

NANOPOWER PUSH-PULL OUTPUT COMPARATOR

FEATURES

- **Controlled Baseline**
 - One Assembly/Test Site, One Fabrication Site
- **Extended Temperature Performance of -40°C to 125°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree†**
- **Low Supply Current . . . 560 nA**
- **Input Common-Mode Range Exceeds the Rails . . . -0.1 V to $V_{\text{CC}} + 5\text{ V}$**
- **Supply Voltage Range . . . 2.7 V to 16 V**
- **Reverse Battery Protection Up to 18 V**
- **Push-Pull CMOS Output Stage**
- **Ultrasmall Packaging**
 - 5-Pin SOT-23
- **Universal Op-Amp EVM (Reference SLOU060 for more information)**

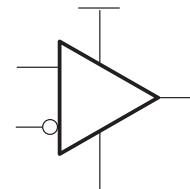
† Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

APPLICATIONS

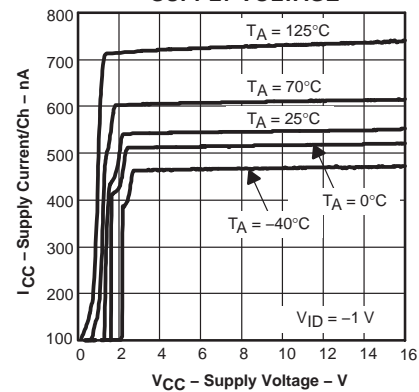
- **Portable Battery Monitoring**
- **Security Detection Systems**

DESCRIPTION

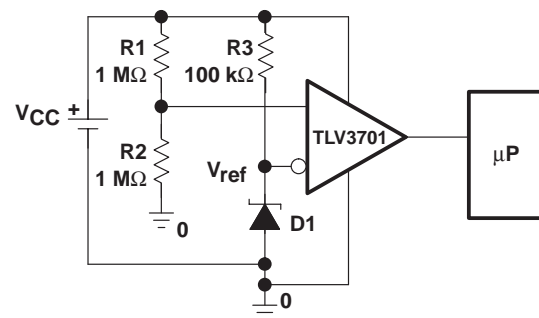
The TLV3701 is part of Texas Instruments' first family of nanopower comparator with only 560 nA supply current, which make this device ideal for low power applications.



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.

DESCRIPTION (continued)

The TLV3701 has a minimum operating supply voltage of 2.7 V over the extended temperature range $T_A = -40^{\circ}\text{C}$ to 125°C , while having an input common-mode range of -0.1 to $V_{CC} + 5$ 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.

This device is available in the small SOT-23 package. Other package options may be made available upon request.

A SELECTION OF OUTPUT COMPARATORST

DEVICE	V _{CC} (V)	V _{IO} (μV)	I _{CC/Ch} (μA)	I _B (pA)	t _{PLH} (μs)	t _{PHL} (μs)	t _f (μs)	t _r (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

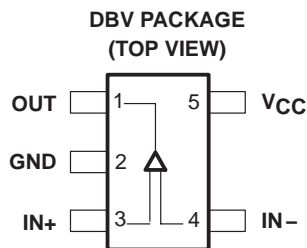
† All specifications are typical values measured at 5 V.

AVAILABLE OPTIONST

T _A	V _{IO} max AT 25°C	PACKAGED DEVICES	
		SOT-23 (DBV)‡	SYMBOL
-40°C to 125°C	5000 μV	TLV3701QDBVREP	VBCE

† Contact the local TI sales office for availability of other package options.

‡ This package is only available taped and reeled with standard quantities of 3000 pieces per reel.



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

Supply voltage, V_{CC} (see Note 1)	17 V
Differential input voltage, V_{ID}	± 20 V
Input voltage range, V_I (see Notes 1 and 2)	0 to $V_{CC} + 5$ V
Input current range, I_I	± 10 mA
Output current range, I_O	± 10 mA
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A	-40°C to 125°C
Maximum junction temperature, T_J	150°C
Storage temperature range, T_{stg}	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltage values, except differential voltages, are with respect to GND.
 2. Input voltage range is limited to 20 V max or $V_{CC} + 5$ V, whichever is smaller.

DISSIPATION RATING TABLE

PACKAGE	θ_{JC} ($^\circ\text{C}/\text{W}$)	θ_{JA} ($^\circ\text{C}/\text{W}$)	$T_A \leq 25^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
DBV	55	324.1	385 mW	77.1 mW

recommended operating conditions

		MIN	MAX	UNIT
Supply voltage, V_{CC}	Single supply	2.7	16	V
	Split supply	± 1.35	± 8	
Common-mode input voltage range, V_{ICR}		-0.1	$V_{CC}+5$	V
Operating free-air temperature, T_A		-40	125	$^\circ\text{C}$

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

dc performance

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

† Full range is -40°C to 125°C for Q suffix.

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

input/output characteristics

PARAMETER		TEST CONDITIONS	T_A^\dagger	MIN	TYP	MAX	UNIT	
I_{IO}	Input offset current	$V_{IC} = V_{CC}/2, R_S = 50\ \Omega$	25°C		20	100	pA	
			Full range			1000		
I_{IB}	Input bias current		25°C		80	250	pA	
			Full range			2000		
$r_{i(d)}$	Differential input resistance		25°C		300		M Ω	
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	
			Full range	25°C		$V_{CC} - 320$		
						$V_{CC} - 450$		
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	
			Full range	25°C		80		200
								300

† Full range is –40°C to 125°C for Q suffix.

power supply

PARAMETER		TEST CONDITIONS	T_A^\dagger	MIN	TYP	MAX	UNIT
I_{CC}	Supply current	Output state high	25°C		560	800	nA
			Full range			1200	
PSRR	Power supply rejection ratio	$V_{IC} = V_{CC}/2\text{ V},$ 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 –40°C to 125°C for Q suffix.

switching characteristics at recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{(PLH)}$	Propagation response time, low-to-high-level output (see Note 3)	$f = 1\text{ kHz},$ $V_{STEP} = 100\text{ mV},$ $C_L = 10\text{ pF},$ $V_{CC} = 2.7\text{ V}$	Overdrive = 2 mV		240	μs
			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	$C_L = 10\text{ pF}, V_{CC} = 2.7\text{ V}$		7	μs	
t_f	Fall time	$C_L = 10\text{ pF}, V_{CC} = 2.7\text{ V}$		9	μs	

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 11–16 for further details.

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
	Input bias/offset current	vs Free-air temperature	1
V_{OL}	Low-level output voltage	vs Low-level output current	2, 4, 6
V_{OH}	High-level output voltage	vs High-level output current	3, 5, 7
I_{CC}	Supply current	vs Supply voltage	8
		vs Free-air temperature	9
	Output fall time/rise time	vs Supply voltage	10
	Low-to-high level output response for various input overdrives		11, 13, 15
	High-to-low level output response for various input overdrives		12, 14, 16

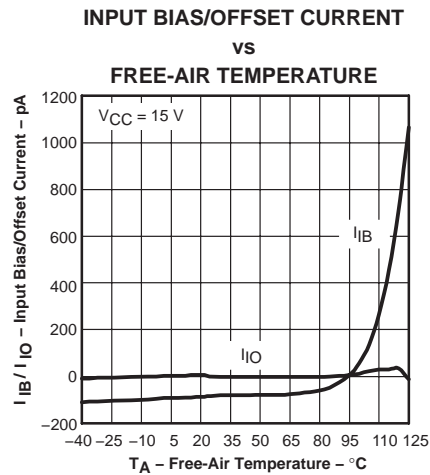


Figure 1

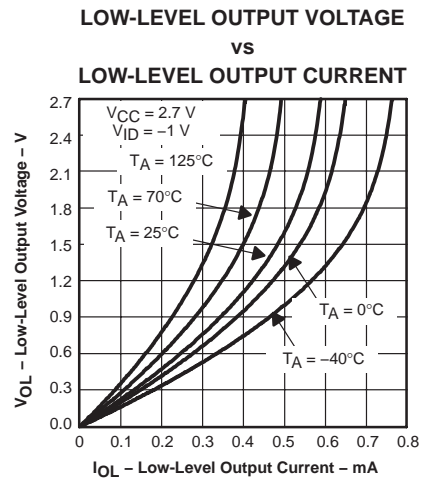


Figure 2

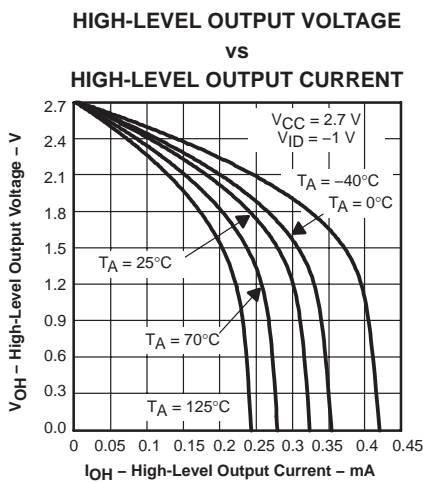


Figure 3

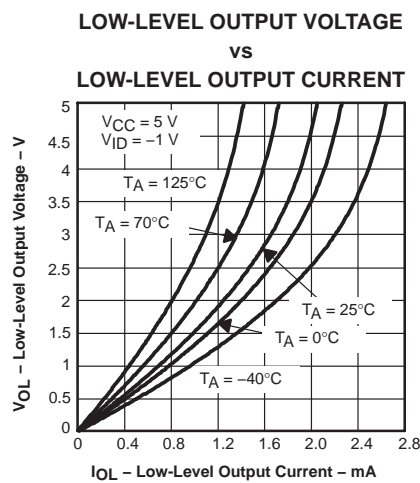


Figure 4

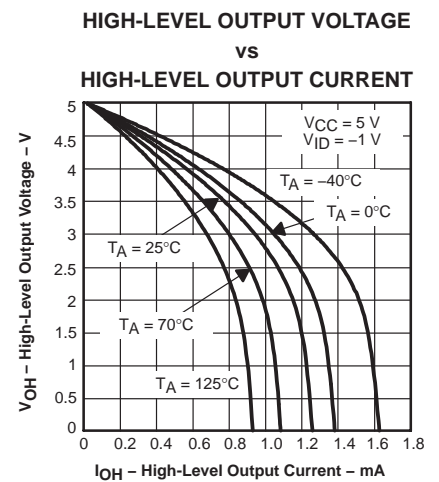


Figure 5

TYPICAL CHARACTERISTICS

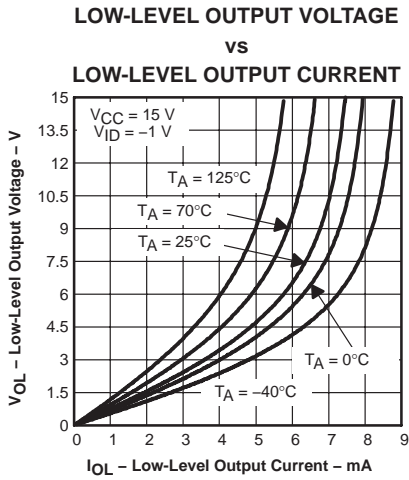


Figure 6

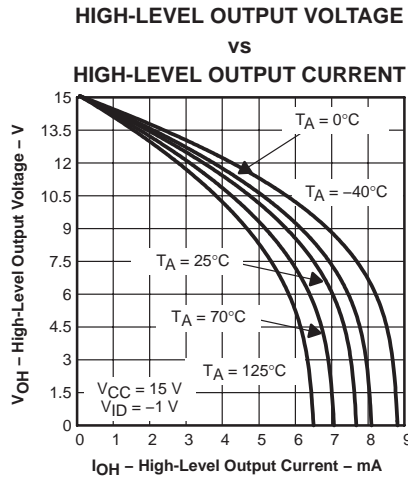


Figure 7

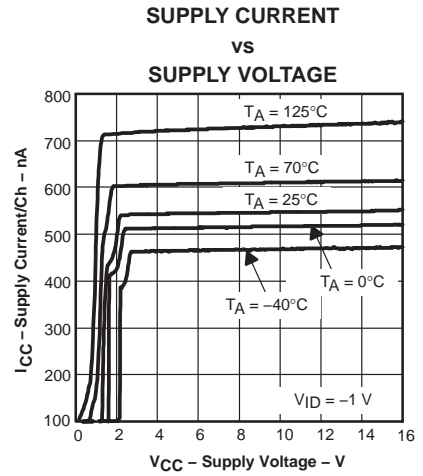


Figure 8

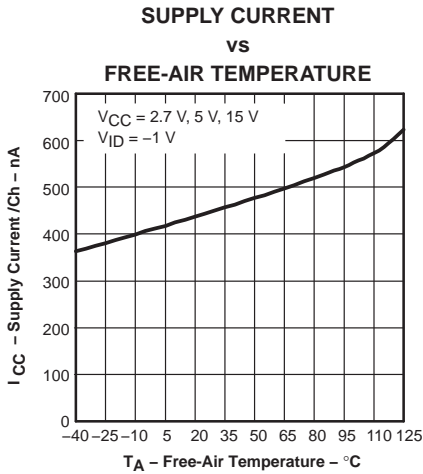


Figure 9

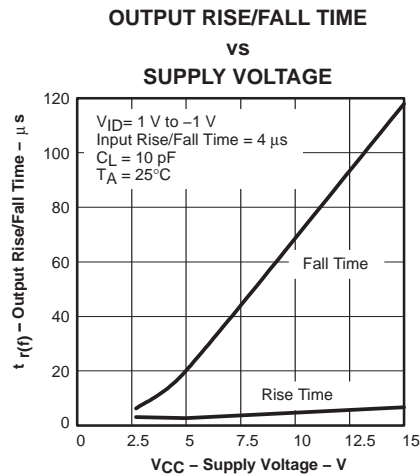


Figure 10

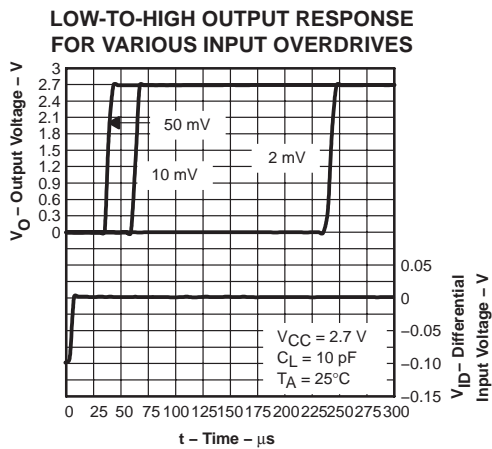


Figure 11

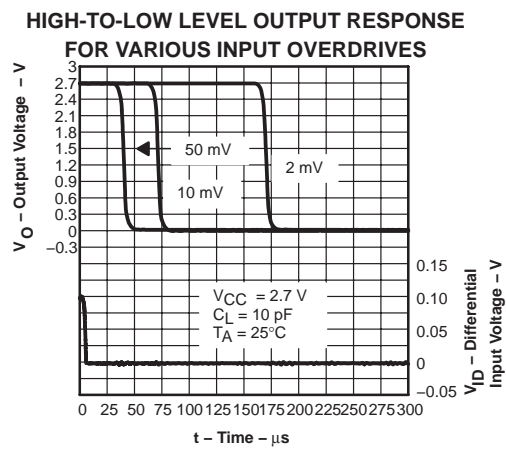


Figure 12

TYPICAL CHARACTERISTICS

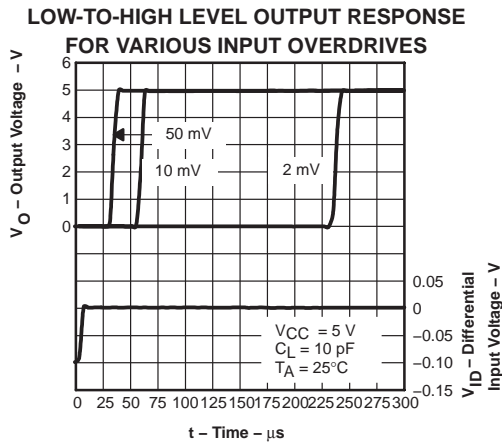


Figure 13

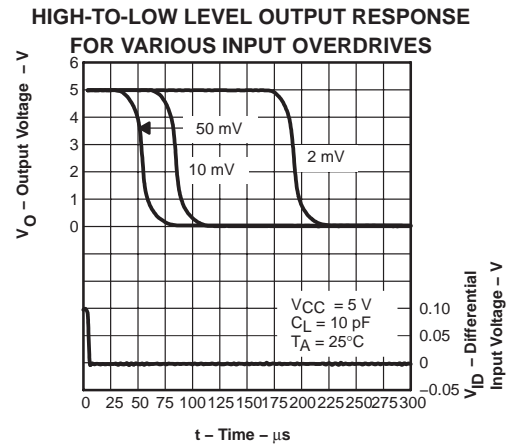


Figure 14

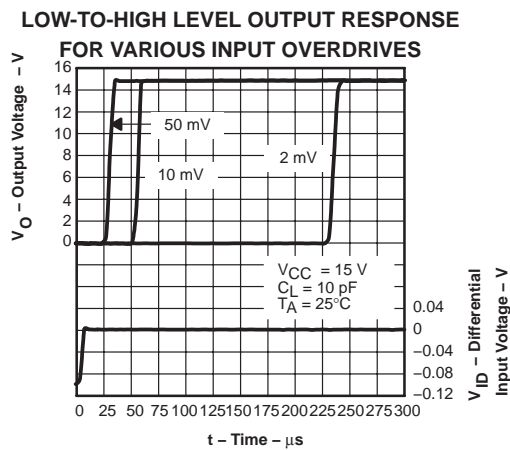


Figure 15

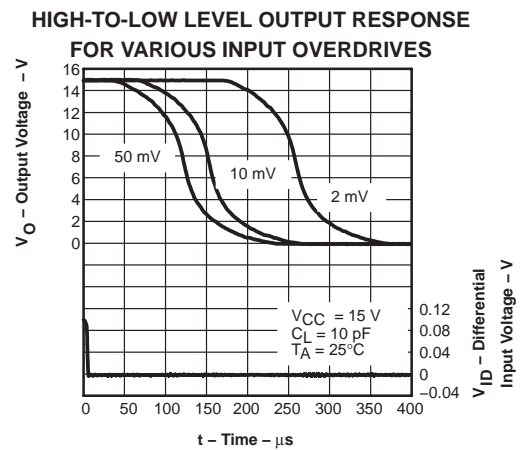


Figure 16

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TLV3701QDBVREP	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
V62/04726-01XE	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

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

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

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

OBsolete: TI has discontinued the production of the device.

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

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

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

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

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

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

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-EP :

- Catalog: [TLV3701](#)
- Automotive: [TLV3701-Q1](#)

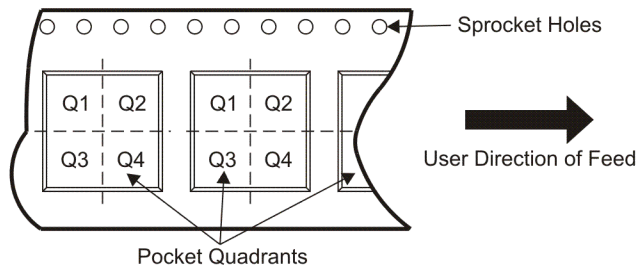
NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

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
TLV3701QDBVREP	SOT-23	DBV	5	3000	180.0	9.0	3.15	3.2	1.4	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLV3701QDBVREP	SOT-23	DBV	5	3000	182.0	182.0	20.0

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	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2008, Texas Instruments Incorporated