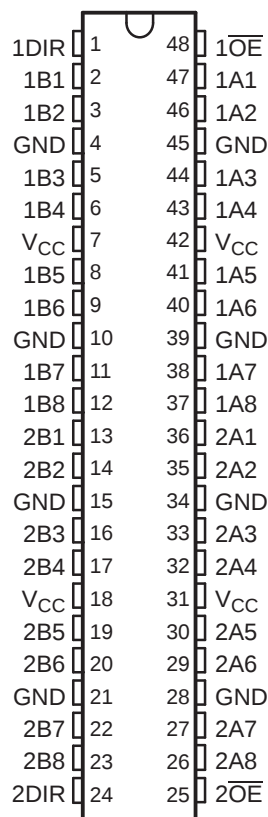


FEATURES

- Members of the Texas Instruments Widebus™ Family
- A-Port Outputs Have Equivalent 22-Ω Series Resistors, So No External Resistors Are Required
- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V V_{CC})
- Support Unregulated Battery Operation Down to 2.7 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- I_{off} and Power-Up 3-State Support Hot Insertion
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Distributed V_{CC} and GND Pins Minimize High-Speed Switching Noise
- Flow-Through Architecture Optimizes PCB Layout
- Latch-Up Performance Exceeds 500 mA Per JESD 17
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

SN54LVTH162245 . . . WD PACKAGE
SN74LVTH162245 . . . DGG OR DL PACKAGE
(TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

The 'LVTH162245 devices are 16-bit (dual-octal) noninverting 3-state transceivers designed for low-voltage (3.3-V) V_{CC} operation, but with the capability to provide a TTL interface to a 5-V system environment.

These devices can be used as two 8-bit transceivers or one 16-bit transceiver. The devices allow data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable ($\overline{OE}$) input can be used to disable the device so that the buses are effectively isolated.

The logic levels of the direction-control (DIR) input and the output-enable ($\overline{OE}$) input activate either the B-port outputs or the A-port outputs or place both output ports into the high-impedance mode. The device transmits data from the A bus to the B bus when the B-port outputs are activated, and from the B bus to the A bus when the A-port outputs are activated. The input circuitry on both A and B ports is always active and must have a logic HIGH or LOW level applied to prevent excess I_{CC} and I_{CCZ} .

Active bus-hold circuitry holds unused or undriven inputs at a valid logic state. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

The A-port outputs, which are designed to source or sink up to 12 mA, include equivalent 22-Ω series resistors to reduce overshoot and undershoot.



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.

Widebus is a trademark of Texas Instruments.

SN54LVTH162245, SN74LVTH162245

3.3-V ABT 16-BIT BUS TRANSCEIVERS

WITH 3-STATE OUTPUTS

SCBS260Q – JUNE 1993 – REVISED NOVEMBER 2006

DESCRIPTION/ORDERING INFORMATION (CONTINUED)

When V_{CC} is between 0 and 1.5 V, the devices are in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

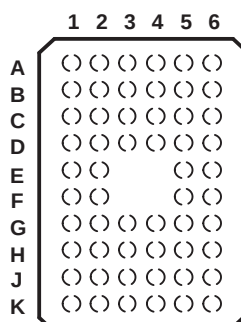
These devices are fully specified for hot-insertion applications using I_{off} and power-up 3-state. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

ORDERING INFORMATION

T_A	PACKAGE ⁽¹⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	FBGA – GRD	Reel of 1000	74LVTH162245GRDR	LL2245
	FBGA – ZRD (Pb-free)		74LVTH162245ZRDR	
	SSOP – DL	Tube of 25	SN74LVTH162245DL	LVTH162245
			SN74LVTH162245DLG4	
		Reel of 1000	SN74LVTH162245DLR	
			74LVTH162245DLRG4	
	TSSOP – DGG	Reel of 2000	SN74LVTH162245DGGR	LVTH162245
			74LVTH162245DGGRG4	
			74LVTH162245GRE4	
	VFBGA – GQL	Reel of 1000	SN74LVTH162245KR	LL2245
	VFBGA – ZQL (Pb-free)		74LVTH162245ZQLR	
–55°C to 125°C	CFP – WD	Tube	SNJ54LVTH162245WD	SNJ54LVTH162245WD

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

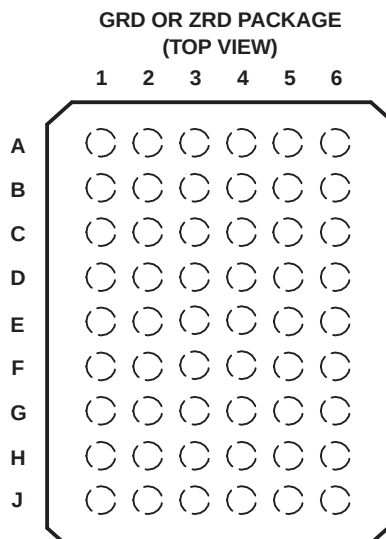
GQL OR ZQL PACKAGE
(TOP VIEW)



TERMINAL ASSIGNMENTS⁽¹⁾
(56-Ball GQL/ZQL Package)

	1	2	3	4	5	6
A	1DIR	NC	NC	NC	NC	$1\overline{OE}$
B	1B2	1B1	GND	GND	1A1	1A2
C	1B4	1B3	V_{CC}	V_{CC}	1A3	1A4
D	1B6	1B5	GND	GND	1A5	1A6
E	1B8	1B7			1A7	1A8
F	2B1	2B2			2A2	2A1
G	2B3	2B4	GND	GND	2A4	2A3
H	2B5	2B6	V_{CC}	V_{CC}	2A6	2A5
J	2B7	2B8	GND	GND	2A8	2A7
K	2DIR	NC	NC	NC	NC	$2\overline{OE}$

(1) NC – No internal connection



TERMINAL ASSIGNMENTS⁽¹⁾
(54-Ball GRD/ZRD Package)

	1	2	3	4	5	6
A	1B1	NC	1DIR	1 $\overline{OE}$	NC	1A1
B	1B3	1B2	NC	NC	1A2	1A3
C	1B5	1B4	V _{CC}	V _{CC}	1A4	1A5
D	1B7	1B6	GND	GND	1A6	1A7
E	2B1	1B8	GND	GND	1A8	2A1
F	2B3	2B2	GND	GND	2A2	2A3
G	2B5	2B4	V _{CC}	V _{CC}	2A4	2A5
H	2B7	2B6	NC	NC	2A6	2A7
J	2B8	NC	2DIR	2 $\overline{OE}$	NC	2A8

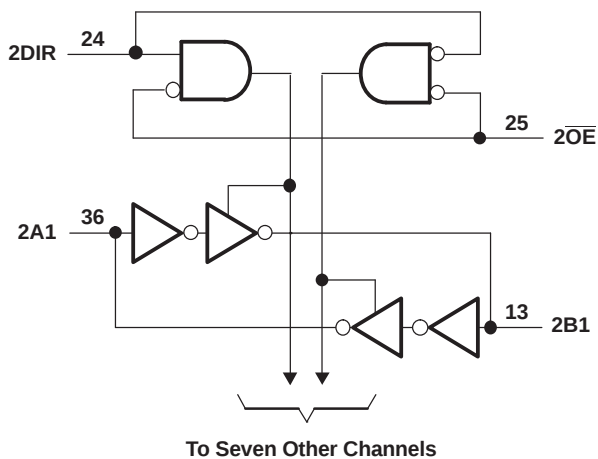
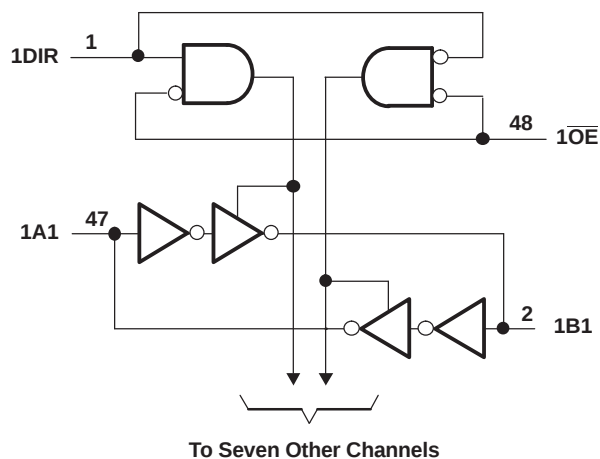
(1) NC – No internal connection

FUNCTION TABLE⁽¹⁾
(EACH 8-BIT SECTION)

CONTROL INPUTS		OUTPUT CIRCUITS		OPERATION
$\overline{OE}$	DIR	A PORT	B PORT	
L	L	Enabled	Hi-Z	B data to A bus
L	H	Hi-Z	Enabled	A data to B bus
H	X	Hi-Z	Hi-Z	Isolation

(1) Input circuits of the data I/Os always are active.

LOGIC DIAGRAM (POSITIVE LOGIC)



SN54LVTH162245, SN74LVTH162245

3.3-V ABT 16-BIT BUS TRANSCEIVERS

WITH 3-STATE OUTPUTS

SCBS260Q – JUNE 1993 – REVISED NOVEMBER 2006

Absolute Maximum Ratings⁽¹⁾

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

		MIN	MAX	UNIT
V_{CC}	Supply voltage range	–0.5	4.6	V
V_I	Input voltage range ⁽²⁾	–0.5	7	V
V_O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾	–0.5	7	V
V_O	Voltage range applied to any output in the high state ⁽²⁾	–0.5	$V_{CC} + 0.5$	V
I_O	Current into any output in the low state	SN54LVTH162245 (B port)		96
		SN74LVTH162245 (B port)		128
		A port		30
I_O	Current into any output in the high state ⁽³⁾	SN54LVTH162245 (B port)		48
		SN74LVTH162245 (B port)		64
		A port		30
I_{IK}	Input clamp current	$V_I < 0$	–50	mA
I_{OK}	Output clamp current	$V_O < 0$	–50	mA
θ_{JA}	Package thermal impedance ⁽⁴⁾	DGG package		70
		DL package		63
		GQL/ZQL package		42
		GRD/ZRD package		36
T_{stg}	Storage temperature range	–65	150	°C

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

(2) The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

(3) This current flows only when the output is in the high state and $V_O > V_{CC}$.

(4) The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions⁽¹⁾

			SN54LVTH162245		SN74LVTH162245		UNIT
			MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage		2.7	3.6	2.7	3.6	V
V _{IH}	High-level input voltage		2		2		V
V _{IL}	Low-level input voltage		0.8		0.8		V
V _I	Input voltage		5.5		5.5		V
I _{OH}	High-level output current	A port	−12		−12		mA
		B port	−24		−32		
I _{OL}	Low-level output current	A port	12		12		mA
		B port	48		64		
Δt/Δv	Input transition rise or fall rate	Outputs enabled	10		10		ns/V
Δt/ΔV _{CC}	Power-up ramp rate		200		200		μs/V
T _A	Operating free-air temperature		−55	125	−40	85	°C

(1) All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

Electrical Characteristics

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

PARAMETER		TEST CONDITIONS		SN54LVTH162245			SN74LVTH162245			UNIT	
				MIN	TYP ⁽¹⁾	MAX	MIN	TYP ⁽¹⁾	MAX		
V _{IK}		V _{CC} = 2.7 V, I _I = −18 mA		−1.2			−1.2			V	
V _{OH}	A port	V _{CC} = 2.7 V to 3.6 V, I _{OH} = −100 μA		V _{CC} − 0.2			V _{CC} − 0.2			V	
		V _{CC} = 3 V, I _{OH} = −12 mA		2			2				
	B port	V _{CC} = 2.7 V to 3.6 V, I _{OH} = −100 μA		V _{CC} − 0.2			V _{CC} − 0.2				
		V _{CC} = 2.7 V, I _{OH} = −8 mA		2.4			2.4				
		V _{CC} = 3 V	I _{OH} = −24 mA		2						
			I _{OH} = −32 mA					2			
V _{OL}	A port	V _{CC} = 2.7 V to 3.6 V, I _{OL} = 100 μA		0.2			0.2			V	
		V _{CC} = 3 V, I _{OL} = 12 mA		0.8			0.8				
	B port	V _{CC} = 2.7 V	I _{OL} = 100 μA		0.2			0.2			
			I _{OL} = 24 mA		0.5			0.5			
		V _{CC} = 3 V	I _{OL} = 16 mA		0.4			0.4			
			I _{OL} = 32 mA		0.5			0.5			
			I _{OL} = 48 mA		0.55						
			I _{OL} = 64 mA					0.55			
I _I	Control inputs	V _{CC} = 3.6 V, V _I = V _{CC} or GND		±1			±1			μA	
		V _{CC} = 0 or 3.6 V, V _I = 5.5 V		10			10				
	A or B port ⁽²⁾	V _{CC} = 3.6 V	V _I = 5.5 V		20			20			
			V _I = V _{CC}		5			5			
			V _I = 0		−10			−10			
I _{off}			V _{CC} = 0, V _I or V _O = 0 to 4.5 V					±100			μA
I _{I(hold)}	A or B port	V _{CC} = 3 V	V _I = 0.8 V		75			75			μA
			V _I = 2 V		−75			−75			
		V _{CC} = 3.6 V, ⁽³⁾ V _I = 0 to 3.6 V					500 −750				
I _{OZPU}		V _{CC} = 0 to 1.5 V, V _O = 0.5 V to 3 V, OE = don't care		±100 ⁽⁴⁾			±100			μA	
I _{OZPD}		V _{CC} = 1.5 V to 0, V _O = 0.5 V to 3 V, OE = don't care		±100 ⁽⁴⁾			±100			μA	
I _{CC}		V _{CC} = 3.6 V, I _O = 0, V _I = V _{CC} or GND	Outputs high		0.19			0.19			mA
			Outputs low		5			5			
			Outputs disabled		0.19			0.19			
ΔI _{CC} ⁽⁵⁾		V _{CC} = 3 V to 3.6 V, One input at V _{CC} − 0.6 V, Other inputs at V _{CC} or GND		0.3			0.2			mA	
C _I		V _I = 3 V or 0		4			4			pF	
C _{io}		V _O = 3 V or 0		10			10			pF	

(1) All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$.

(2) Unused pins at V_{CC} or GND

(3) This is the bus-hold maximum dynamic current. It is the minimum overdrive current required to switch the input from one state to another.

(4) On products compliant to MIL-PRF-38535, this parameter is not production tested.

(5) This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V_{CC} or GND.

SN54LVTH162245, SN74LVTH162245

3.3-V ABT 16-BIT BUS TRANSCEIVERS

WITH 3-STATE OUTPUTS

SCBS260Q – JUNE 1993 – REVISED NOVEMBER 2006

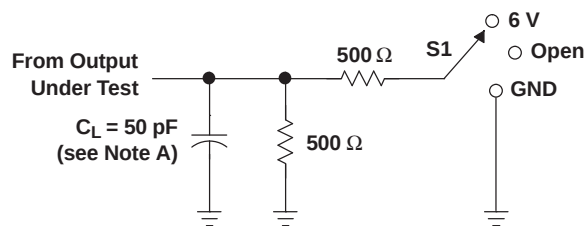
Switching Characteristics

over recommended operating free-air temperature range, $C_L = 50$ pF (unless otherwise noted) (see [Figure 1](#))

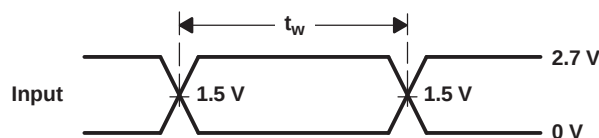
PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVTH162245				SN74LVTH162245				UNIT	
			$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$		$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		$V_{CC} = 2.7\text{ V}$			
			MIN	MAX	MIN	MAX	MIN	TYP ⁽¹⁾	MAX	MIN		MAX
t_{PLH}	A	B	1	3.5	4		1	2.3	3.3	3.7		ns
t_{PHL}			1	3.5	3.9		1	2.2	3.3	3.5		
t_{PLH}	B	A	1	4.3	5.3		1	2.8	4	4.6		ns
t_{PHL}			1	4.2	4.5		1	2.5	3.4	3.6		
t_{PZH}	$\overline{OE}$	B	1	4.8	5.9		1	2.8	4.6	5.4		ns
t_{PZL}			1	4.8	5.5		1	3	4.6	5.2		
t_{PZH}	$\overline{OE}$	A	1	5.5	7.2		1	3.3	5.3	6.3		ns
t_{PZL}			1	5.4	6.4		1	3.3	5.1	5.8		
t_{PHZ}	$\overline{OE}$	B	1.5	5.5	5.8		1.5	3.8	5.2	5.5		ns
t_{PLZ}			1.5	5.5	5.8		1.5	3.5	5.1	5.4		
t_{PHZ}	$\overline{OE}$	A	1.5	5.8	6.5		1.5	4	5.6	5.9		ns
t_{PLZ}			1.2	6.3	6.3		1.5	3.8	5.5	5.5		
$t_{sk(LH)}$									0.5			ns
$t_{sk(HL)}$									0.5			

(1) All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$.

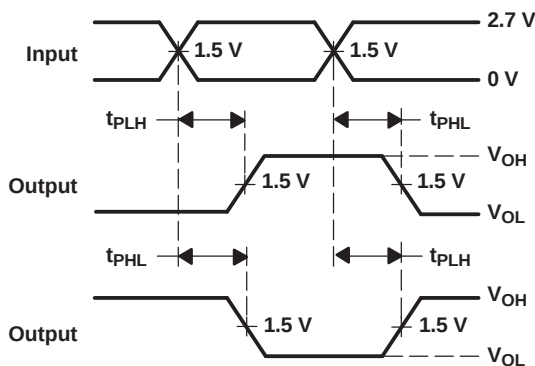
PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT

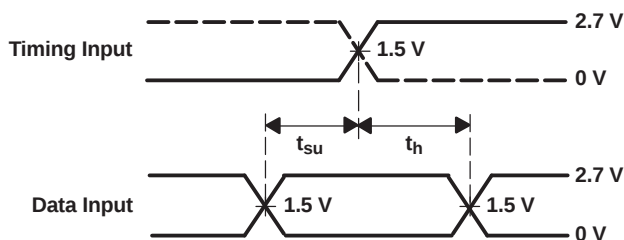


VOLTAGE WAVEFORMS
PULSE DURATION

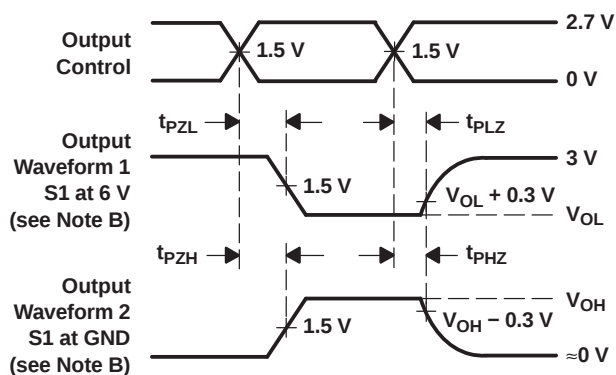


VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
D. The outputs are measured one at a time, with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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)
5962-9678001QXA	Active	Production	CFP (WD) 48	15 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9678001QX A SNJ54LVTH16224 5WD
5962-9678001VXA	Active	Production	CFP (WD) 48	15 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9678001VX A SNV54LVTH16224 5WD
74LVTH162245DGGRG4	Active	Production	TSSOP (DGG) 48	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
74LVTH162245DLR1G4	Active	Production	SSOP (DL) 48	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
74LVTH162245DLR1G4.B	Active	Production	SSOP (DL) 48	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
74LVTH162245GRE4	Active	Production	TSSOP (DGG) 48	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
SN74LVTH162245DGGR	Active	Production	TSSOP (DGG) 48	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
SN74LVTH162245DGGR.B	Active	Production	TSSOP (DGG) 48	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
SN74LVTH162245DL	Active	Production	SSOP (DL) 48	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
SN74LVTH162245DL.B	Active	Production	SSOP (DL) 48	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
SN74LVTH162245DLG4	Active	Production	SSOP (DL) 48	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
SN74LVTH162245DLR	Active	Production	SSOP (DL) 48	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
SN74LVTH162245DLR.B	Active	Production	SSOP (DL) 48	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	LVTH162245
SNJ54LVTH162245WD	Active	Production	CFP (WD) 48	15 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9678001QX A SNJ54LVTH16224 5WD

⁽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.

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 SN54LVTH162245, SN54LVTH162245-SP, SN74LVTH162245 :

- Catalog : [SN74LVTH162245](#), [SN54LVTH162245](#)
- Enhanced Product : [SN74LVTH162245-EP](#), [SN74LVTH162245-EP](#)
- Military : [SN54LVTH162245](#)
- Space : [SN54LVTH162245-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

TAPE AND REEL INFORMATION



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
74LVTH162245DLR1G4	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1
SN74LVTH162245DGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1
SN74LVTH162245DLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
74LVTH162245DLR1G4	SSOP	DL	48	1000	356.0	356.0	53.0
SN74LVTH162245DGGR	TSSOP	DGG	48	2000	356.0	356.0	45.0
SN74LVTH162245DLR	SSOP	DL	48	1000	356.0	356.0	53.0

TUBE

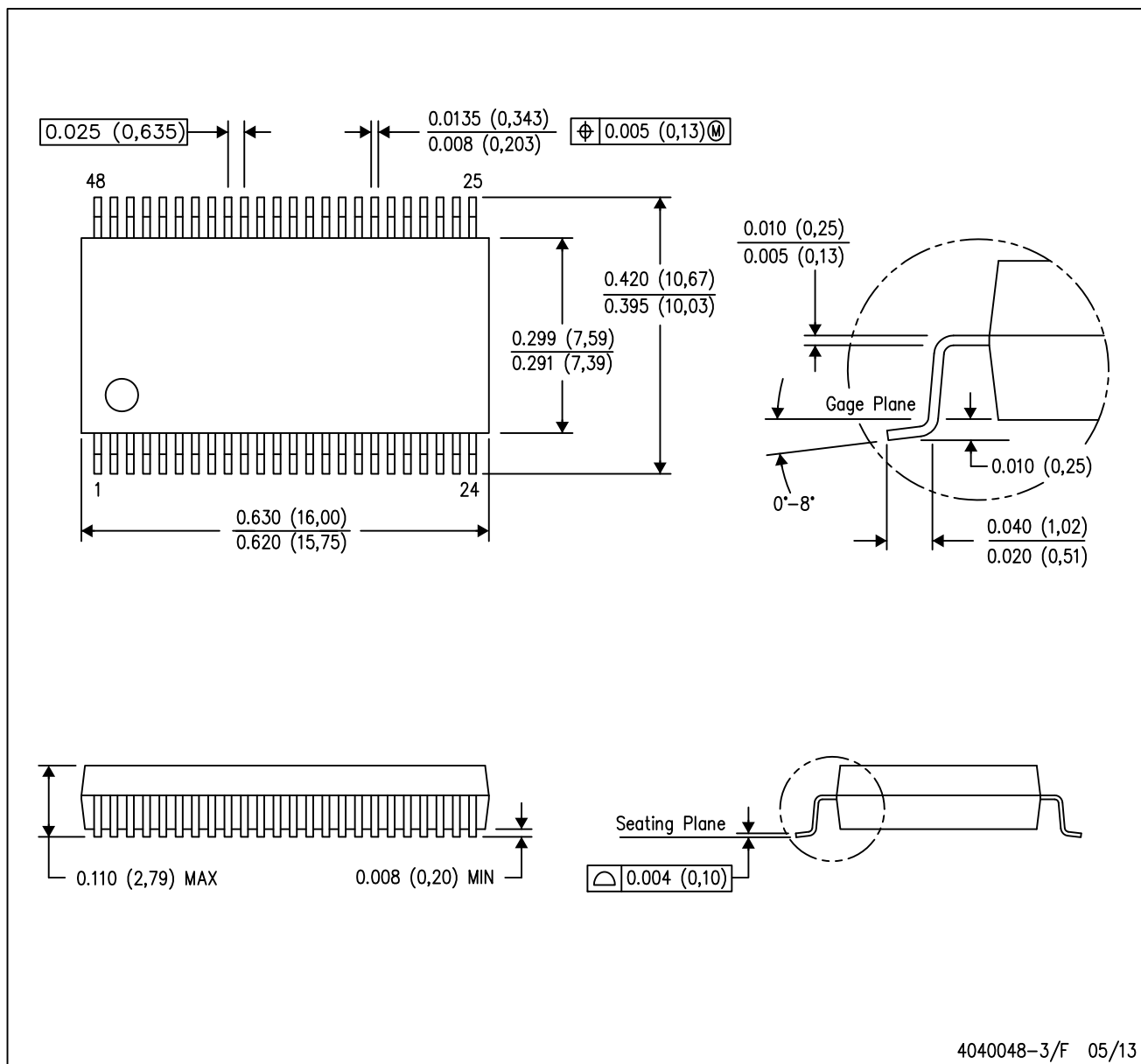


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74LVTH162245DL	DL	SSOP	48	25	473.7	14.24	5110	7.87
SN74LVTH162245DL.B	DL	SSOP	48	25	473.7	14.24	5110	7.87
SN74LVTH162245DLG4	DL	SSOP	48	25	473.7	14.24	5110	7.87

DL (R-PDSO-G48)

PLASTIC SMALL-OUTLINE PACKAGE



- 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 MO-118



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NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

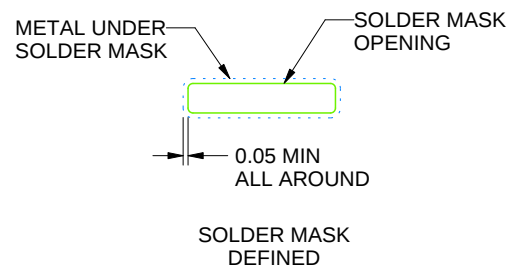
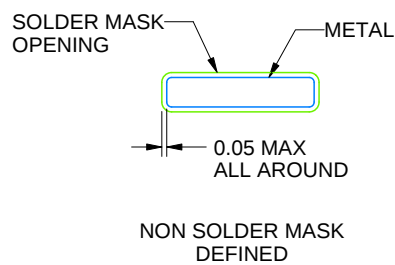
DGG0048A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

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NOTES: (continued)

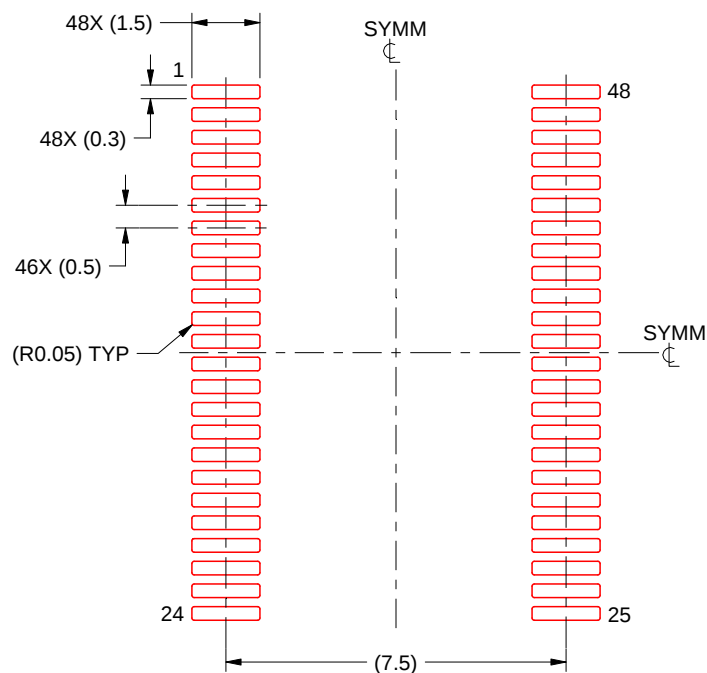
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DGG0048A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

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NOTES: (continued)

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

DGG (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN

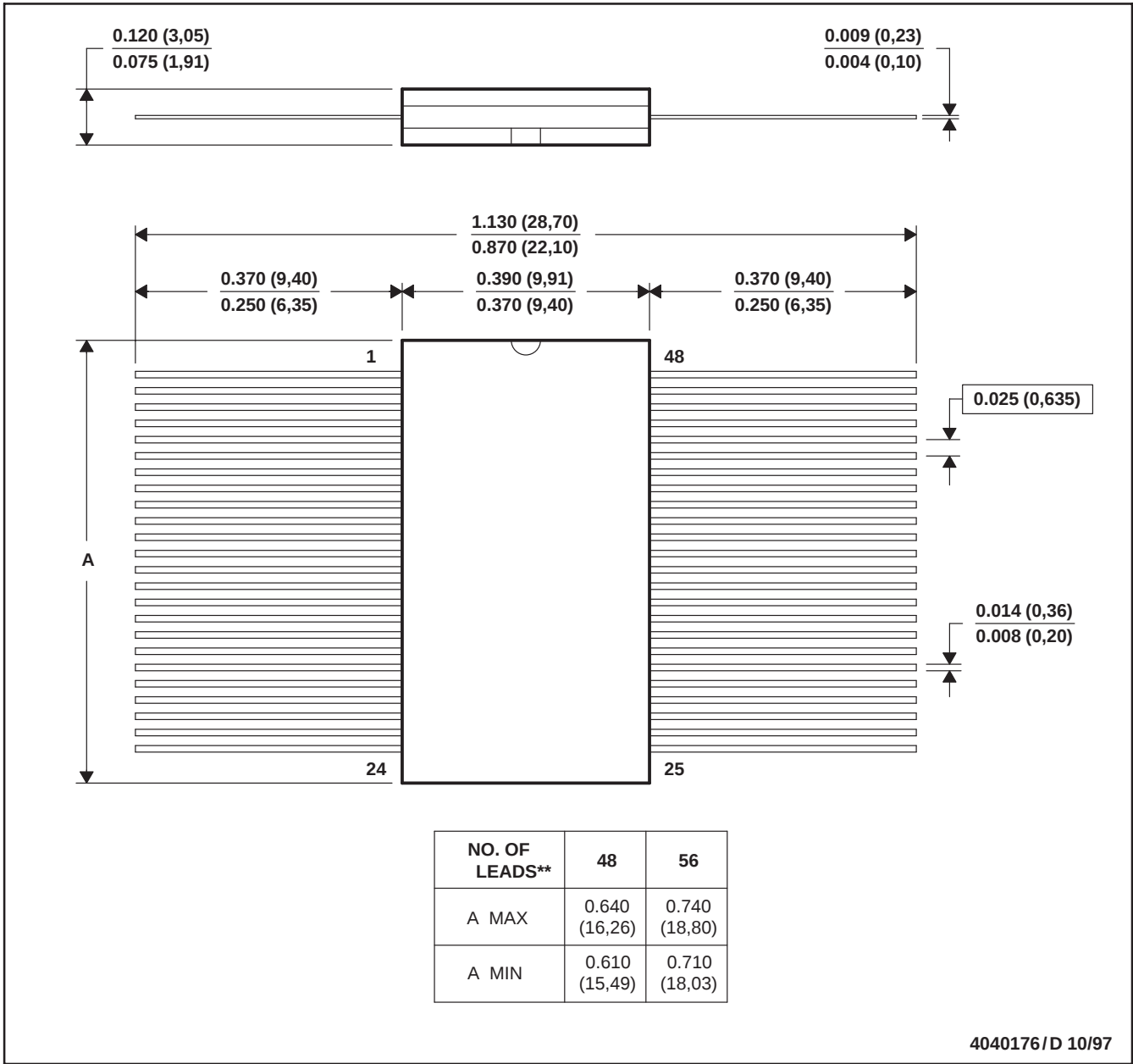


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

WD (R-GDFP-F**)

CERAMIC DUAL FLATPACK

48 LEADS SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only
E. Falls within MIL STD 1835: GDFP1-F48 and JEDEC MO-146AA
GDFP1-F56 and JEDEC MO-146AB

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