TLV2352 Dual Low-Voltage Differential Comparators

1 Features

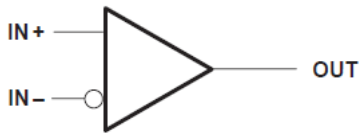
- Wide range of supply voltages: 2V to 8V
- Wide range of supply voltages: 2.7V to 8V (TLV2352IDR and TLV2352IPWR only)
- Fully characterized at 3V and 5V
- Very-low supply-current drain: 120µA typical at 3V
- Output compatible with TTL, MOS, and CMOS
- Fast response time: 200ns typical for TTL-level input step
- High input impedance: $10^{12}\Omega$ typical
- Extremely low input bias current: 5pA typical
- Common-mode input voltage range includes ground
- Built-in ESD protection

2 Description

The TLV2352 consists of two independent, low-power comparators specifically designed for single power-supply applications and operates with power-supply rails as low as 2V (2.7V TLV2352IDR and TLV2352IPWR only). When powered from a 3V supply, the typical supply current is only 120µA.

The TLV2352 is designed using the Texas Instruments CMOS technology and therefore features an extremely high input impedance (typically greater than $10^{12}\Omega$), which allows direct interfacing with high-impedance sources. The outputs are N-channel open-drain configurations that require an external pullup resistor to provide a positive output voltage swing, and can be connected to achieve positive-logic wired-AND relationships. The TLV2352I is fully characterized at 3V and 5V for operation from –40°C to 85°C. The TLV2352M is fully characterized at 3V and 5V for operation from –55°C to 125°C.

The TLV2352 has internal electrostatic discharge (ESD) protection circuits and has been classified with a 1000V ESD rating using Human Body Model testing. However, care must be exercised in handling this device as exposure to ESD can result in degradation of the device parametric performance.



Symbol (Each Comparator)

Table of Contents

3 Device Comparison Table

Device Information

T_A	V_{IO} max at 25°C	PACKAGED DEVICES					
		SMALL OUTLINE (D)(1)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	TSSOP (PW)(2)	PLASTIC DIP (U)
–40°C to 85°C	5mV	TLV2352ID	—	—	TLV2352IP	TLV2352IPWLE	—
–55°C to 125°C	5mV	—	TLV2352MFK	TLV2352MJG	—	—	TLV2352MU

(1) The D package is available taped and reeled. Add the suffix R to the device type (e.g., TLV2352IDR).
(2) The PW packages are only available left-ended taped and reeled (e.g., TLV2352IPWLE).

4 Pin Configuration and Functions

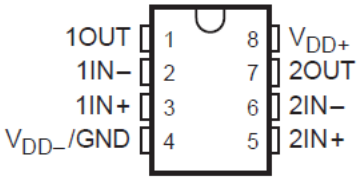


Figure 4-1. TLV2352I D or P Package TLV2352M JG Package (Top View)

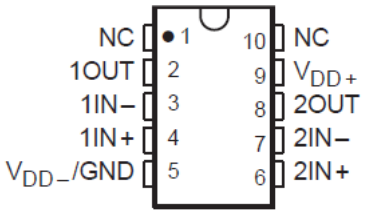
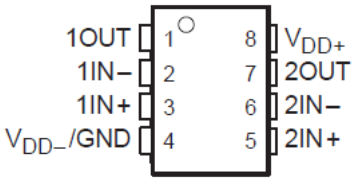


Figure 4-2. TLV2254M U Package (Top View)



NC - No internal connection

Figure 4-3. TLV2352I PW Package (Top View)

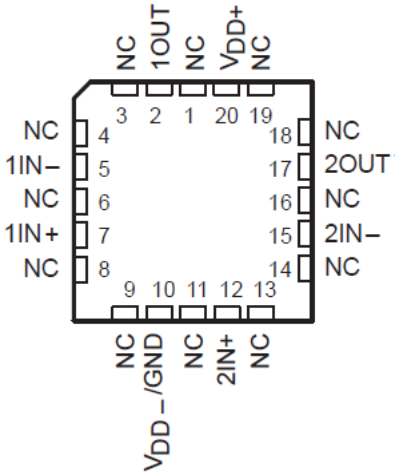


Figure 4-4. TLV2352M FK Package (Top View)

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

			MIN	MAX	UNIT
V_{DD}	Supply voltage(2)			8	V
V_{ID}	Differential input voltage(3)			±VDD	V
V_I	Input voltage range		–0.3	VDD	V
V_O	Output voltage			8	V
I_I	Input current			±5	mA
I_O	Output current			20	mA
	Duration of output short-circuit current to GND(4)		Unlimited		
T_A	Operating free-air temperature range	TLV2352I	–40	85	°C
		TLV2352M	–55	125	
T_{stg}	Storage temperature range		–65	150	°C
	Lead temperature 1.6mm (1/16 inch) from case for 10 seconds	D package		260	°C
		P package			
		PW package			
	Lead temperature 1.6mm (1/16 inch) from case for 10 seconds	FK package		300	°C
		JG package			
		U package			

(1) Stress 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, are with respect to network ground.
(3) Differential voltages are at IN+ with respect to IN–.
(4) Short circuits from outputs to V_{DD} can cause excessive heating and eventual device destruction.

5.2 Recommended Operating Conditions

			MIN	MAX	UNIT
V_{DD}	Supply voltage		2	8	V
V_{DD}	Supply voltage (TLV2352IDR and TLV2352IPWR only)		2.7	8	V
V_{IC}	Common-mode input voltage	V_{DD} = 3V	0	1.75	V
		V_{DD} = 5V	0	3.75	
T_A	Operating free-air temperature	TLV2352I	–40	85	°C
		TLV2352M	–55	125	

5.3 Electrical Characteristics TLV2352I

at specified free-air temperature(1)

PARAMETER		TEST CONDITIONS		T_A (2)	TLV2352I						UNIT
					V_{DD} = 3V			V_{DD} = 5V			
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	$V_{IC} = V_{ICR}$min		25°C		1	5		1	5	mV
				Full range			7			7	
I_{IO}	Input offset current			25°C		1			1		pA
				85°C			1			1	nA
I_{IB}	Input bias current			25°C		5			5		pA
				85°C			2			2	nA
V_{ICR}	Common-mode input voltage range			25°C	0 to 2			0 to 4			V
				Full range	0 to 1.75			0 to 3.75			
I_{OH}	High-level output current	V_{ID} = 1V		25°C		0.1			0.1		nA
				Full range			1			1	µA
V_{OL}	Low-level output voltage	V_{ID} = –1V	I_{OL} = 2mA	25°C		115	300		150	400	mV
				Full range			600			700	
I_{OL}	Low-level output current	V_{ID} = –1V	V_{OL} = 1.5V	25°C	6	16		6	16		mA
I_{DD}	Supply current	V_{ID} = 1V	No load	25°C		120	250		140	300	µA
				Full range			350			400	

(1) All characteristics are measured with zero common-mode input voltages unless otherwise noted.
(2) Full range is –40°C to 85°C.

5.4 Switching Characteristics TLV2352I 3V

V_{dd} = 3V, T_a = 25°C

PARAMETER	TEST CONDITIONS		TLV2352I			UNIT
			MIN	TYP	MAX	
Response time	R_L = 5.1kΩ, C_L = 15pF(1) (2)	100mV input step with 5mV overdrive		640		ns

5.5 Switching Characteristics TLV2352I 3V (TLV2352IDR and TLV2352IPWR only)

V_{dd} = 3V, T_a = 25°C

PARAMETER	TEST CONDITIONS		TLV2352I			UNIT
			MIN	TYP	MAX	
Response time	R_L = 5.1kΩ, C_L = 15pF(1) (2)	100mV input step with 10mV overdrive		200		ns

(1) C_L includes probe and jig capacitance.
(2) The response time specified is the interval between the input step function and the instant when the output crosses V_O = 1V with V_{DD} = 3V or V_O = 1.4V with V_{DD} = 5V.

5.6 Switching Characteristics TLV2352I 5V

V_{DD} = 5V, T_A = 25°C

PARAMETER	TEST CONDITIONS		TLV2352I			UNIT
			MIN	TYP	MAX	
Response time	R_L = 5.1kΩ, C_L = 15pF(1) (2)	100mV input step with 5mV overdrive		650		ns
		TTL-level input step		200		

5.7 Switching Characteristics TLV2352I 5V (TLV2352IDR and TLV2352IPWR only)

V_{DD} = 5V, T_A = 25°C

PARAMETER	TEST CONDITIONS		TLV2352I			UNIT
			MIN	TYP	MAX	
Response time	R_L = 5.1kΩ, C_L = 15pF(1) (2)	100mV input step with 10mV overdrive		200		ns
		100mV overdrive		100		

(1) C_L includes probe and jig capacitance.
(2) The response time specified is the interval between the input step function and the instant when the output crosses V_O = 1V with V_{DD} = 3V or V_O = 1.4V with V_{DD} = 5V.

5.8 Electrical Characteristics TLV2352M

at specified free-air temperature(1)

PARAMETER		TEST CONDITIONS		T_A (2)	TLV2352M						UNIT
					V_{DD} = 3V			V_{DD} = 5V			
					MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = V_{ICR}min		25°C		1	5		1	5	mV
				Full range			10			10	
I_{IO}	Input offset current			25°C		1			1		pA
				125°C			10			10	nA
I_{IB}	Input bias current			25°C		5			5		pA
				125°C			20			20	nA
V_{ICR}	Common-mode input voltage range			25°C	0 to 2			0 to 4			V
				Full range	0 to 1.75			0 to 3.75			
I_{OH}	High-level output current	V_{ID} = 1V		25°C		0.1			0.1		nA
				Full range			1			1	µA
V_{OL}	Low-level output voltage	V_{ID} = –1V	I_{OL} = 2mA	25°C		115	300		150	400	mV
				Full range			600			700	
I_{OL}	Low-level output current	V_{ID} = –1V	V_{OL} = 1.5V	25°C	6	16		6	16		mA
I_{DD}	Supply current	V_{ID} = 1V	No load	25°C		120	250		140	300	µA
				Full range			350			400	

(1) All characteristics are measured with zero common-mode input voltages unless otherwise noted.
(2) Full range is – 55°C to 125°C.

5.9 Switching Characteristics TLV2352M 3V

V_{DD} = 3V, T_A = 25°C

PARAMETER	TEST CONDITIONS		TLV2352M			UNIT
			MIN	TYP	MAX	
Response time	R_L = 5.1kΩ, C_L = 100pF(1) (2)	100mV input step with 5mV overdrive			1400	ns

(1) C_L includes probe and jig capacitance.
(2) The response time specified is the interval between the input step function and the instant when the output crosses V_O = 1V with V_{DD} = 3V or V_O = 1.4V with V_{DD} = 5V.

5.10 Switching Characteristics TLV2352M 5V

V_{DD} = 5V, T_A = 25°C

PARAMETER	TEST CONDITIONS		TLV2352M			UNIT
			MIN	TYP	MAX	
Response time	R_L = 5.1kΩ, C_L = 100pF(1) (2)	100mV input step with 5mV overdrive			1300	ns
		TTL-level input step			900	

(1) C_L includes probe and jig capacitance.
(2) The response time specified is the interval between the input step function and the instant when the output crosses V_O = 1V with V_{DD} = 3V or V_O = 1.4V with V_{DD} = 5V.

6 Typical Characteristics (TLV2352IDR and TLV2352IPWR only)

At T_A = 25°C, V_S = 3.3V, V_{CM} = V_S/2V, C_L = 15pF, Input Overdrive = Input Underdrive = 100mV, R_{PU} = 10kΩ, unless otherwise noted.

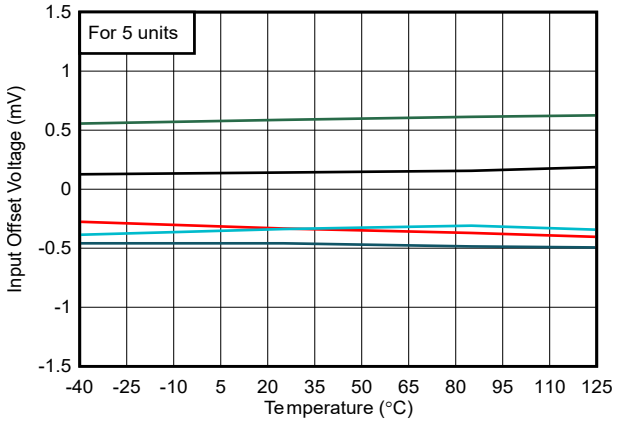


Figure 6-1. Offset vs. Temperature

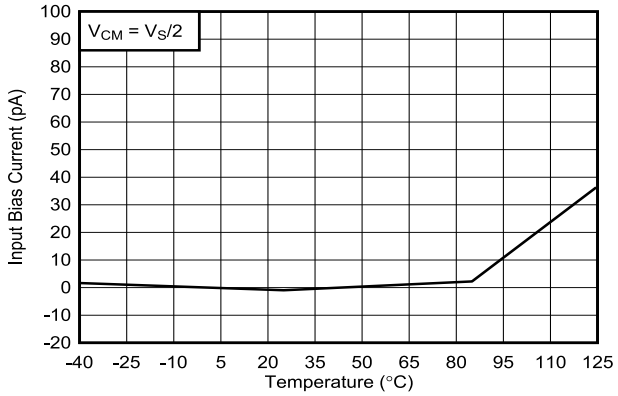


Figure 6-2. Bias Current vs. Temperature

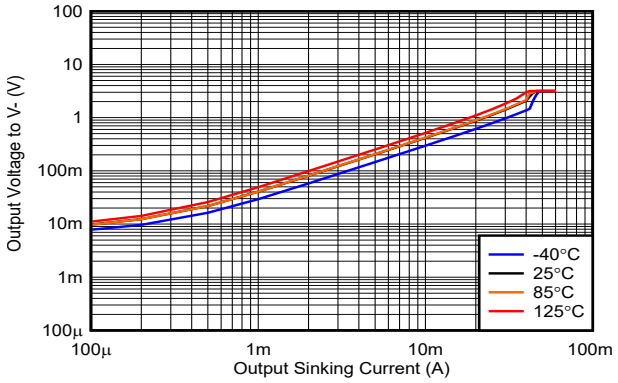


Figure 6-3. Output Voltage vs. Sinking Current

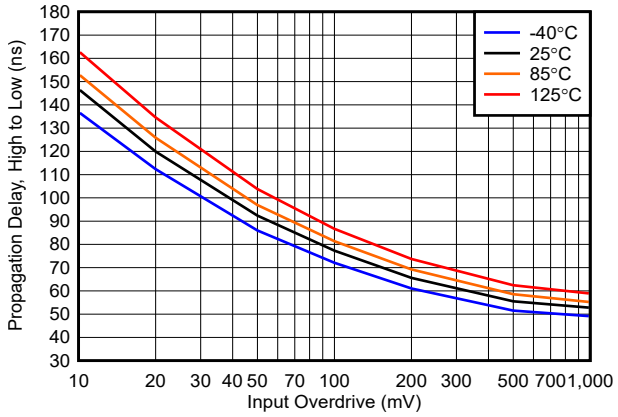


Figure 6-4. Propagation Delay, (High to Low) vs. Input Overdrive

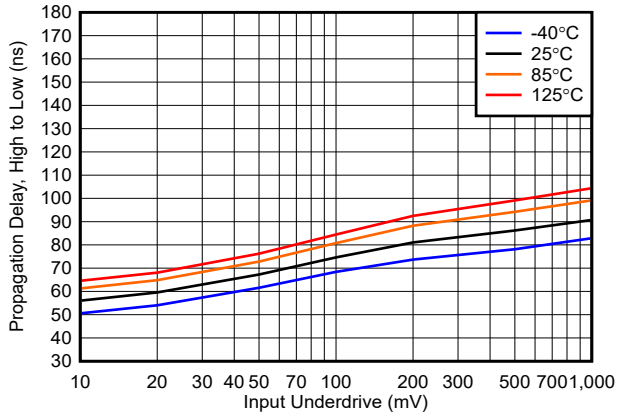


Figure 6-5. Propagation Delay, (High to Low) vs. Input Underdrive

7 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions.

7.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

7.2 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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7.3 Trademarks

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7.4 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

7.5 Glossary

TI Glossary	This glossary lists and explains terms, acronyms, and definitions.

8 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision C (June 2025) to Revision D (July 2025)	Page
• Removed TLV2352Y throughout data sheet	1
• Specified electrical characteristic differences for orderables TLV2352IDR and TLV2352IPWR	1

Changes from Revision B (March 1999) to Revision C (June 2025)	Page
• Updates throughout data sheet to reflect performance of new die	1
• Updated the numbering format for tables, figures, and cross-references throughout the document	1

9 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
5962-9688101QPA	Active	Production	CDIP (JG) | 8	50 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	9688101QPA TLV2352M
TLV2352ID	Obsolete	Production	SOIC (D) | 8	-	-	Call TI	Call TI	-40 to 85	2352I
TLV2352IDR	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2352I
TLV2352IDR.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	2352I
TLV2352IP	Active	Production	PDIP (P) | 8	50 | TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	TLV2352IP
TLV2352IP.A	Active	Production	PDIP (P) | 8	50 | TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	TLV2352IP
TLV2352IPW	Obsolete	Production	TSSOP (PW) | 8	-	-	Call TI	Call TI	-40 to 85	TY2352
TLV2352IPWR	Active	Production	TSSOP (PW) | 8	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TY2352
TLV2352IPWR.A	Active	Production	TSSOP (PW) | 8	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TY2352
TLV2352MJG	Active	Production	CDIP (JG) | 8	50 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	TLV2352MJG
TLV2352MJG.A	Active	Production	CDIP (JG) | 8	50 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	TLV2352MJG
TLV2352MJGB	Active	Production	CDIP (JG) | 8	50 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	9688101QPA TLV2352M
TLV2352MJGB.A	Active	Production	CDIP (JG) | 8	50 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	9688101QPA TLV2352M

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

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

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

OTHER QUALIFIED VERSIONS OF TLV2352, TLV2352M :

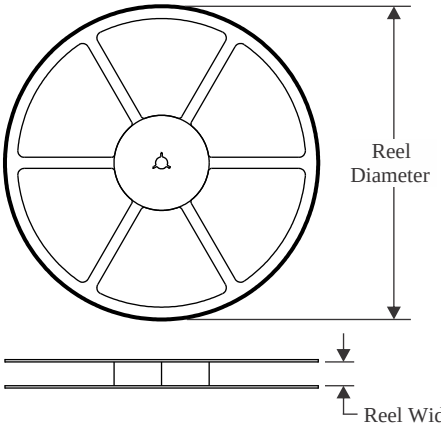
- Catalog : TLV2352
- Military : TLV2352M

NOTE: Qualified Version Definitions:

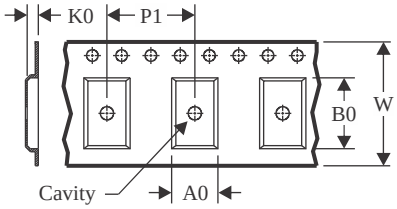
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

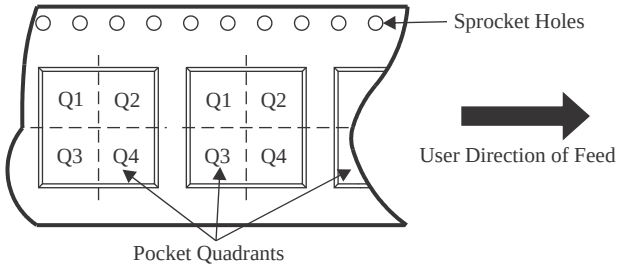


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

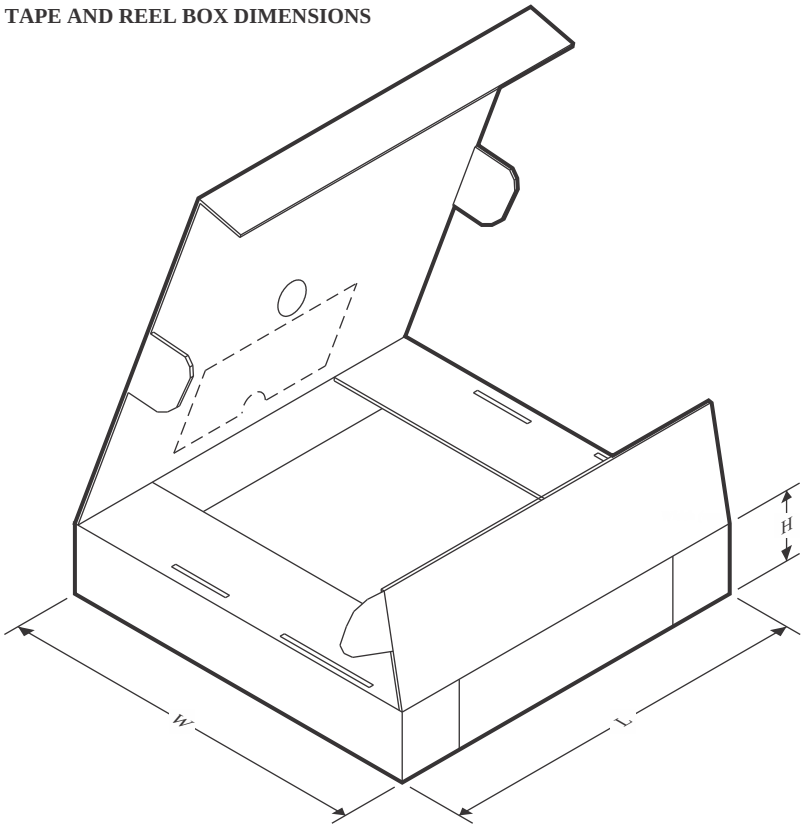
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TLV2352IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLV2352IPWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1

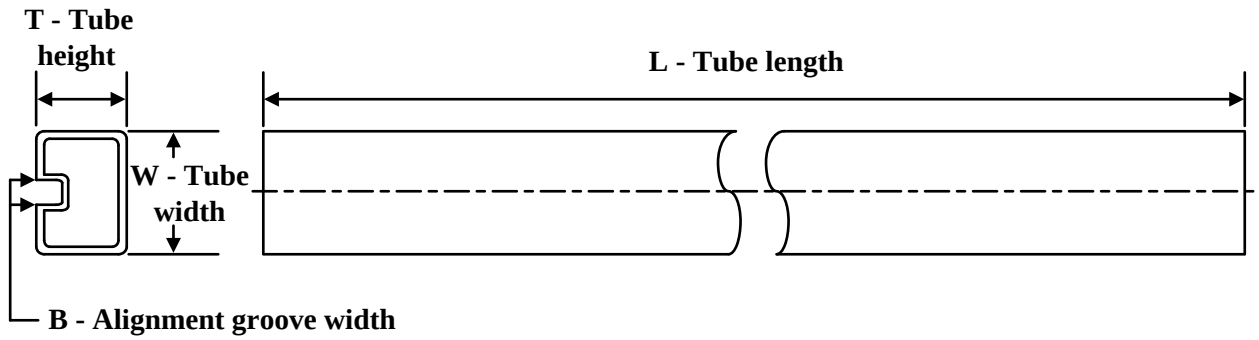
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLV2352IDR	SOIC	D	8	2500	353.0	353.0	32.0
TLV2352IPWR	TSSOP	PW	8	2000	353.0	353.0	32.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
TLV2352IP	P	PDIP	8	50	506	13.97	11230	4.32
TLV2352IP.A	P	PDIP	8	50	506	13.97	11230	4.32

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