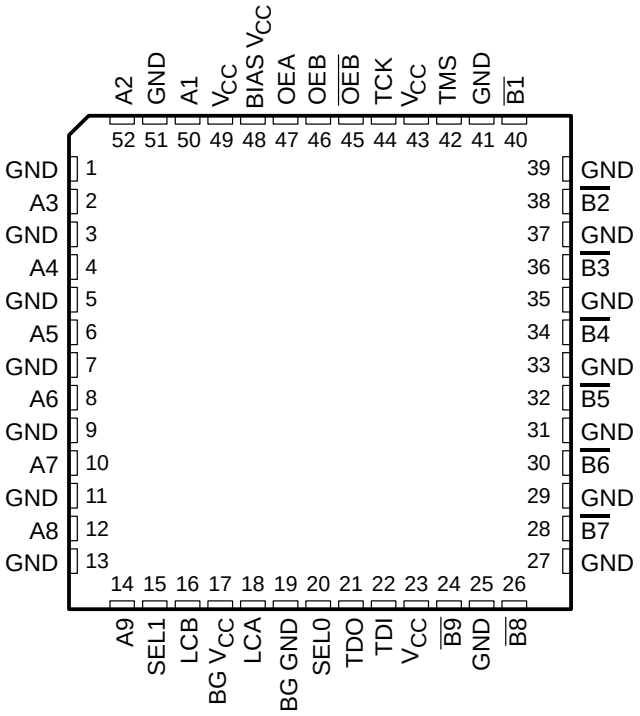
- **Compatible With IEEE Std 1194.1-1991 (BTL)**
- **TTL A Port, Backplane Transceiver Logic (BTL) $\overline{B}$ Port**
- **Open-Collector $\overline{B}$-Port Outputs Sink 100 mA**
- **High-Impedance State During Power Up and Power Down**
- **BIAS V_{CC} Minimizes Signal Distortion During Live Insertion 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**

RC PACKAGE
(TOP VIEW)



description

The SN74FB2031 is a 9-bit transceiver designed to translate signals between TTL and backplane transceiver logic (BTL) environments. The device is designed specifically to be compatible with IEEE Std 1194.1-1991.

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.

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 four-wire IEEE Std 1149.1 (JTAG) test bus, although currently there are no plans to release a JTAG-featured version. TMS and TCK are not connected and TDI is shorted to TDO.

description (continued)

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.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	QFP – RC	Tube	SN74FB2031RC	FB2031

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

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	

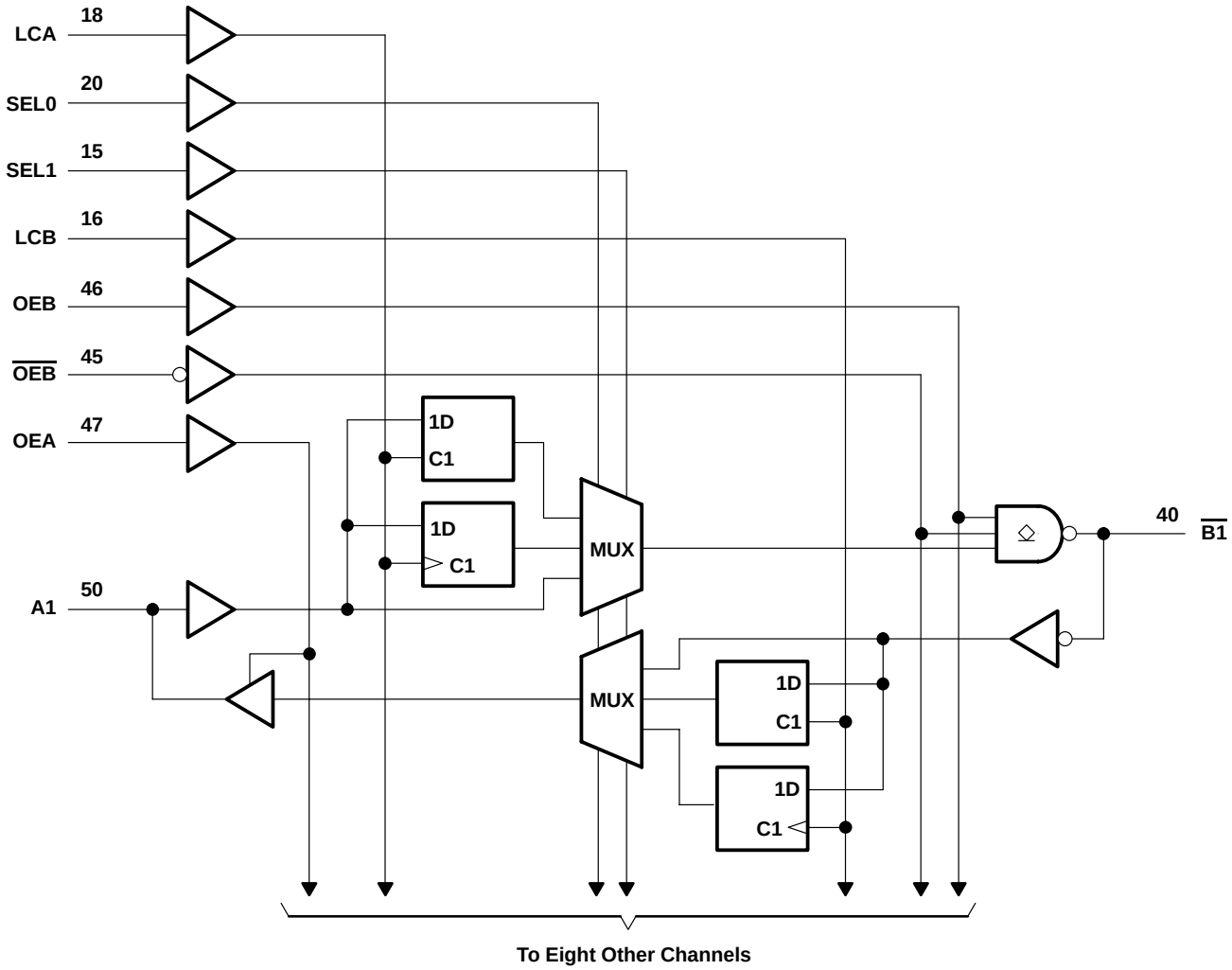
STORAGE MODE

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



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 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, V_O . . . . . –0.5 V to 3.5 V
Voltage range applied to any output in the high state, V_O . . . . . –0.5 V to V_{CC}
Input clamp current, I_{IK}: Except $\overline{B}$ port . . . . . –40 mA
$\overline{B}$ port . . . . . –18 mA
Current applied to any single output in the low state, I_O: A port . . . . . 48 mA
$\overline{B}$ port . . . . . 200 mA
Package thermal impedance, θ_{JA} (see Note 1) . . . . . 44°C/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 package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 2)

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

NOTE 2: To ensure proper device operation, all unused inputs must be terminated as follows: A and control inputs to V_{CC}(5 V) or GND, and B inputs to GND only. 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		MIN	TYP†	MAX	UNIT
V_{IK}	$\overline{B}$ port	V_{CC} = 4.5 V,	I_I = –18 mA			–1.2	V
	Except $\overline{B}$ port	V_{CC} = 4.5 V,	I_I = –40 mA			–0.5	
V_{OH}	A port	V_{CC} = 4.5 V,	I_{OH} = –3 mA	2.5	3.3		V
V_{OL}	A port	V_{CC} = 4.5 V,	I_{OL} = 24 mA		0.35	0.5	V
	$\overline{B}$ port	V_{CC} = 4.5 V	I_{OL} = 80 mA	0.75		1.1	
			I_{OL} = 100 mA			1.15	
I_I	Except $\overline{B}$ port	V_{CC} = 5.5 V,	V_I = 5.5 V			50	µA
I_{IH}‡	Except $\overline{B}$ port	V_{CC} = 5.5 V,	V_I = 2.7 V			50	µA
I_{IL}‡	Except $\overline{B}$ port	V_{CC} = 5.5 V,	V_I = 0.5 V			–50	µA
	$\overline{B}$ port	V_{CC} = 5.5 V,	V_I = 0.75 V			–100	
I_{OZH}	A port	V_{CC} = 2.1 V to 5.5 V,	V_O = 2.7 V			50	µA
I_{OZL}	A port	V_{CC} = 2.1 V to 5.5 V,	V_O = 0.5 V			–50	µA
I_{OZPU}	A port	V_{CC} = 0 to 2.1 V,	V_O = 0.5 V to 2.7 V			50	µA
I_{OZPD}	A port	V_{CC} = 2.1 V to 0,	V_O = 0.5 V to 2.7 V			–50	µA
I_{OH}	$\overline{B}$ port	V_{CC} = 0 to 5.5 V,	V_O = 2.1 V			100	µA
I_{OS}§	A port	V_{CC} = 5.5 V,	V_O = 0	–30		–150	mA
I_{CC}	A port to $\overline{B}$ port	V_{CC} = 5.5 V,	I_O = 0			78	mA
	$\overline{B}$ port to A port					78	
C_i		V_I = 0.5 V or 2.5 V			4.5		pF
C_{io}	A port	V_O = 0.5 V or 2.5 V			8.5		pF
	$\overline{B}$ port per IEEE Std 1194.1-1991	V_{CC} = 0 to 5.5 V				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.

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

PARAMETER		TEST CONDITIONS			MIN	MAX	UNIT
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	μA
		V_{CC} = 4.5 V to 5.5 V				10	
V_O	$\overline{B}$ port	V_{CC} = 0,	V_I (BIAS V_{CC}) = 5 V		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		μA
		V_{CC} = 0 to 5.5 V,	OEB = 0 to 0.8 V			100	
		V_{CC} = 0 to 2.2 V,	OEB = 0 to 5 V			100	

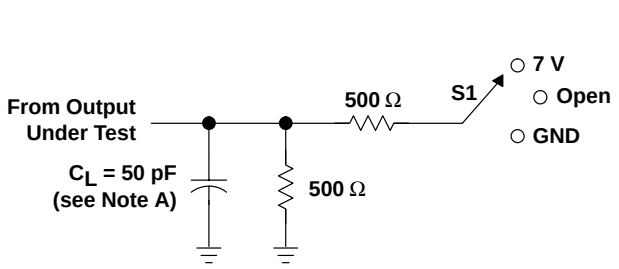
timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

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

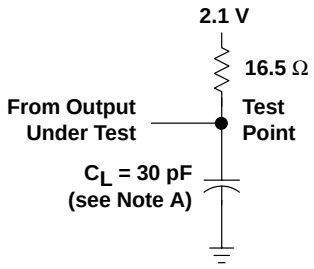
switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 5 V, T_A = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
f_{max}			150			150		MHz
t_{PLH}	A (through mode)	$\overline{B}$	3.7	4.5	5.9	3.2	6.6	ns
t_{PHL}			2.9	4	5.7	2.6	5.9	
t_{PLH}	A (transparent)	$\overline{B}$	4.1	5	6.5	3.6	7.3	ns
t_{PHL}			3.3	4.5	6.1	3	6.5	
t_{PLH}	LCA	$\overline{B}$	4.5	5.4	7	3.9	7.8	ns
t_{PHL}			4	5.1	6.7	3.4	7.4	
t_{PLH}	LCB	A	2.8	3.7	4.7	1.9	6	ns
t_{PHL}			2.5	3.4	4.9	1.8	5.5	
t_{PLH}	SEL1 or SEL0	A	2.5	3.8	5.3	1.9	6.3	ns
t_{PHL}			2.2	3.5	5.1	1.6	5.6	
t_{PLH}	SEL1 or SEL0	$\overline{B}$	4.1	5.3	6.9	3.7	7.8	ns
t_{PHL}			3.7	5.2	6.9	3.3	7.7	
t_{PLH}	$\overline{B}$ (through mode)	A	3.1	4	5.6	2.2	7.1	ns
t_{PHL}			2.6	3.4	4.9	1.4	5.7	
t_{PLH}	$\overline{B}$ (transparent)	A	3.3	4.2	5.9	2.4	7.6	ns
t_{PHL}			2.8	3.9	5.5	1.8	6.3	
t_{PLH}	OEB or $\overline{OEB}$	$\overline{B}$	3.7	4.6	6.1	3.2	6.7	ns
t_{PHL}			2.9	4.3	5.8	2.5	6.4	
t_{PZH}	OEA	A	2.3	3.1	4.5	1.6	5	ns
t_{PZL}			1.9	2.7	4.1	1.6	4.4	
t_{PHZ}	OEA	A	2.2	3.1	4.5	1.5	5.2	ns
t_{PLZ}			2.5	3.3	4.9	2	5.2	
$t_{sk(p)}$ Pulse skew	A	$\overline{B}$		0.5				ns
	$\overline{B}$	A		0.3				
$t_{sk(o)}$ Output skew	A	$\overline{B}$		0.2				ns
	$\overline{B}$	A		0.3				
t_t	Transition time, $\overline{B}$ outputs (1.3 V to 1.8 V)		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	5.4	
$t_{(pr)}$	$\overline{B}$-port input pulse rejection		1			1		ns

PARAMETER MEASUREMENT INFORMATION

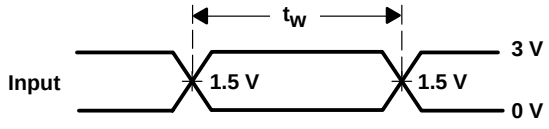


LOAD CIRCUIT FOR A OUTPUTS

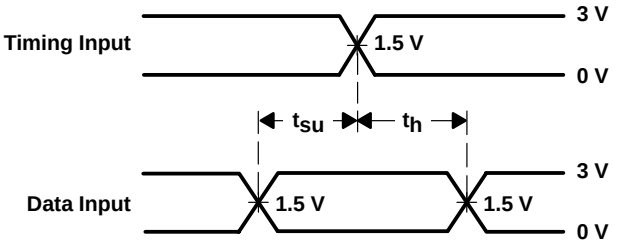


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open

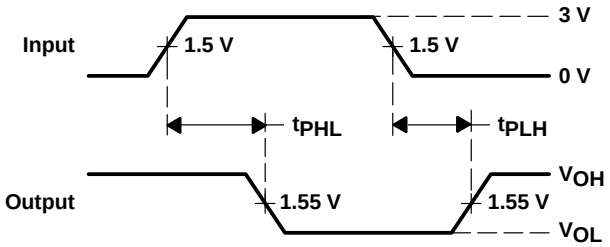
LOAD CIRCUIT FOR B OUTPUTS



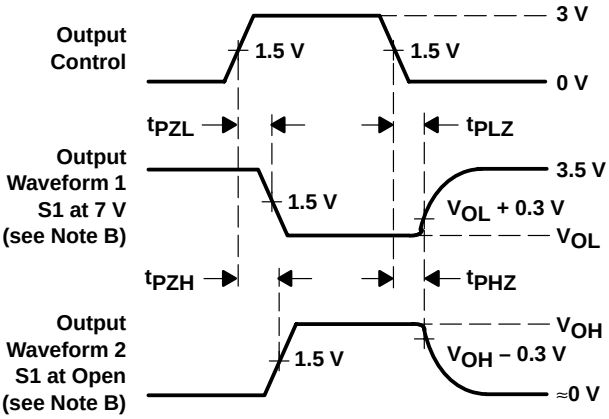
VOLTAGE WAVEFORMS
PULSE DURATION



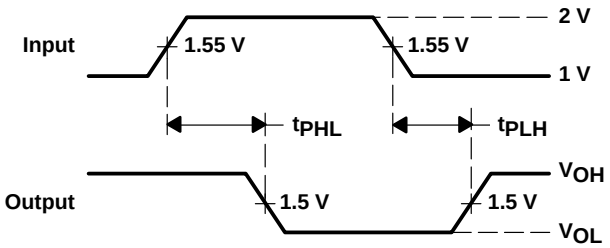
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES (A TO B)



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES (A PORT)



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES (B TO A)

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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