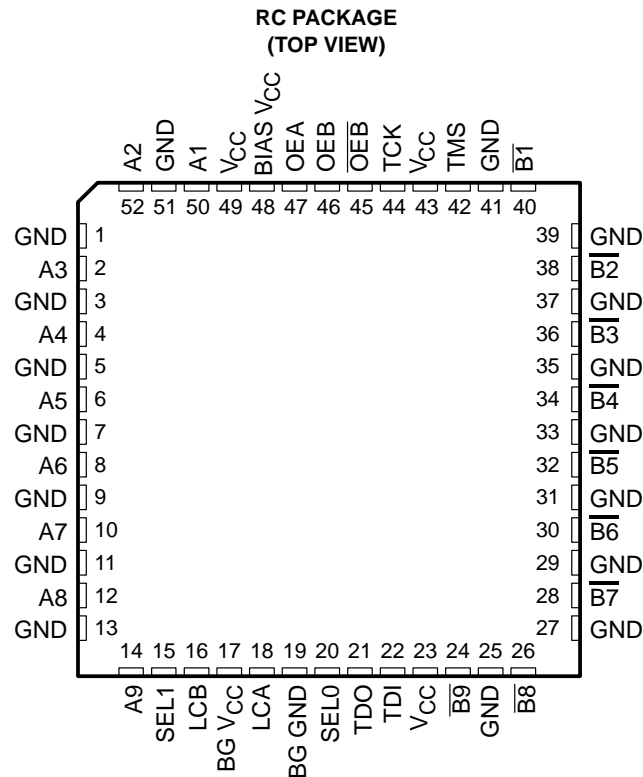


# SN74FB2031 9-BIT TTL/BTL ADDRESS/DATA TRANSCEIVER

SCBS176N – NOVEMBER 1991 – REVISED JUNE 2001

- Compatible With IEEE Std 1194.1-1991 (BTL)
- TTL A Port, Backplane Transceiver Logic (BTL)  $\bar{B}$  Port
- Open-Collector  $\bar{B}$ -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
- $\bar{B}$ -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



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

The A port operates at TTL signal levels. The A outputs reflect the inverse of the data at the  $\bar{B}$  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.



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

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# SN74FB2031

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### 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](http://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

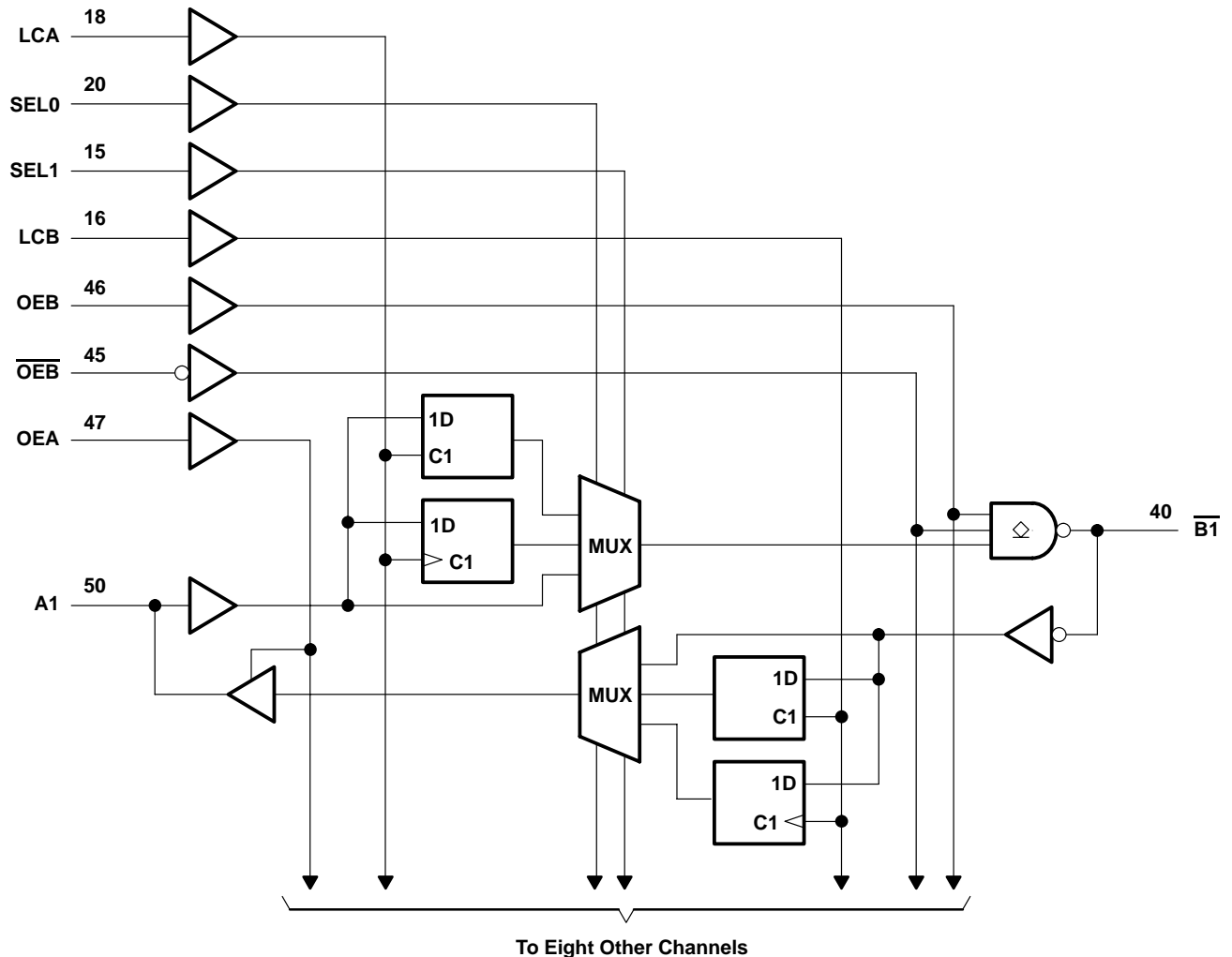
#### SELECT

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



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## functional block diagram



**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>**

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, $\theta_{JA}$ (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 JEDEC 51-7.

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### 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 Except $\overline{B}$ port	1.62 2	2.3	V
$V_{IL}$	Low-level input voltage	$\overline{B}$ port Except $\overline{B}$ port	0.75 0.8	1.47	V
$I_{OH}$	High-level output current	A port		–3	mA
$I_{OL}$	Low-level output current	A port $\overline{B}$ port		24 100	mA
$T_A$	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
$I_{IH}^\ddagger$	Except $\overline{B}$ port	$V_{CC} = 5.5$ V,	$V_I = 2.7$ V			50	μA
$I_{IL}^\ddagger$	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	μA
$I_{OZH}$	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
$I_{OS}^\S$	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,  $T_A = 25^\circ\text{C}$ .

‡ 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.



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

PARAMETER		TEST CONDITIONS		MIN	MAX	UNIT
I <sub>CC</sub> (BIAS V <sub>CC</sub> )		V <sub>CC</sub> = 0 to 4.5 V	V <sub>B</sub> = 0 to 2 V, V <sub>I</sub> (BIAS V <sub>CC</sub> ) = 4.5 V to 5.5 V	450		μA
		V <sub>CC</sub> = 4.5 V to 5.5 V		10		
V <sub>O</sub>	B̄ port	V <sub>CC</sub> = 0, V <sub>I</sub> (BIAS V <sub>CC</sub> ) = 5 V		1.62	2.1	V
I <sub>O</sub>	B̄ port	V <sub>CC</sub> = 0, V <sub>B</sub> = 1 V, V <sub>I</sub> (BIAS V <sub>CC</sub> ) = 4.5 V to 5.5 V		−1		μA
		V <sub>CC</sub> = 0 to 5.5 V, OEB = 0 to 0.8 V		100		
		V <sub>CC</sub> = 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 <sub>clock</sub>	Clock frequency			150		MHz
t <sub>w</sub>	Pulse duration		LCA or LCB		3.3	ns
t <sub>su</sub>	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 <sub>h</sub>	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	



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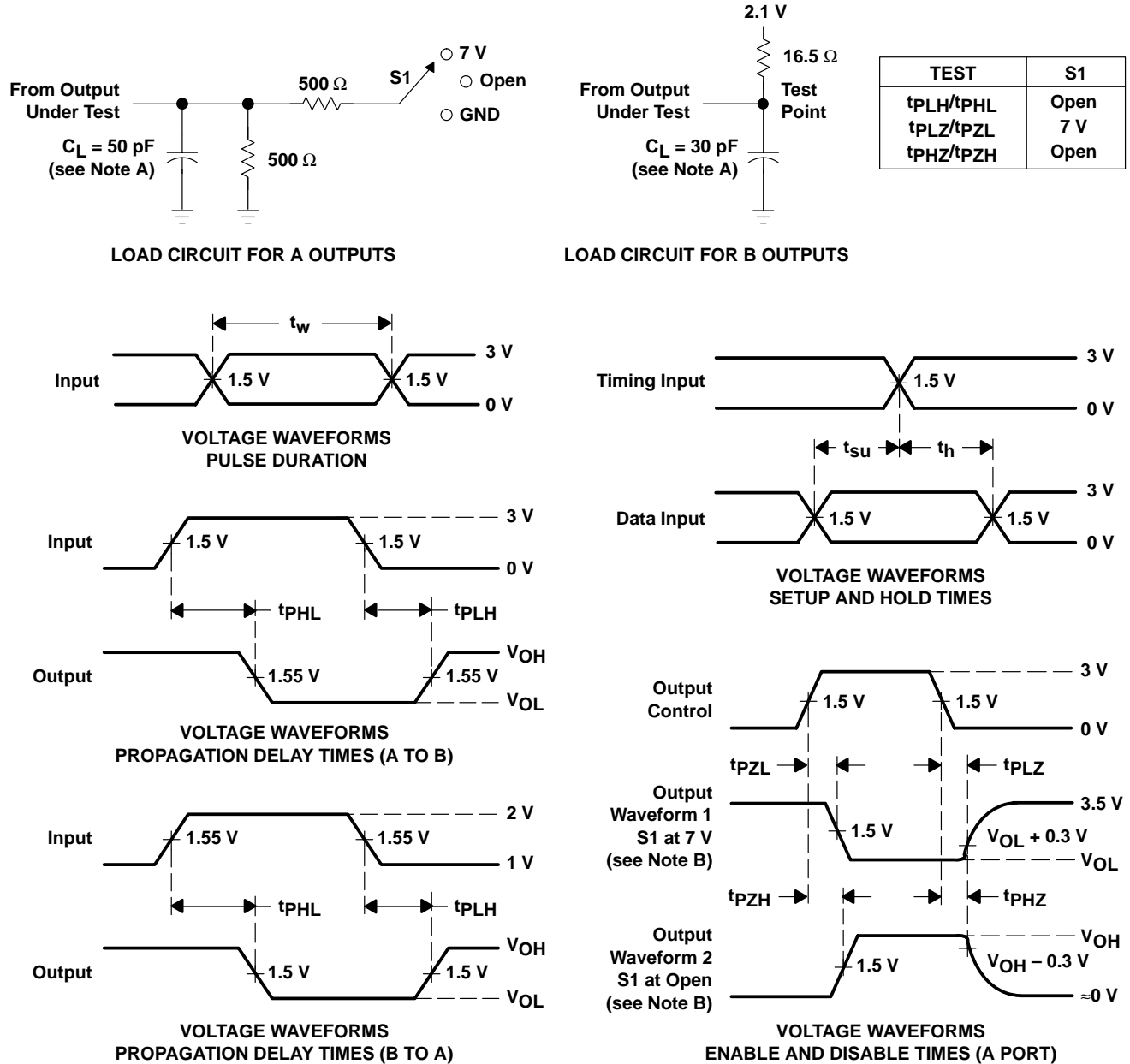
## 9-BIT TTL/BTL ADDRESS/DATA TRANSCEIVER

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$			MIN	MAX	UNIT
			MIN	TYP	MAX			
$f_{\text{max}}$			150			150		MHz
$t_{\text{PLH}}$	A (through mode)	$\overline{B}$	3.7	4.5	5.9	3.2	6.6	ns
$t_{\text{PHL}}$			2.9	4	5.7	2.6	5.9	
$t_{\text{PLH}}$	A (transparent)	$\overline{B}$	4.1	5	6.5	3.6	7.3	ns
$t_{\text{PHL}}$			3.3	4.5	6.1	3	6.5	
$t_{\text{PLH}}$	LCA	$\overline{B}$	4.5	5.4	7	3.9	7.8	ns
$t_{\text{PHL}}$			4	5.1	6.7	3.4	7.4	
$t_{\text{PLH}}$	LCB	A	2.8	3.7	4.7	1.9	6	ns
$t_{\text{PHL}}$			2.5	3.4	4.9	1.8	5.5	
$t_{\text{PLH}}$	SEL1 or SEL0	A	2.5	3.8	5.3	1.9	6.3	ns
$t_{\text{PHL}}$			2.2	3.5	5.1	1.6	5.6	
$t_{\text{PLH}}$	SEL1 or SEL0	$\overline{B}$	4.1	5.3	6.9	3.7	7.8	ns
$t_{\text{PHL}}$			3.7	5.2	6.9	3.3	7.7	
$t_{\text{PLH}}$	$\overline{B}$ (through mode)	A	3.1	4	5.6	2.2	7.1	ns
$t_{\text{PHL}}$			2.6	3.4	4.9	1.4	5.7	
$t_{\text{PLH}}$	$\overline{B}$ (transparent)	A	3.3	4.2	5.9	2.4	7.6	ns
$t_{\text{PHL}}$			2.8	3.9	5.5	1.8	6.3	
$t_{\text{PLH}}$	OEB or $\overline{OEB}$	$\overline{B}$	3.7	4.6	6.1	3.2	6.7	ns
$t_{\text{PHL}}$			2.9	4.3	5.8	2.5	6.4	
$t_{\text{PZH}}$	OEA	A	2.3	3.1	4.5	1.6	5	ns
$t_{\text{PZL}}$			1.9	2.7	4.1	1.6	4.4	
$t_{\text{PHZ}}$	OEA	A	2.2	3.1	4.5	1.5	5.2	ns
$t_{\text{PLZ}}$			2.5	3.3	4.9	2	5.2	
$t_{\text{sk(p)}}$ Pulse skew	A	$\overline{B}$	0.5					ns
	$\overline{B}$	A	0.3					
$t_{\text{sk(o)}}$ 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, A outputs (10% to 90%)		0.5	3.5	4.7	0	5.4	
$t_{\text{(pr)}}$	$\overline{B}$ -port input pulse rejection		1			1		ns

## PARAMETER MEASUREMENT INFORMATION



- 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:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns; BTL inputs:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns.  
 D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
SN74FB2031RC	LIFEBUY	QFP	RC	52	96	TBD	CU SNPB	Level-2-240C-1 YEAR	0 to 70	FB2031	
SN74FB2031RCG3	ACTIVE	QFP	RC	52	96	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR	0 to 70	FB2031	<a href="#">Samples</a>
SN74FB2031RCR	LIFEBUY	QFP	RC	52	500	TBD	CU SNPB	Level-2-240C-1 YEAR	0 to 70	FB2031	
SN74FB2031RCRG3	ACTIVE	QFP	RC	52	500	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR	0 to 70	FB2031	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Only one of markings shown within the brackets will appear on the physical device.

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**OTHER QUALIFIED VERSIONS OF SN74FB2031 :**



- 
- Military: [SN54FB2031](#)

NOTE: Qualified Version Definitions:

- Military - QML certified for Military and Defense Applications

**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
SN74FB2031RCR	QFP	RC	52	500	330.0	24.4	14.2	14.2	2.6	24.0	24.0	Q2
SN74FB2031RCRG3	QFP	RC	52	500	330.0	24.4	14.2	14.2	2.6	24.0	24.0	Q2

## TAPE AND REEL BOX DIMENSIONS

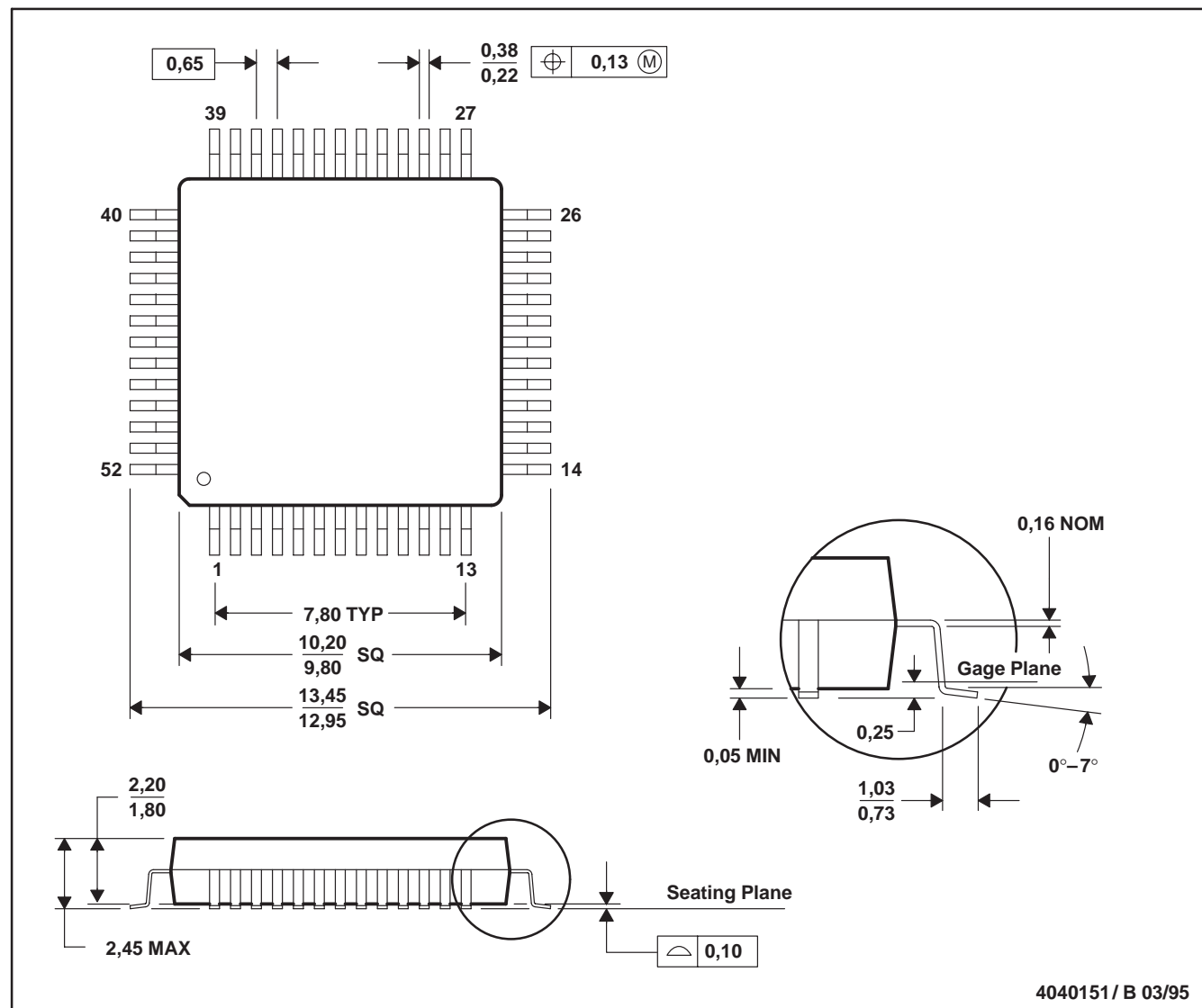


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74FB2031RCR	QFP	RC	52	500	367.0	367.0	45.0
SN74FB2031RCRG3	QFP	RC	52	500	367.0	367.0	45.0

## RC (S-PQFP-G52)

## PLASTIC QUAD FLATPACK



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Falls within JEDEC MS-022

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