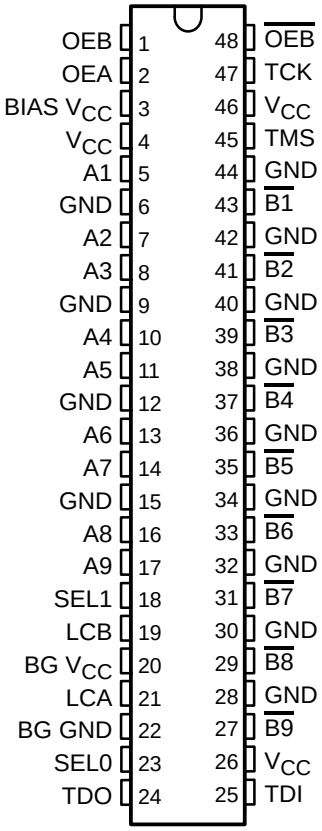
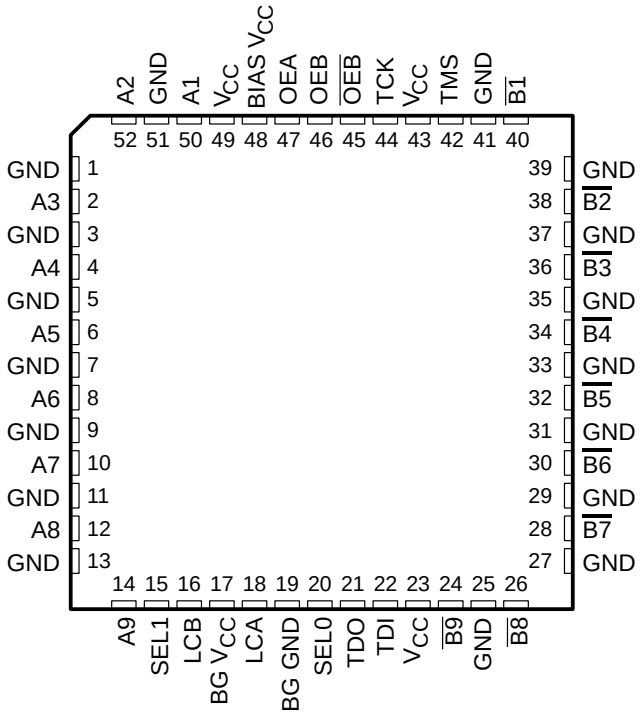
- **Compatible With IEEE 1194.1-1991 (BTL) Standard**
- **TTL A Port, Backplane Transceiver Logic (BTL) $\overline{B}$ Port**
- **Open-Collector $\overline{B}$-Port Outputs Sink 100 mA**
- **Isolated Logic-Ground and Bus-Ground Pins Reduce Noise**
- **BIAS V_{CC} Minimizes Signal Distortion During Live Insertion or Withdrawal**
- **$\overline{B}$-Port Biasing Network Preconditions the Connector and PC Trace to the BTL High-Level Voltage**
- **TTL-Input Structures Incorporate Active Clamping to Aid in Line Termination**
- **Package Options Include Plastic Quad Flat (RC) Package and Ceramic Flat (WD) Package**

SN54FB2031 . . . WD PACKAGE
(TOP VIEW)



SN74FB2031 . . . RC PACKAGE
(TOP VIEW)



description

The 'FB2031 are 9-bit transceivers designed to translate signals between TTL and backplane transceiver logic (BTL) environments. They are specifically designed to be compatible with IEEE 1194.1-1991 (BTL) standard.

The $\overline{B}$ port operates at BTL-signal levels. The open-collector $\overline{B}$ ports are specified to sink 100 mA. Two output enables (OEB and $\overline{OEB}$) are provided for the $\overline{B}$ outputs. When OEB is low, $\overline{OEB}$ is high, or V_{CC} is less than 2.1 V, the $\overline{B}$ port is turned off.

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 A port operates at TTL-signal levels. The A outputs reflect the inverse of the data at the $\overline{B}$ port when the A-port output enable (OEA) is high. When OEA is low or V_{CC} is less than 2.1 V, the A outputs are in the high-impedance state.

Pins are allocated for the 4-wire IEEE 1149.1 (JTAG) test bus. TMS and TCK are not connected and TDI is shorted to TDO.

BIAS V_{CC} establishes a voltage between 1.62 V and 2.1 V on the BTL outputs when V_{CC} is not connected.

BG V_{CC} and BG GND are the supply inputs for the bias generator.

To ensure the high-impedance state during power up or power down, A port 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.

The SN54FB2031 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74FB2031 is characterized for operation from 0°C to 70°C.

Function Tables

TRANSCEIVER

INPUTS			FUNCTION
OEA	OEB	$\overline{OEB}$	
L	H	L	$\overline{A}$ data to B bus
H	L	X	$\overline{B}$ data to A bus
H	X	H	
H	H	L	$\overline{A}$ data to B bus, $\overline{B}$ data to A bus
L	L	X	Isolation
L	X	H	

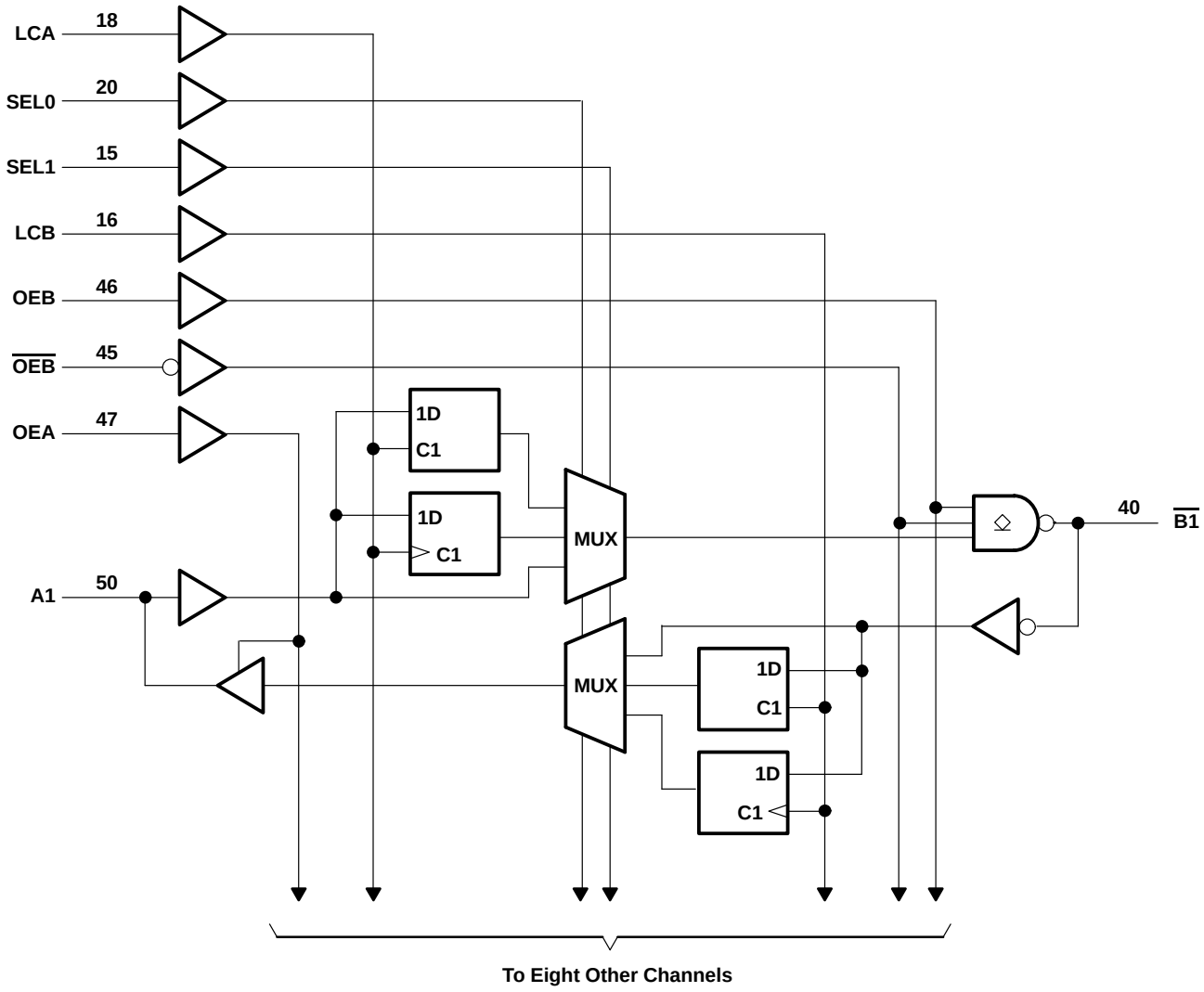
STORAGE MODE

LCA, LCB	RESULT
0	Transparent
1	Latches latched
↑	Flip-flops triggered

SELECT

SEL1	SEL0	MUX A→B	MUX B→A
0	0	Latch	Latch
0	1	Through	Through
1	0	Flip-flop	Flip-flop
1	1	Flip-flop	Latch

functional block diagram



Pin numbers shown are for the RC package.

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

Supply voltage range, V_{CC} . . . . . –0.5 V to 7 V
Input voltage range, V_I: except $\overline{B}$ port . . . . . –1.2 V to 7
$\overline{B}$ port . . . . . –1.2 V to 3.5 V
Input clamp current: except $\overline{B}$ port . . . . . –40 mA
$\overline{B}$ port . . . . . –18 mA
Voltage range applied to any $\overline{B}$ output in the disabled or power-off state . . . . . –0.5 V to 3.5 V
Voltage range applied to any output in the high state . . . . . –0.5 V to V_{CC}
Current applied to any single output in the low state: A port . . . . . 48 mA
$\overline{B}$ port . . . . . 200 mA
Maximum power dissipation at T_A = 55°C (in still air) (see Note 1): RC package . . . . . 1.4 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.

NOTE 1: The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 75 mils.

recommended operating conditions (see Note 2)

			SN54FB2031			SN74FB2031			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}, BIAS V_{CC}, BG V_{CC}	Supply voltage		4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High-level input voltage	$\overline{B}$ port	1.62*		2.3	1.62		2.3	V
		Except $\overline{B}$ port	2			2			
V_{IL}	Low-level input voltage	$\overline{B}$ port	0.75		1.47*	0.75		1.47	V
		Except $\overline{B}$ port			0.8			0.8	
I_{OH}	High-level output current	A port			–3			–3	mA
I_{OL}	Low-level output current	A port			24			24	mA
		$\overline{B}$ port			100			100	
T_A	Operating free-air temperature		–55		125	0		70	°C

* On products compliant to MIL-PRF-38535, this parameter is based on characterization data but is not tested.

NOTE 2: Unused pins (input or I/O) 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		SN54FB2031			SN74FB2031			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{IK}	$\overline{B}$ port	V_{CC} = 4.5 V	I_I = –18 mA			–1.2			–1.2	V
	Except $\overline{B}$ port		I_I = –40 mA			–0.5			–0.5	
V_{OH}	A port	V_{CC} = 4.5 V	I_{OH} = –1 mA		3.2					V
			I_{OH} = –3 mA	2.5	3.3		2.5	3.3		
V_{OL}	A port	V_{CC} = 4.5 V	I_{OL} = 20 mA		0.31					V
			I_{OL} = 24 mA		0.35	0.5		0.35	0.5	
	$\overline{B}$ port	V_{CC} = 4.5 V	I_{OL} = 80 mA	0.70		1.2	0.75		1.1	
			I_{OL} = 100 mA			1.15			1.15	
I_I	Except $\overline{B}$ port	V_{CC} = 5.5 V,	V_I = 5.5 V			50			50	µA
I_{IH}‡	Except $\overline{B}$ port	V_{CC} = 5.5 V,	V_I = 2.7 V			50			50	µA
I_{IL}‡	Except $\overline{B}$ port	V_{CC} = 5.5 V	V_I = 0.5 V			–50			–50	µA
	$\overline{B}$ port		V_I = 0.75 V			–100			–100	
I_{OZH}	A port	V_{CC} = 2.1 V to 5.5 V,	V_O = 2.7 V			50			50	µA
I_{OZL}	A port	V_{CC} = 2.1 V to 5.5 V,	V_O = 0.5 V			–50			–50	µA
I_{OZPU}	A port	V_{CC} = 0 to 2.1 V,	V_O = 0.5 V to 2.7 V			50			50	µA
I_{OZPD}	A port	V_{CC} = 2.1 V to 0,	V_O = 0.5 V to 2.7 V			–50			–50	µA
I_{OH}	$\overline{B}$ port	V_{CC} = 0 to 5.5 V,	V_O = 2.1 V			100			100	µA
I_{OS}§	A port	V_{CC} = 5.5 V,	V_O = 0	–30		–150	–30		–150	mA
I_{CC}	A port to $\overline{B}$ port	V_{CC} = 5.5 V,	I_O = 0			70			78	mA
	$\overline{B}$ port to A port					80			78	
C_i		V_I = 0.5 V or 2.5 V				13		4.5		pF
C_{io}¶	A port	V_O = 0.5 V or 2.5 V				13		8.5		pF
	$\overline{B}$ port per P1194.0	V_{CC} = 0 to 5.5 V				12			6	

† All typical values are at V_{CC} = 5 V, T_A = 25°C.
‡ For I/O ports, the parameters I_{IH} and I_{IL} include the off-state output current.
§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.
¶ Parameter is based on characterization but is not tested.

live-insertion specifications over recommended operating free-air temperature range

PARAMETER		TEST CONDITIONS		SN54FB2031		SN74FB2031		UNIT
				MIN	MAX	MIN	MAX	
I_{CC} (BIAS V_{CC})		V_{CC} = 0 to 4.5 V	V_B = 0 to 2 V, V_I (BIAS V_{CC}) = 4.5 V to 5.5 V		450		450	µA
		V_{CC} = 4.5 V to 5.5 V			10		10	
V_O	$\overline{B}$ port	V_{CC} = 0,	V_I (BIAS V_{CC}) = 5 V	1.62	2.1	1.62	2.1	V
I_O	$\overline{B}$ port	V_{CC} = 0,	V_B = 1 V, V_I (BIAS V_{CC}) = 4.5 V to 5.5 V	–30		–1		µA
		V_{CC} = 0 to 5.5 V,	OEB = 0 to 0.8 V		100		100	
		V_{CC} = 0 to 2.2 V,	OEB = 0 to 5 V		100		100	

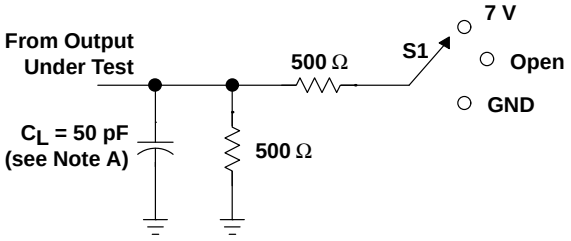
timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

			SN54FB2031		SN74FB2031		UNIT
			MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency		0	150	0	150	MHz
t_w	Pulse duration, LCA or LCB		3.3		3.3		ns
t_{su}	Setup time	Data before LCA↑ (clock mode)	1.5		1.4		ns
		Data before LCB↑ (clock mode)	2.8		2.8		
		Data before LCA↑ (latch mode)	1.1		1.1		
		Data before LCB↑ (latch mode)	2.4		2.4		
t_h	Hold time	Data after LCA↑ (clock mode)	0.6		0.6		ns
		Data after LCB↑ (clock mode)	0		0		
		Data after LCA↑ (latch mode)	0.9		0.9		
		Data after LCB↑ (latch mode)	0		0		

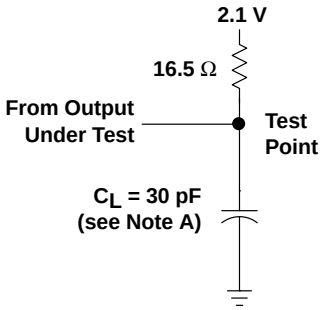
switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

PARAMETER		FROM (INPUT)	TO (OUTPUT)	SN54FB2031					SN74FB2031					UNIT
				V_{CC} = 5 V, T_A = 25°C			MIN	MAX	V_{CC} = 5 V, T_A = 25°C			MIN	MAX	
				MIN	TYP	MAX			MIN	TYP	MAX			
f_{max}						150		150			150		150	MHz
t_{PLH}		A (through mode)	$\overline{B}$	1.2	4.5	7	1	8	3.7	4.5	5.9	3.2	6.6	ns
t_{PHL}				1	4	6.7	0.8	7.8	2.9	4	5.7	2.6	5.9	
t_{PLH}		A (transparent)	$\overline{B}$	1.4	5	7.3	1.2	8.6	4.1	5	6.5	3.6	7.3	ns
t_{PHL}				1.2	4.5	7.2	1	8.3	3.3	4.5	6.1	3	6.5	
t_{PLH}		LCA	$\overline{B}$	1.4	5.4	7.7	1	9.1	4.5	5.4	7	3.9	7.8	ns
t_{PHL}				1.6	5.1	7.9	1.1	9	4	5.1	6.7	3.4	7.4	
t_{PLH}		LCB	A	1	3.7	7	0.7	7.9	2.8	3.7	4.7	1.9	6	ns
t_{PHL}				0.9	3.4	6.9	0.6	7.4	2.5	3.4	4.9	1.8	5.5	
t_{PLH}		SEL1 or SEL0	A	0.7	3.8	6.4	0.5	7.9	2.5	3.8	5.3	1.9	6.3	ns
t_{PHL}				0.8	3.5	6.3	0.6	7.1	2.2	3.5	5.1	1.6	5.6	
t_{PLH}		SEL1 or SEL0	$\overline{B}$	1.3	5.3	7.8	1.1	9.3	4.1	5.3	6.9	3.7	7.8	ns
t_{PHL}				1.1	5.2	7.9	0.9	9.2	3.7	5.2	6.9	3.3	7.7	
t_{PLH}		$\overline{B}$ (through mode)	A	0.9	4	6.8	0.7	8.6	3.1	4	5.6	2.2	7.1	ns
t_{PHL}				1.1	3.4	6.9	0.6	7.6	2.6	3.4	4.9	1.4	5.7	
t_{PLH}		$\overline{B}$ (transparent)	A	1	4.2	7.6	1	9	3.3	4.2	5.9	2.4	7.6	ns
t_{PHL}				1.4	3.9	7.4	1	8.2	2.8	3.9	5.5	1.8	6.3	
t_{PLH}		OEB or $\overline{OEB}$	$\overline{B}$	1	4.6	7.3	0.8	8.4	3.7	4.6	6.1	3.2	6.7	ns
t_{PHL}				1	4.3	6.9	0.6	8.2	2.9	4.3	5.8	2.5	6.4	
t_{PZH}		OEA	A	0.4	3.1	6.2	0.3	7.3	2.3	3.1	4.5	1.6	5	ns
t_{PZL}				0.4	2.7	6.1	0.3	7	1.9	2.7	4.1	1.6	4.4	
t_{PHZ}		OEA	A	0.3	3.1	6.4	0.2	7.1	2.2	3.1	4.5	1.5	5.2	ns
t_{PLZ}				0.4	3.3	6.5	0.3	7.2	2.5	3.3	4.9	2	5.2	
$t_{sk(p)}$	Skew for any single channel $\lvert t_{PHL} - t_{PLH} \rvert$	A	$\overline{B}$		0.5					0.5				ns
		$\overline{B}$	A		0.3					0.3				
$t_{sk(o)}$	Skew between drivers in the same package	A	$\overline{B}$		0.2					0.2				ns
		$\overline{B}$	A		0.3					0.3				
t_t	Transition time, $\overline{B}$ outputs (1.3 V to 1.8 V)			0.4	2	4.5	0.4	4.5	0.6	2	2.8	0.4	2.9	ns
	Transition time, $\overline{A}$ outputs (10% to 90%)			0.5	3.5	4.7	0	6.4	0.5	3.5	4.7	0	5.4	
$\overline{B}$-port input pulse rejection				1			1		1			1		ns

PARAMETER MEASUREMENT INFORMATION

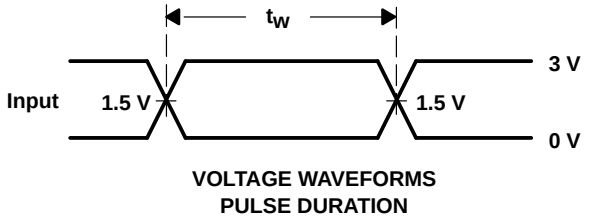


LOAD CIRCUIT FOR A OUTPUTS

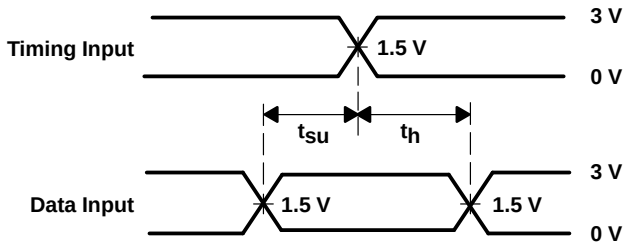


LOAD CIRCUIT FOR B OUTPUTS

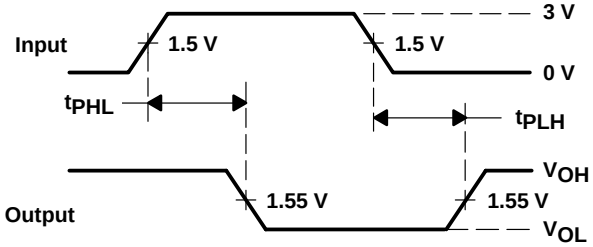
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



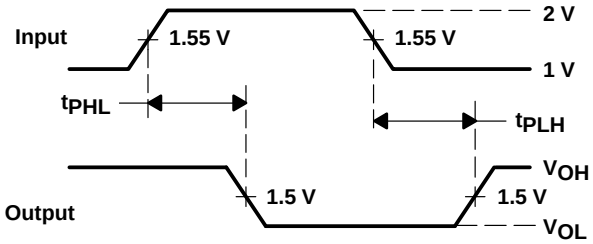
VOLTAGE WAVEFORMS
PULSE DURATION



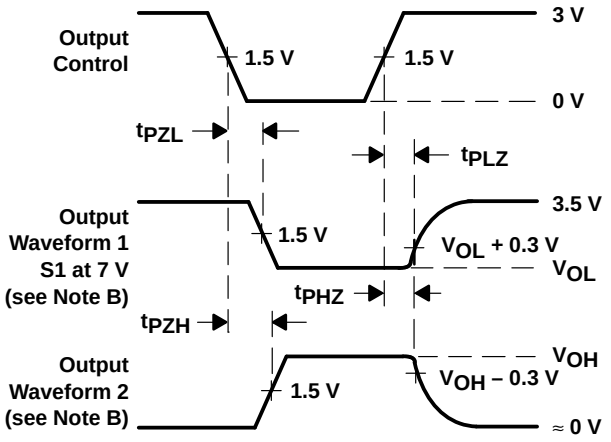
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES (A to B)



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES (B to A)



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES (A port)

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: TTL inputs: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns. BTL inputs: 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 Circuits and Voltage Waveforms

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