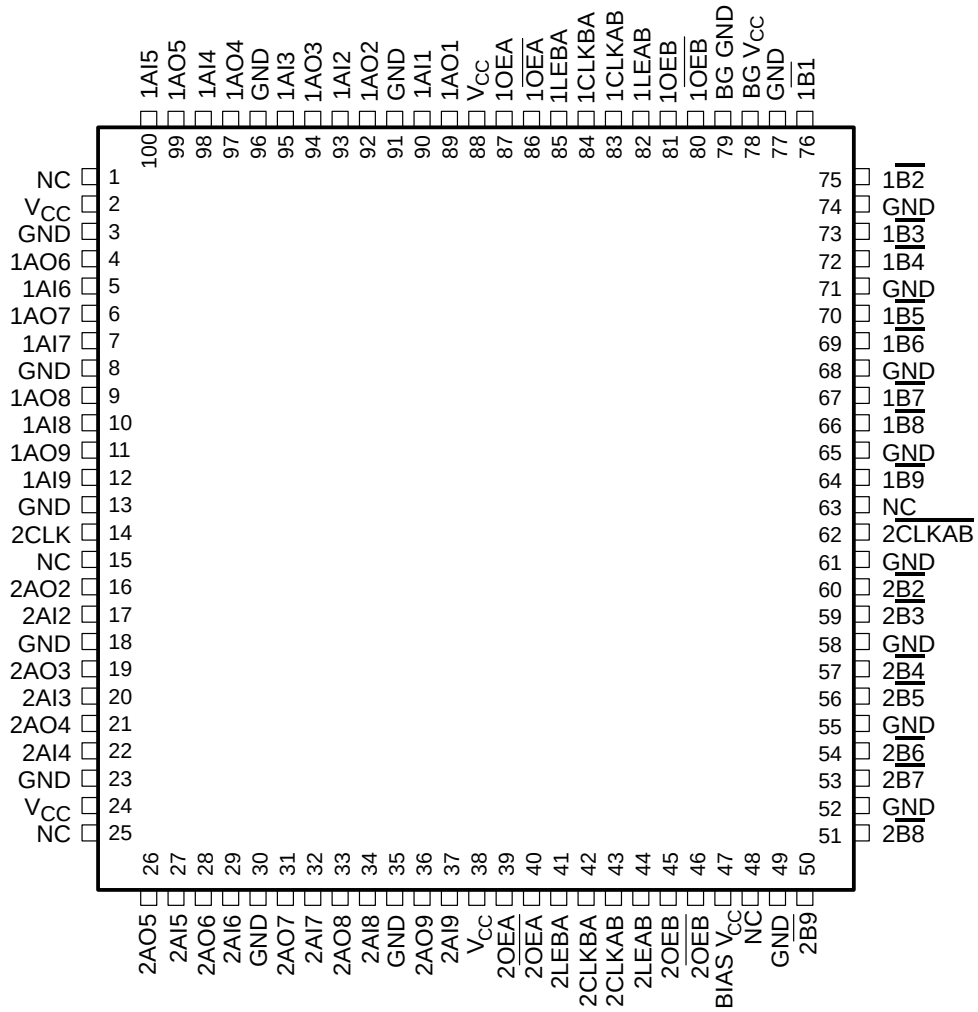
- **Compatible With IEEE 1194.1-1991 (BTL) Standard**
- **TTL A Port, Backplane Transceiver Logic $\overline{B}$ Port**
- **Open-Collector $\overline{B}$-Port Outputs Sink 100 mA**
- **BIAS V_{CC} Minimizes Signal Distortion During Live Insertion/Withdrawal**
- **$\overline{B}$-Port Biasing Network Preconditions the Connector and PC Trace to the Backplane Transceiver Logic High-Level Voltage**
- **TTL-Input Structures Incorporate Active Clamping to Aid in Line Termination**
- **Package Options Include High-Power Shrink Quad Flat (PCA) Package With 0.5-mm Pin Pitch and Ceramic Quad Flat (HQA) Package**

SN54FB1651 . . . HQA PACKAGE
SN74FB1651 . . . PCA PACKAGE
(TOP VIEW)



NC – No internal connection

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

The ′FB1651 contain an 8-bit and a 9-bit transceiver with a buffered clock. The clock and the transceivers are designed to translate signals between TTL and backplane transceiver logic (BTL) environments. They are specifically designed to be compatible with the IEEE 1194.1-1 (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 typically less than 2.5 V, the $\overline{B}$ port is turned off.

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 when V_{CC} is typically less than 2.5 V, the A outputs are in the high-impedance state.

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

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.

The SN54FB1651 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74FB1651 is characterized for operation from 0°C to 70°C.

Function Tables

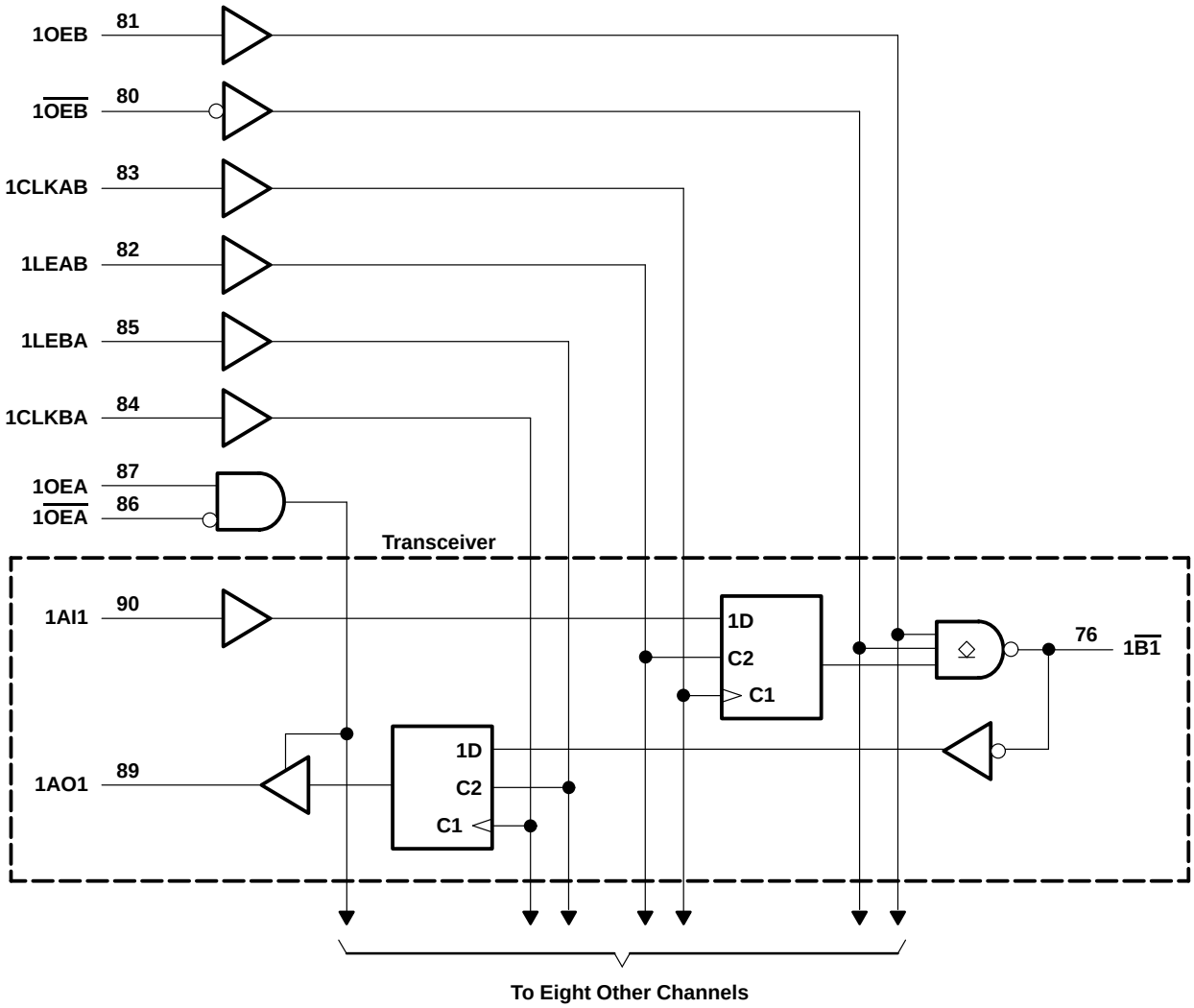
TRANSCEIVER

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

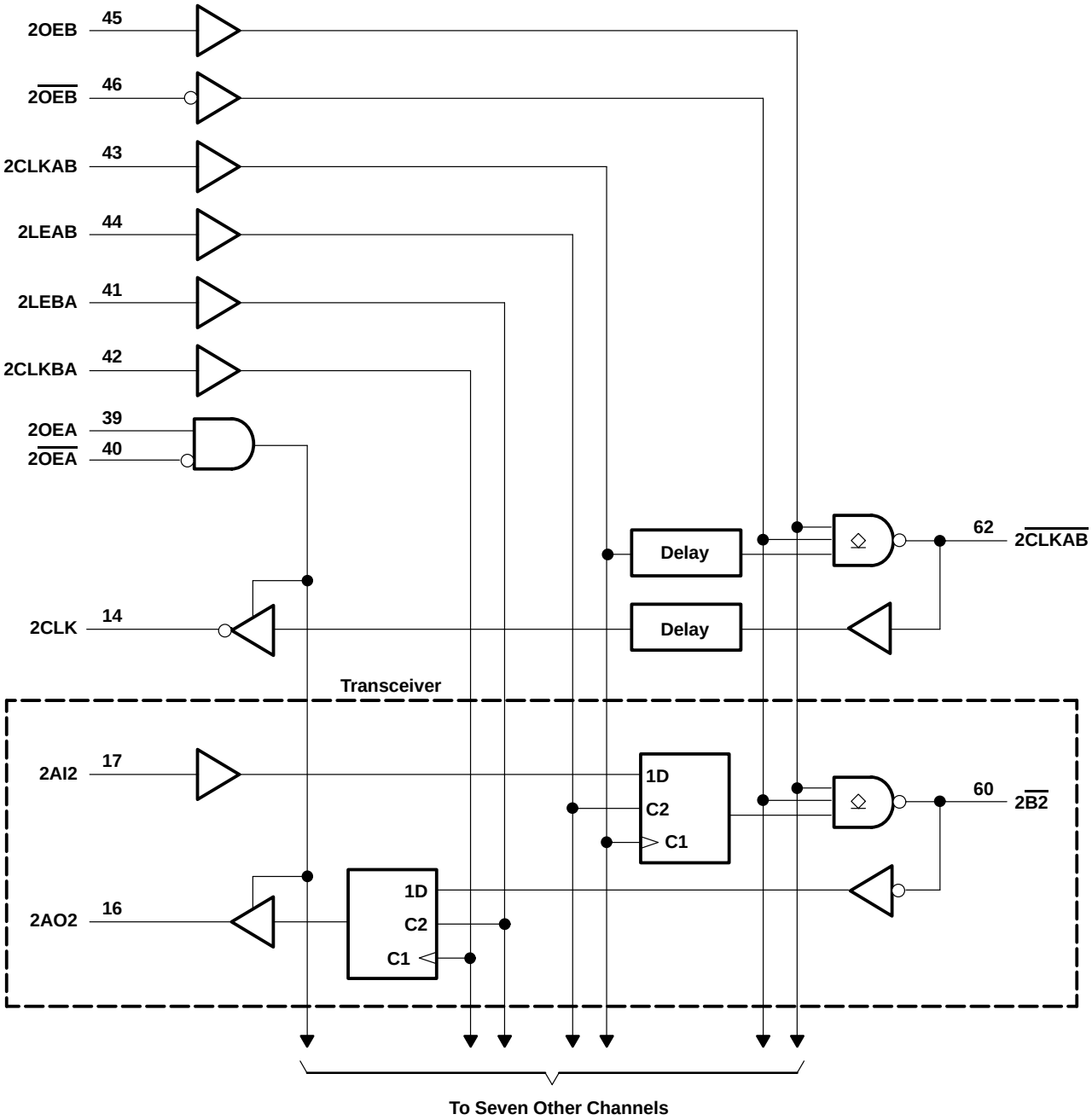
STORAGE MODE

INPUTS		FUNCTION
LE	CLK	
H	X	Transparent
L	↑	Store data
L	L	Storage

functional block diagram



functional block diagram (continued)



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

Supply voltage range, V_{CC}, BIAS V_{CC}, BG V_{CC} . . . . . –0.5 V to 7 V
Input voltage range, V_I: Except $\overline{B}$ port . . . . . –1.2 V to 7 V
$\overline{B}$ port . . . . . –1.2 V to 3.5 V
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}
Input clamp current, I_I: Except $\overline{B}$ port . . . . . –40 mA
$\overline{B}$ port . . . . . –18 mA
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): PCA package . . . . . 1.8 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. For more information, refer to the *Package Thermal Considerations* application note in the 1994 *ABT Advanced BiCMOS Technology Data Book*, literature number SCBD002B.

recommended operating conditions (see Note 2)

			SN54FB1651			SN74FB1651			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}, BG V_{CC}, BIAS 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_{IK}	Input clamp current				–18			–18	mA
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

NOTE 2: Unused inputs must be held high or low to prevent them from floating.

electrical characteristics over recommended operating free-air temperature range

PARAMETER		TEST CONDITIONS		SN54FB1651			SN74FB1651			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}	AO port	V_{CC} = 4.5 V	I_{OH} = –1 mA							V
			I_{OH} = –3 mA	2.5	3.3		2.5	3.3		
V_{OL}	AO port	V_{CC} = 4.5 V,	I_{OL} = 24 mA		0.35	0.5		0.35	0.5	V
	$\overline{B}$ port	V_{CC} = 4.5 V	I_{OL} = 80 mA	0.75		1.1	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_{CC} = 5.5 V,	V_I = 0.75 V			–100			–100	
I_{OZH}	AO port	V_{CC} = 5.5 V,	V_O = 2.7 V			50			50	µA
I_{OZL}	AO port	V_{CC} = 5.5 V,	V_O = 0.5 V			–50			–50	µA
I_{OZPU}	AO port	V_{CC} = 0 to 2.1 V,	V_O = 0.5 V to 2.7 V			50			50	µA
I_{OZPD}	AO 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			100			100	mA
	$\overline{B}$ port to A port					120			120	
C_i	AI port	V_I = 0.5 V or 2.5 V			5.5			5.5		pF
	Control inputs				5.5			5.5		
C_o	AO ports	V_O = 0.5 V or 2.5 V			5.5			5.5		pF
C_{io}¶	$\overline{B}$ port per P1194.0	V_{CC} = 0 to 5.5 V				5.5			5.5	pF

† 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 production tested.

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

PARAMETER		TEST CONDITIONS		SN54FB1651		SN74FB1651		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	–1		–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)

			V_{CC} = 5 V, T_A = 25°C		SN54FB1651		SN74FB1651				UNIT
							T_A = 0 to 70°C		T_A = –40°C to 85°C		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN†	MAX†	
f_{clock}	Clock frequency		0	150	0	150	0	150	0	150	MHz
t_w	Pulse duration, CLK or LE		3.3		3.3		3.3		3.3		ns
t_{su}	Setup time	Data before LE	4.8		5.5		4.8		5.5		ns
		Data before CLK↑	4.9		5.5		4.9		5.5		
t_h	Hold time	Data after LE	1.8		1.8		1.8		1.8		ns
		Data after CLK↑	1.1		1.1		1.1		1.1		

† These parameters are warranted but not production tested.

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

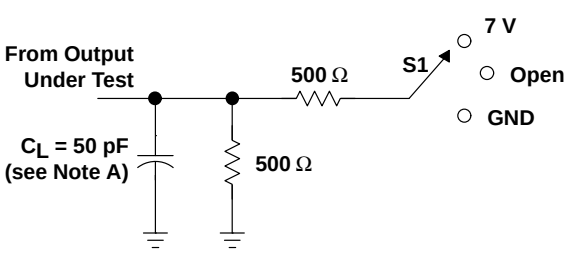
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 5 V, T_A = 25°C			SN54FB1651		SN74FB1651				UNIT
								T_A = 0 to 70°C		T_A = –40°C to 85°C		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
f_{max}			150			150		150		150		MHz
t_{PLH}	AI	$\overline{B}$	1.8	3.7	5.3	1.8	6.6	1.8	6.2	1.8	6.3	ns
t_{PHL}			2.9	4.4	6	2.9	7.3	2.9	6.6	2.9	7.2	
t_{PLH}	LEAB	$\overline{B}$	2.7	4.2	5.8	2.7	6.9	2.7	6.4	2.7	6.5	ns
t_{PHL}			3.5	5	6.5	3.5	7.5	3.5	7.3	3.5	7.3	
t_{PLH}	CLKAB	$\overline{B}$	2.3	3.9	5.5	2.3	6.5	2.3	6	2.3	6.1	ns
t_{PHL}			2.9	4.5	6.1	2.9	6.8	2.9	6.7	2.9	6.7	
t_{PLH}	2CLKAB	$2\overline{CLKAB}$	4.6	6.9	8.8	4.6	10.7	4.6	9.9	4.6	10.2	ns
t_{PHL}			4.9	6.5	8.1	4.9	9.2	4.9	8.8	4.9	8.9	
t_{PLH}	$\overline{B}$	AO	3.5	5.9	7.9	3.5	9.7	3.5	8	3.5	8.9	ns
t_{PHL}			2.2	3.7	5.3	2.2	6	2.2	5.7	2.2	5.8	
t_{PLH}	LEBA	AO	1.8	3.2	4.6	1.8	5.4	1.8	5.1	1.8	5.2	ns
t_{PHL}			1.7	3	4.4	1.7	5.1	1.7	4.7	1.7	4.8	
t_{PLH}	CLKBA	AO	1.8	3.1	4.6	1.8	5.4	1.8	5.1	1.8	5.1	ns
t_{PHL}			1.7	3.1	4.6	1.7	5.3	1.7	4.9	1.7	5	
t_{PLH}	2CLKBA	2CLK	6.4	9.7	11.8	6.4	15	6.4	13.4	6.4	13.8	ns
t_{PHL}			4.1	6.9	8.9	4.1	11.2	4.1	10.3	4.1	10.5	
t_{PLH}	OEB	$\overline{B}$	2.7	4.6	6.4	2.7	7.4	2.7	6.7	2.7	7	ns
t_{PHL}			2.9	4.1	5.9	2.9	6.8	2.9	6.6	2.9	6.6	
t_{PLH}	$\overline{OEB}$	$\overline{B}$	2.6	4.3	6.2	2.6	7.2	2.6	6.6	2.6	6.7	ns
t_{PHL}			3.4	4.6	6.4	3.4	7.2	3.4	7	3.4	7	
t_{PZH}	OEA	AO	1.4	2.9	4.4	1.4	5.3	1.4	4.9	1.4	5	ns
t_{PZL}			1.4	2.6	4	1.4	4.9	1.4	4.6	1.4	4.7	
t_{PHZ}	OEA	AO	1.7	3.4	5.1	1.7	5.9	1.7	5.8	1.7	5.8	ns
t_{PLZ}			2.2	3.6	5	2.2	5.8	2.2	5.5	2.2	5.6	
t_{PZH}	$\overline{OEA}$	AO	1.7	3.3	4.7	1.7	5.9	1.7	5.5	1.7	5.6	ns
t_{PZL}			1.7	3.1	4.4	1.7	5.4	1.7	5.1	1.7	5.2	
t_{PHZ}	$\overline{OEA}$	AO	1.5	2.9	4.5	1.5	5.2	1.5	5.1	1.5	5.1	ns
t_{PLZ}			2	3.1	4.6	2	5	2	4.8	2	4.8	

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

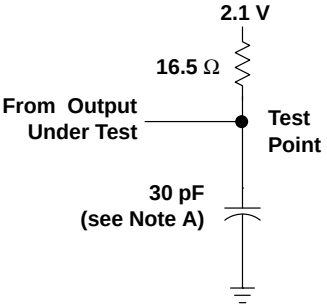
PARAMETER		V_{CC} = 5 V, T_A = 25°C			SN54FB1651		SN74FB1651				UNIT
							T_A = 0 to 70°C		T_A = –40°C to 85°C		
		MIN	TYP	MAX	MIN	MAX	MIN	MAX	MIN	MAX†	
$t_{sk(p)}$‡ Skew for any single channel $\lvert t_{PHL} - t_{PLH} \rvert$	AI to $\overline{B}$ or $\overline{B}$ to AO		0.5								ns
$t_{sk(o)}$‡ Skew between drivers in the same package	AI to $\overline{B}$ or $\overline{B}$ to AO		1								ns
t_t Transition time	$\overline{B}$ outputs (1.3 V to 1.8 V)	0.9	1.7		0.3	6.8	0.5	4.6	0.5	4.6	ns
	AO outputs (10% to 90%)	0.5	2		0.3	4.3	0.4	4.2	0.4	4.2	
$\overline{B}$-port input pulse rejection		1			1		1		1		ns

† These parameters are warranted but not production tested.
‡ Skew values are applicable for through mode only.

PARAMETER MEASUREMENT INFORMATION

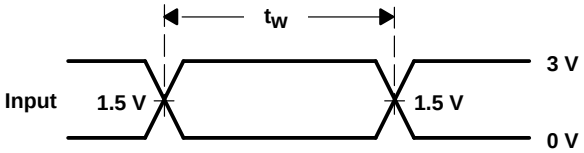


LOAD CIRCUIT FOR A OUTPUTS

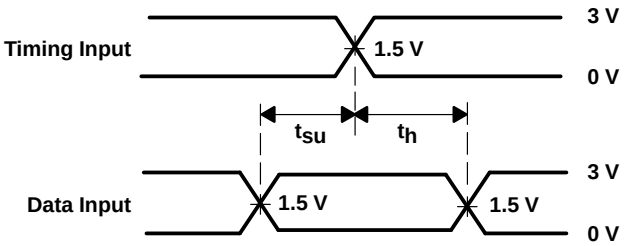


LOAD CIRCUIT FOR B OUTPUTS

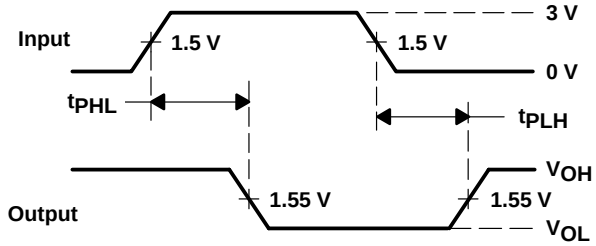
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



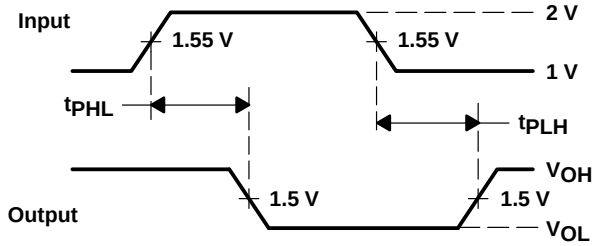
VOLTAGE WAVEFORMS
PULSE DURATION



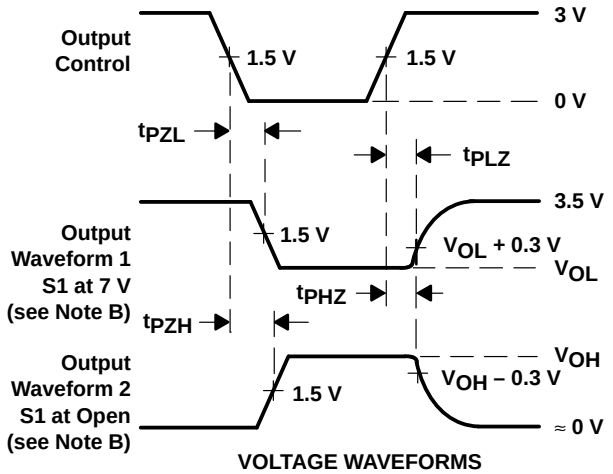
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



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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