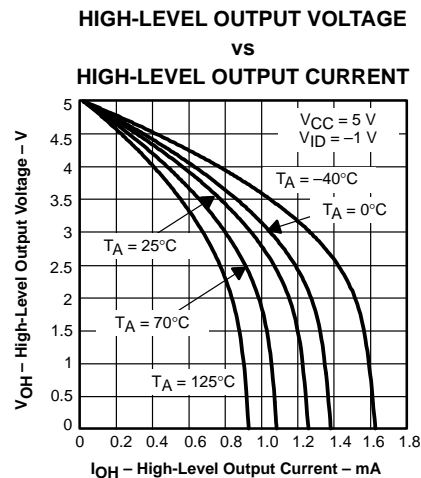


Figure 6

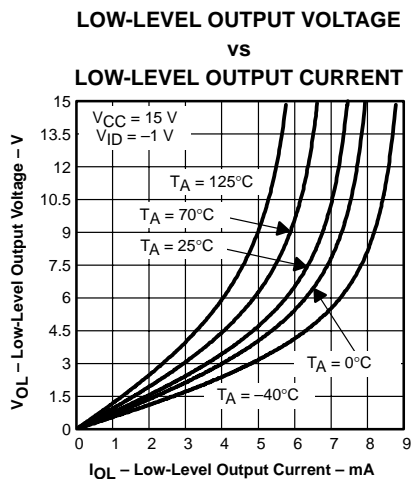


Figure 7

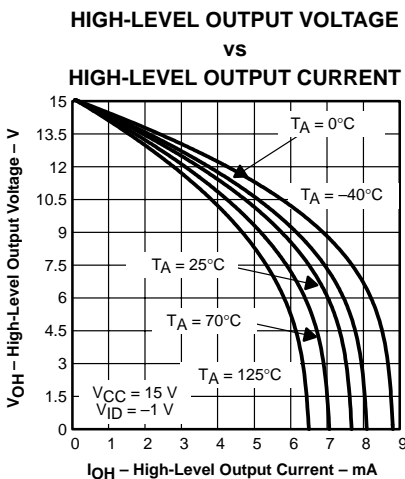


Figure 8

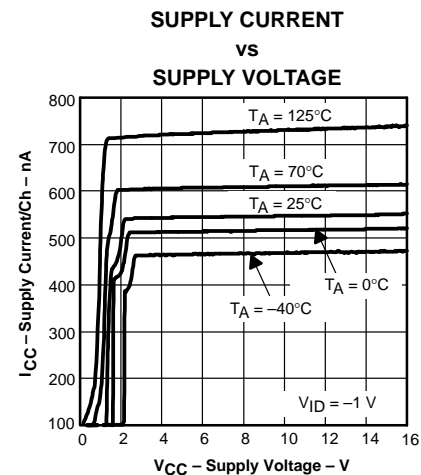


Figure 9

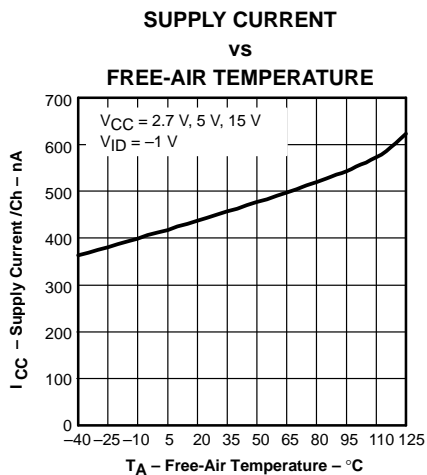


Figure 10

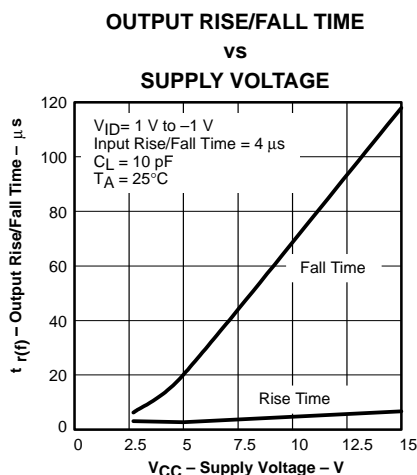


Figure 11

TYPICAL CHARACTERISTICS

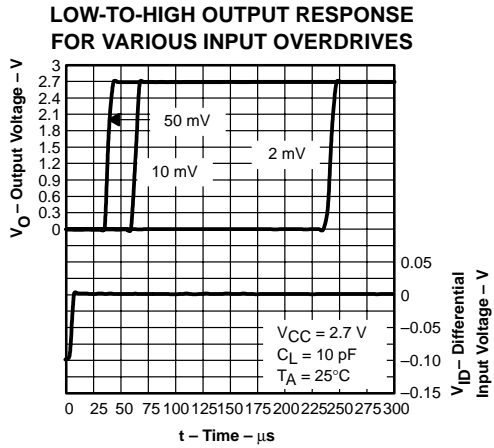


Figure 12

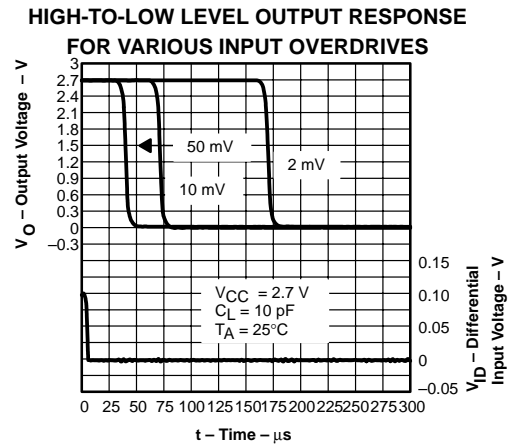


Figure 13

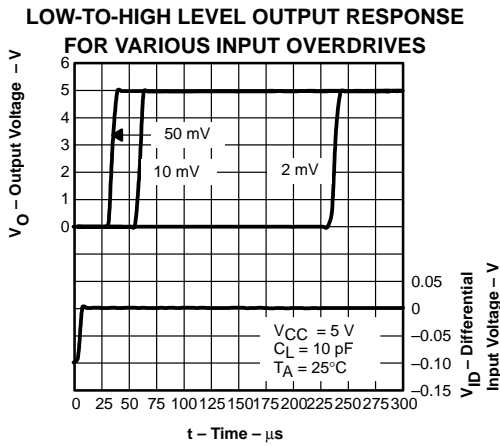


Figure 14

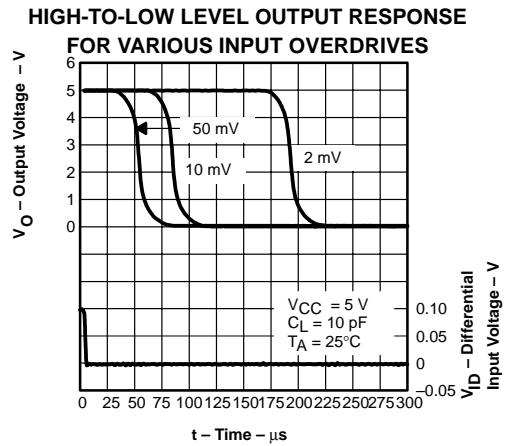


Figure 15

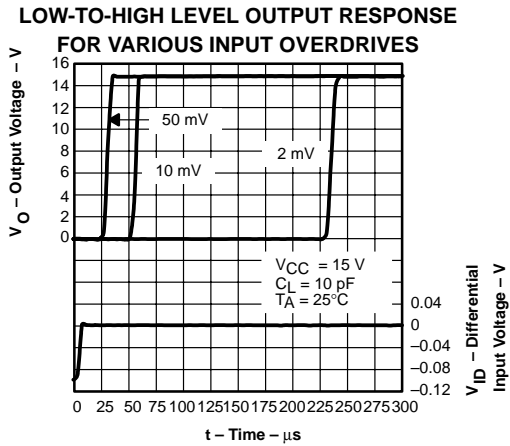


Figure 16

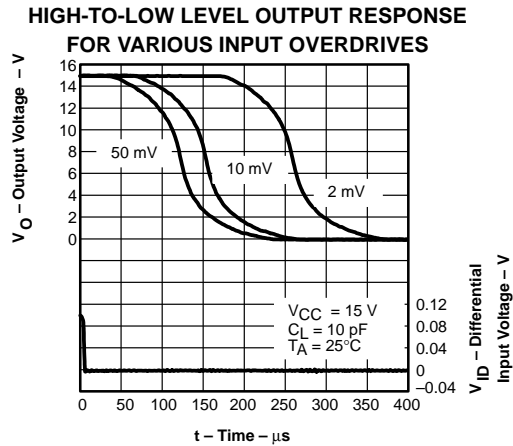


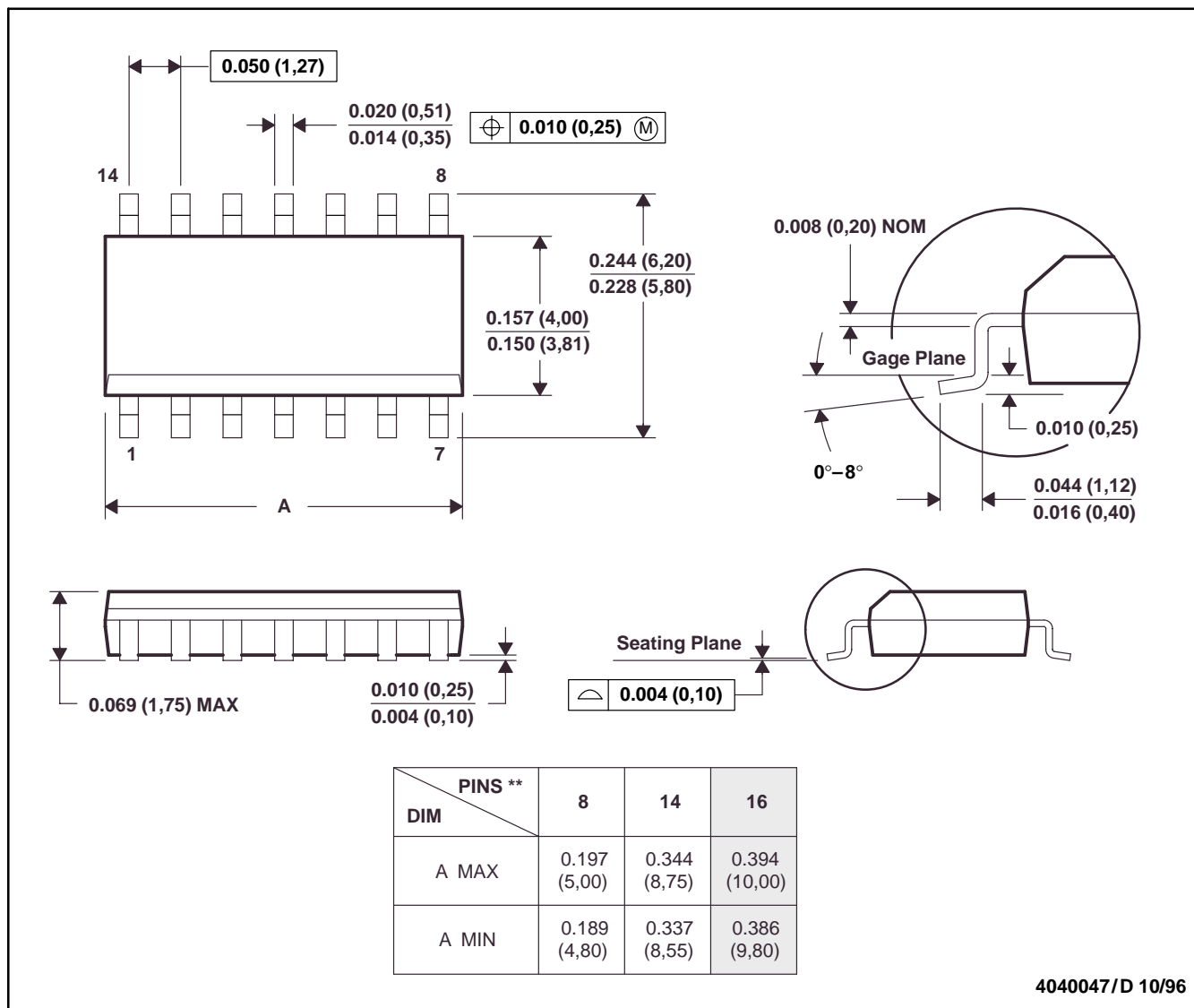
Figure 17

MECHANICAL DATA

D (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



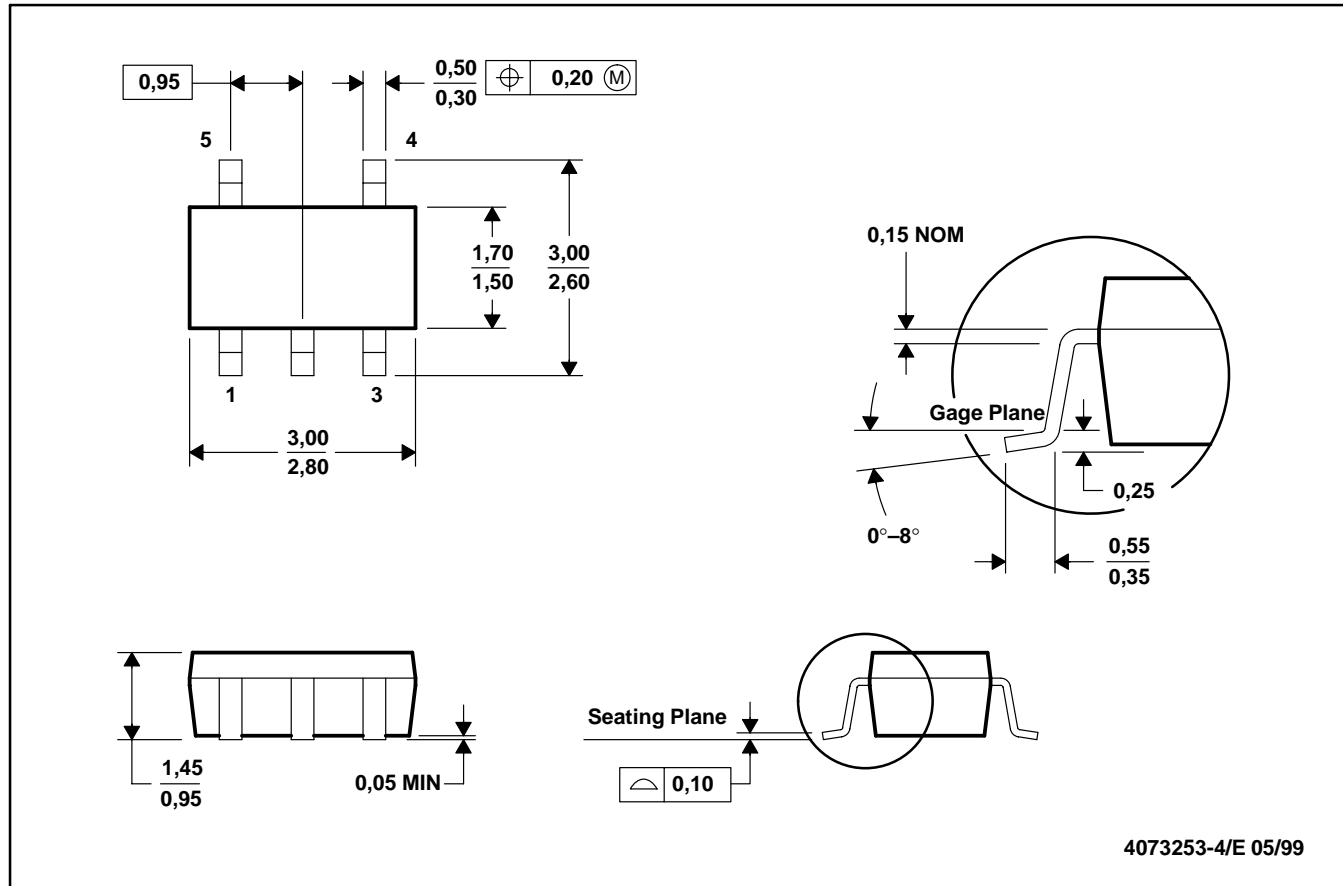
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).  
 D. Falls within JEDEC MS-012

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)

MECHANICAL DATA

DBV (R-PDSO-G5)

PLASTIC SMALL-OUTLINE



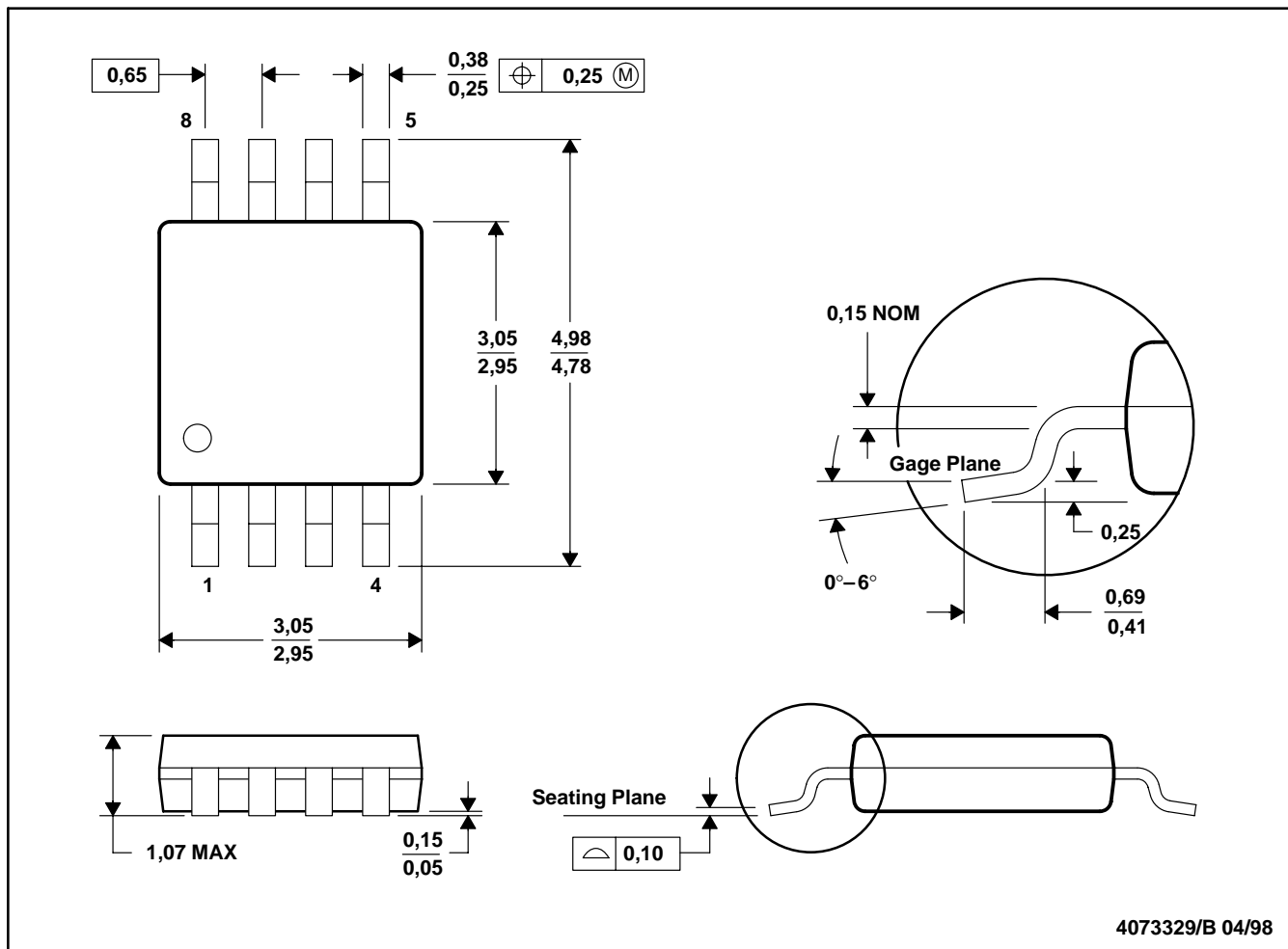
- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion.
  - D. Falls within JEDEC MO-178

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)

MECHANICAL DATA

DGK (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



4073329/B 04/98

- 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.  
 D. Falls within JEDEC MO-187

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)

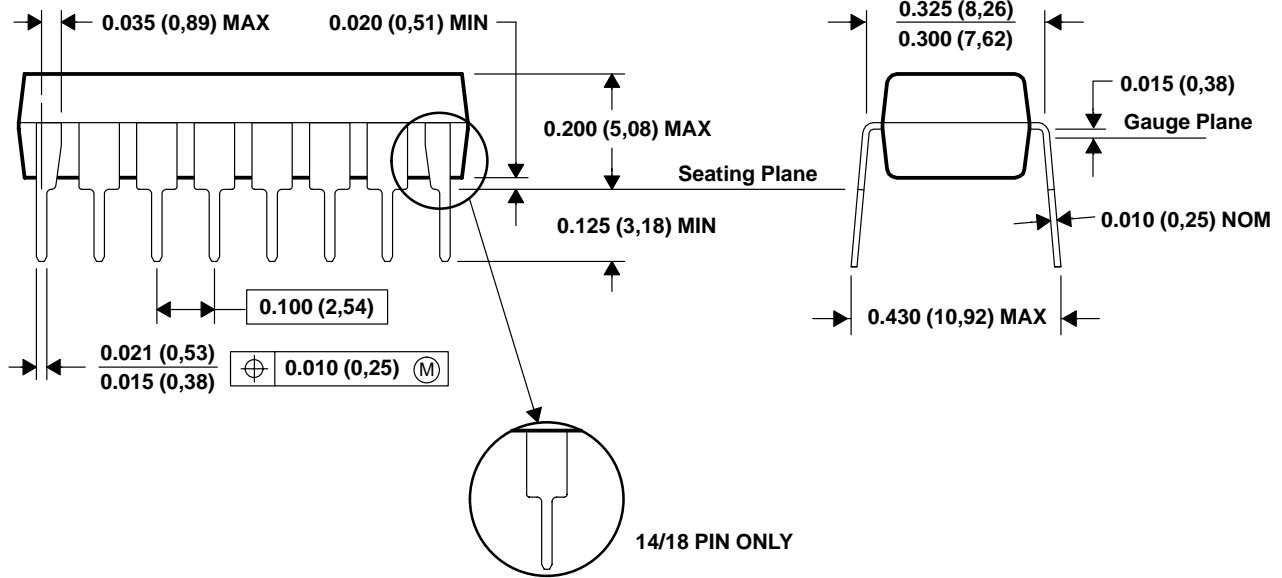
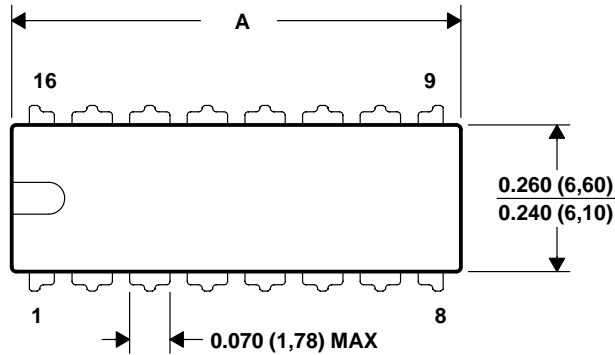
**MECHANICAL DATA**

**N (R-PDIP-T\*\*)**

**PLASTIC DUAL-IN-LINE PACKAGE**

16 PINS SHOWN

| DIM \ PINS ** | 14               | 16               | 18               | 20               |
|---------------|------------------|------------------|------------------|------------------|
| A MAX         | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 0.975<br>(24,77) |
| A MIN         | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |



4040049/D 02/00

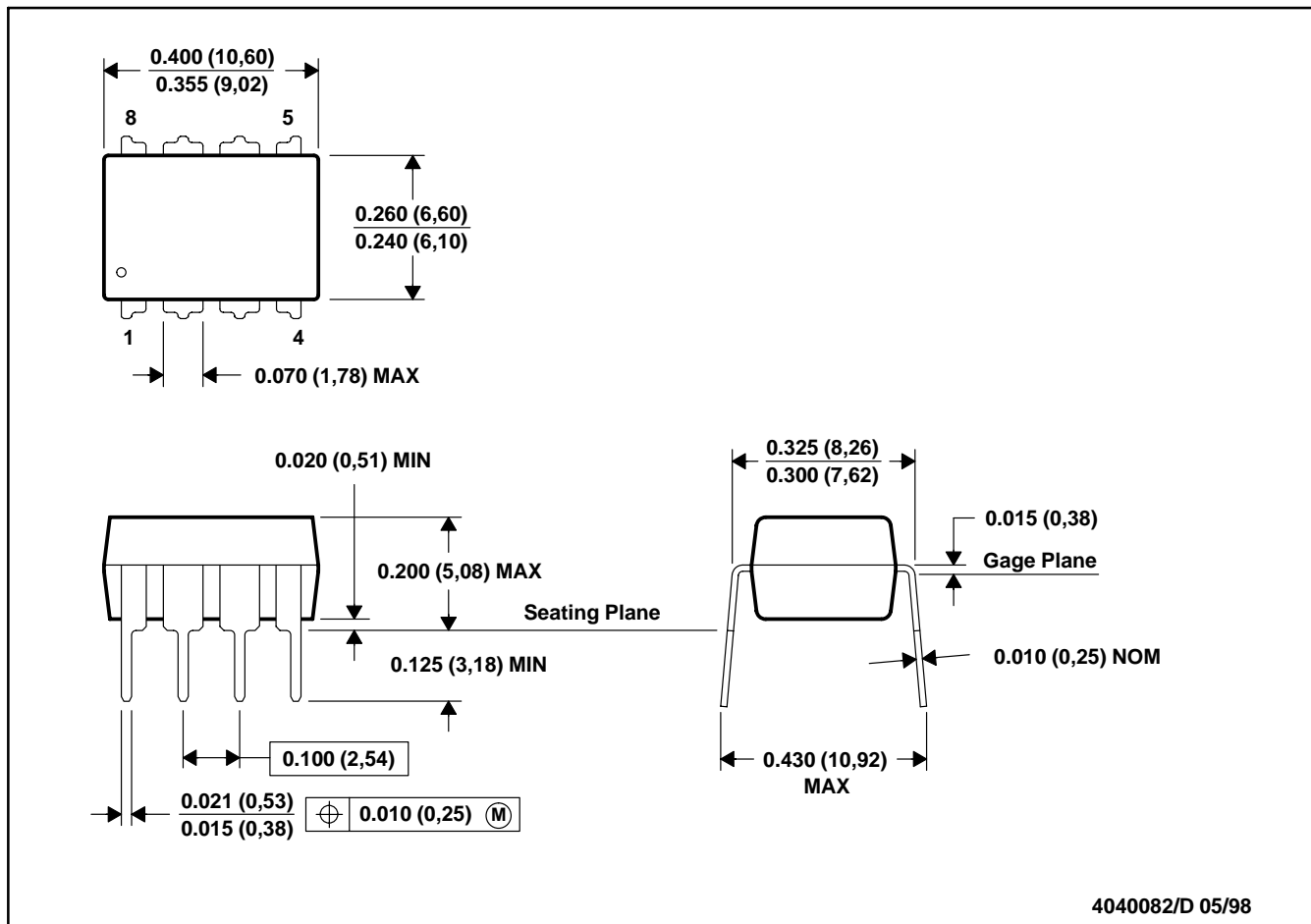
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001 (20-pin package is shorter than MS-001).

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)

MECHANICAL DATA

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001

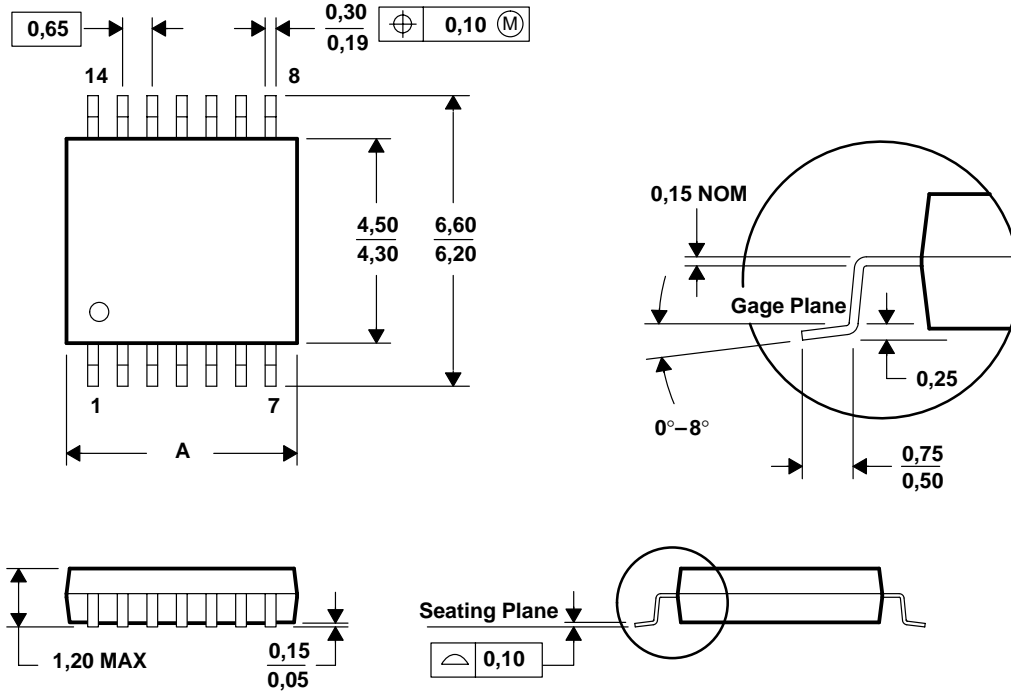
For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)

MECHANICAL DATA

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



| DIM \ PINS ** | 8    | 14   | 16   | 20   | 24   | 28   |
|---------------|------|------|------|------|------|------|
| A MAX         | 3,10 | 5,10 | 5,10 | 6,60 | 7,90 | 9,80 |
| A MIN         | 2,90 | 4,90 | 4,90 | 6,40 | 7,70 | 9,60 |

4040064/F 01/97

- 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 not to exceed 0,15.  
 D. Falls within JEDEC MO-153

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TLV3701CD        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701CDBVR     | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701CDBVRG4   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701CDBVT     | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701CDBVTG4   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701CDG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701ID        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701IDBVR     | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701IDBVRG4   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701IDBVT     | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701IDBVTG4   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701IDG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701IDR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701IDRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3701IP        | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| TLV3701IPE4      | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| TLV3702CD        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702CDG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702CDGK      | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702CDGKG4    | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702CDGKR     | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702CDGKRG4   | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702ID        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702IDG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702IDGK      | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TLV3702IDGKG4    | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702IDGKR     | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702IDGKRG4   | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702IDR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702IDRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3702IP        | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| TLV3702IPE4      | ACTIVE                | PDIP         | P               | 8    | 50          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| TLV3704CD        | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704CDG4      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704CPW       | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704CPWG4     | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704ID        | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704IDG4      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704IDR       | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704IDRG4     | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704IN        | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| TLV3704INE4      | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| TLV3704IPW       | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704IPWG4     | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704IPWR      | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TLV3704IPWRG4    | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

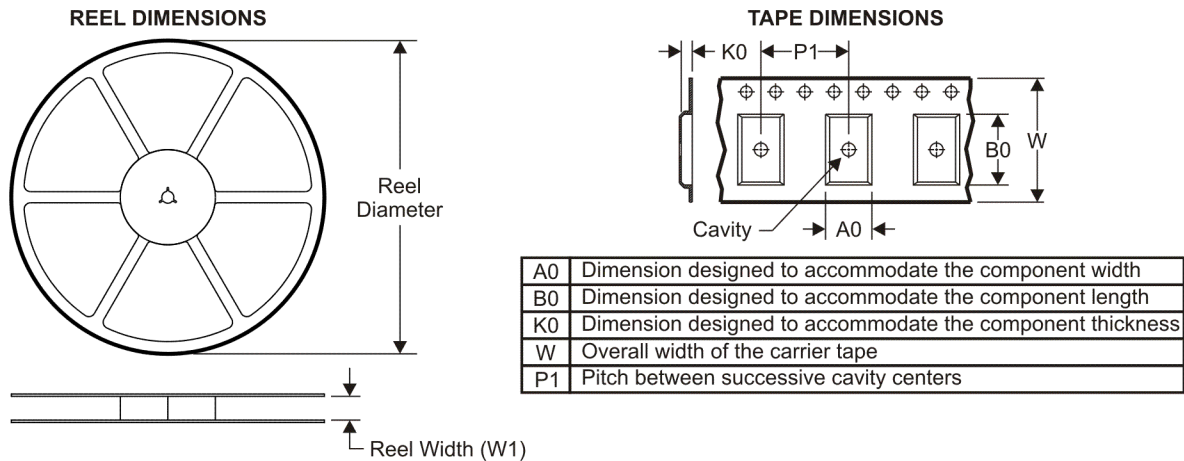
**OTHER QUALIFIED VERSIONS OF TLV3701, TLV3702 :**

- Automotive: [TLV3701-Q1](#), [TLV3702-Q1](#)
- Enhanced Product: [TLV3701-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TLV3701CDBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TLV3701CDBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TLV3701IDBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TLV3701IDBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TLV3701IDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TLV3702CDGKR | MSOP         | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| TLV3702IDGKR | MSOP         | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| TLV3702IDR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TLV3704IDR   | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| TLV3704IPWR  | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 7.0     | 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) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TLV3701CDBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TLV3701CDBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TLV3701IDBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TLV3701IDBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TLV3701IDR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| TLV3702CDGKR | MSOP         | DGK             | 8    | 2500 | 358.0       | 335.0      | 35.0        |
| TLV3702IDGKR | MSOP         | DGK             | 8    | 2500 | 358.0       | 335.0      | 35.0        |
| TLV3702IDR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| TLV3704IDR   | SOIC         | D               | 14   | 2500 | 333.2       | 345.9      | 28.6        |
| TLV3704IPWR  | TSSOP        | PW              | 14   | 2000 | 346.0       | 346.0      | 29.0        |

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

### Products

|                             |  |
|-----------------------------|--|
| Amplifiers                  | <a href="http://amplifier.ti.com">amplifier.ti.com</a>             |
| Data Converters             | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>     |
| DLP® Products               | <a href="http://www.dlp.com">www.dlp.com</a>                       |
| DSP                         | <a href="http://dsp.ti.com">dsp.ti.com</a>                         |
| Clocks and Timers           | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>           |
| Interface                   | <a href="http://interface.ti.com">interface.ti.com</a>             |
| Logic                       | <a href="http://logic.ti.com">logic.ti.com</a>                     |
| Power Mgmt                  | <a href="http://power.ti.com">power.ti.com</a>                     |
| Microcontrollers            | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a> |
| RFID                        | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>               |
| RF/IF and ZigBee® Solutions | <a href="http://www.ti.com/lprf">www.ti.com/lprf</a>               |

### Applications

|                    |  |
|--------------------|--|
| Audio              | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                   |
| Automotive         | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>         |
| Broadband          | <a href="http://www.ti.com/broadband">www.ti.com/broadband</a>           |
| Digital Control    | <a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a> |
| Medical            | <a href="http://www.ti.com/medical">www.ti.com/medical</a>               |
| Military           | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
| Optical Networking | <a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a> |
| Security           | <a href="http://www.ti.com/security">www.ti.com/security</a>             |
| Telephony          | <a href="http://www.ti.com/telephony">www.ti.com/telephony</a>           |
| Video & Imaging    | <a href="http://www.ti.com/video">www.ti.com/video</a>                   |
| Wireless           | <a href="http://www.ti.com/wireless">www.ti.com/wireless</a>             |

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2009, Texas Instruments Incorporated