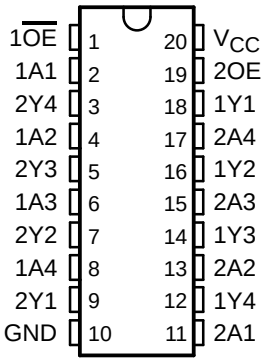
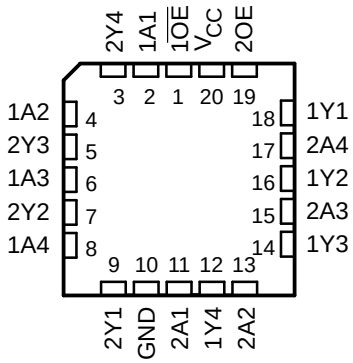
- **State-of-the-Art Advanced BiCMOS Technology (ABT) Design for 3.3-V Operation and Low-Static Power Dissipation**
- **High-Impedance State During Power Up and Power Down**
- **Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V V_{CC})**
- **Support Unregulated Battery Operation Down to 2.7 V**
- **Typical V_{OLP} (Output Ground Bounce) < 0.8 V at V_{CC} = 3.3 V, T_A = 25°C**
- **Power Off Disables Inputs/Outputs, Permitting Live Insertion**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)**
- **Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17**
- **Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors**
- **Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK), and Ceramic (J) DIPs**

SN54LVTH241 . . . J PACKAGE
SN74LVTH241 . . . DB, DW, OR PW PACKAGE
(TOP VIEW)



SN54LVTH241 . . . FK PACKAGE
(TOP VIEW)



description

These octal buffers/drivers are designed specifically for low-voltage (3.3-V) V_{CC} operation, with the capability to provide a TTL interface to a 5-V system environment.

The ′LVTH241 are organized as two 4-bit line drivers with separate output-enable ($1\overline{OE}$, $2\overline{OE}$) inputs. When $1\overline{OE}$ is low or $2\overline{OE}$ is high, the devices pass data from the A inputs to the Y outputs. When $1\overline{OE}$ is high or $2\overline{OE}$ is low, the outputs are in the high-impedance state.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

When V_{CC} is between 0 and 1.5 V, the device is 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 and OE should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sinking/current-sourcing capability of the driver.

The SN74LVTH241 is available in TI's shrink small-outline package (DB), which provides the same input/output (I/O) pin count and functionality of standard small-outline packages in less than half the printed circuit board area.

The SN54LVTH241 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74LVTH241 is characterized for operation from –40°C to 85°C.

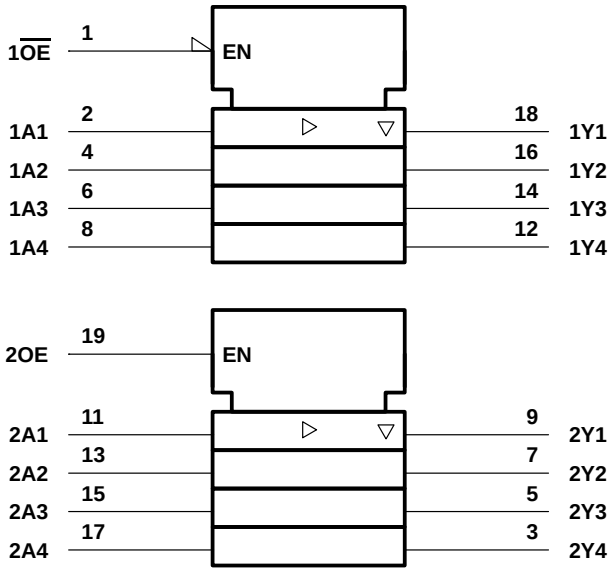
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

FUNCTION TABLES

INPUTS		OUTPUT
$1\overline{OE}$	1A	1Y
L	H	H
L	L	L
H	X	Z

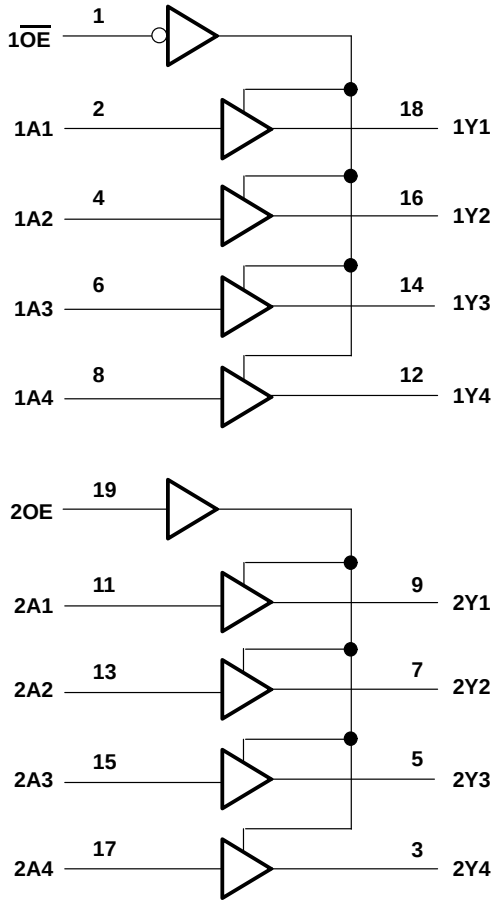
INPUTS		OUTPUT
2OE	2A	2Y
H	H	H
H	L	L
L	X	Z

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



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

Supply voltage range, V_{CC} . . . . . –0.5 V to 4.6 V
Input voltage range, V_I (see Note 1) . . . . . –0.5 V to 7 V
Voltage range applied to any output in the high state or power-off state, V_O (see Note 1) . . . . –0.5 V to 7 V
Current into any output in the low state, I_O: SN54LVTH241 . . . . . 96 mA
SN74LVTH241 . . . . . 128 mA
Current into any output in the high state, I_O (see Note 2): SN54LVTH241 . . . . . 48 mA
SN74LVTH241 . . . . . 64 mA
Input clamp current, I_{IK} (V_I < 0) . . . . . –50 mA
Output clamp current, I_{OK} (V_O < 0) . . . . . –50 mA
Maximum power dissipation at T_A = 55°C (in still air) (see Note 3): DB package . . . . . 0.6 W
DW package . . . . . 1.6 W
PW package . . . . . 0.7 W
Storage temperature range, T_{stg} . . . . . –65°C to 150°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. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This current flows only when the output is in the high state and $V_O > V_{CC}$.
3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils. For more information, refer to the *Package Thermal Considerations* application note in the *ABT Advanced BiCMOS Technology Data Book*.

recommended operating conditions (see Note 4)

			SN54LVTH241		SN74LVTH241		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			–24		–32	mA
I_{OL}	Low-level output current			48		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	Outputs enabled		10		10	ns/V
$\Delta t/\Delta V_{CC}$	Power-up ramp rate		200		200		μs/V
T_A	Operating free-air temperature		–55	125	–40	85	°C

NOTE 4: Unused control inputs must be held high or low to prevent them from floating.

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

PARAMETER	TEST CONDITIONS			SN54LVTH241			SN74LVTH241			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}	V_{CC} = 2.7 V,	I_I = –18 mA				–1.2			–1.2	V
V_{OH}	V_{CC} = 2.7 V to 3.6 V,	I_{OH} = –100 μA		V_{CC}–0.2			V_{CC}–0.2			V
	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}	V_{CC} = 2.7 V	I_{OL} = 100 μA				0.2			0.2	V
		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	V_{CC} = 0 or 3.6 V,	V_I = 5.5 V				10			10	μA
	V_{CC} = 3.6 V	V_I = V_{CC} or GND	Control inputs			±1			±1	
		V_I = V_{CC}	Data inputs			1			1	
		V_I = 0				–5			–5	
I_{off}	V_{CC} = 0,	V_I or V_O = 0 to 4.5 V				±100			±100	μA
$I_{I(hold)}$	V_{CC} = 3 V	V_I = 0.8 V	Data inputs	75			75			μA
		V_I = 2 V		–75			–75			
I_{OZH}	V_{CC} = 3.6 V,	V_O = 3 V				5			5	μA
I_{OZL}	V_{CC} = 3.6 V,	V_O = 0.5 V				–5			–5	μA
I_{OZPU}‡	V_{CC} = 0 to 1.5 V,	V_O = 0.5 V to 3 V, $\overline{OE}$/OE= don't care				±100			±100	μA
I_{OZPD}‡	V_{CC} = 1.5 V to 0,	V_O = 0.5 V to 3 V, $\overline{OE}$/OE= don't care				±100			±100	μA
I_{CC}	V_{CC} = 3.6 V, V_I = V_{CC} or GND	I_O = 0,	Outputs high			0.19			0.19	mA
			Outputs low			5			5	
			Outputs disabled			0.19			0.19	
ΔI_{CC}§	V_{CC} = 3 V to 3.6 V, One input at V_{CC} – 0.6 V, Other inputs at V_{CC} or GND					0.2			0.2	mA
C_i	V_I = 3 V or 0				3			3		pF
C_o	V_O = 3 V or 0				7			7		pF

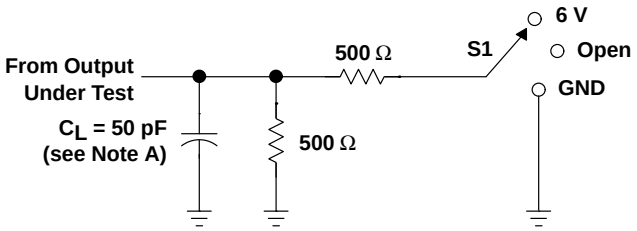
† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.
‡ This parameter is characterized but not tested.
§ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LVTH241				SN74LVTH241				UNIT
			V_{CC} = 3.3 V ± 0.3 V		V_{CC} = 2.7 V		V_{CC} = 3.3 V ± 0.3 V			V_{CC} = 2.7 V	
			MIN	MAX	MIN	MAX	MIN	TYP†	MAX	MIN MAX	
t_{PLH}	A	Y	1	3.7		4	1.1	2.3	3.5	3.9	ns
t_{PHL}			1.2	3.5		3.7	1.3	2.2	3.4	3.6	
t_{PZH}	$\overline{OE}$ or OE	Y	1	4.6		5.5	1.1	2.7	4.5	5.4	ns
t_{PZL}			1.3	4.6		5.1	1.4	2.9	4.4	5	
t_{PHZ}	$\overline{OE}$ or OE	Y	1.5	4.7		5.5	1.6	2.8	4.5	5.3	ns
t_{PLZ}			1.7	5		5.5	1.8	3	4.7	5.2	

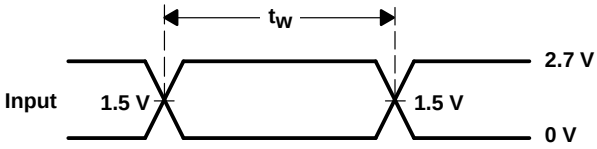
† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

PARAMETER MEASUREMENT INFORMATION

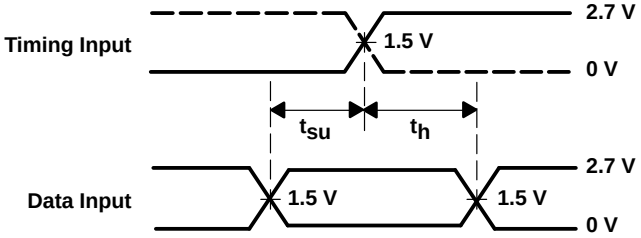


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	6 V
t_{PHZ}/t_{PZH}	GND

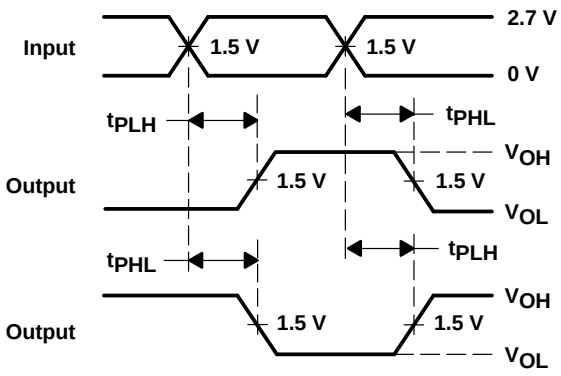
LOAD CIRCUIT



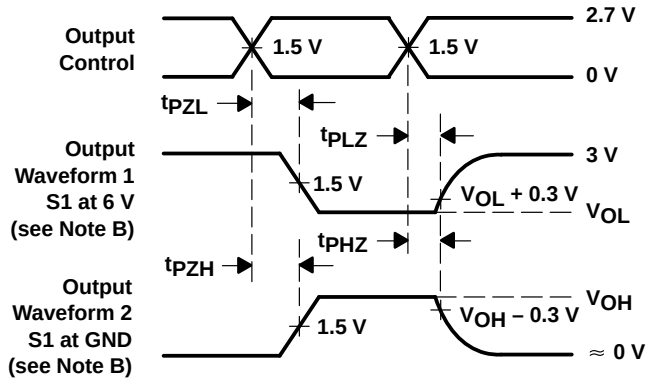
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



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 ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.
D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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