

DATA SHEET

FBL2033

3.3V BTL 8-bit latched/registered/pass-thru
universal transceiver

Product specification

1999 Apr 15

IC23 data handbook

Philips Semiconductors



PHILIPS

3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

FEATURES

- 8-bit transceivers
- Latched, registered or straight through in either A to B or B to A path
- Drives heavily loaded backplanes with equivalent load impedances down to 10Ω.
- High drive 100mA BTL Open Collector drivers on B-port
- Allows incident wave switching in heavily loaded backplane buses
- Reduced BTL voltage swing produces less noise and reduces power consumption
- Built-in precision band-gap reference provides accurate receiver thresholds and improved noise immunity
- Compatible with IEEE Futurebus+ or proprietary BTL backplanes
- Each BTL driver has a dedicated Bus GND for a signal return
- Controlled output ramp and multiple GND pins minimize ground bounce
- Glitch-free power up/power down operation
- Low I_{CC} current
- Tight output skew
- Supports live insertion
- Pins for the optional JTAG boundary scan function are provided
- High density packaging in plastic Quad Flatpack
- 5V compatible I/O on A-port

QUICK REFERENCE DATA

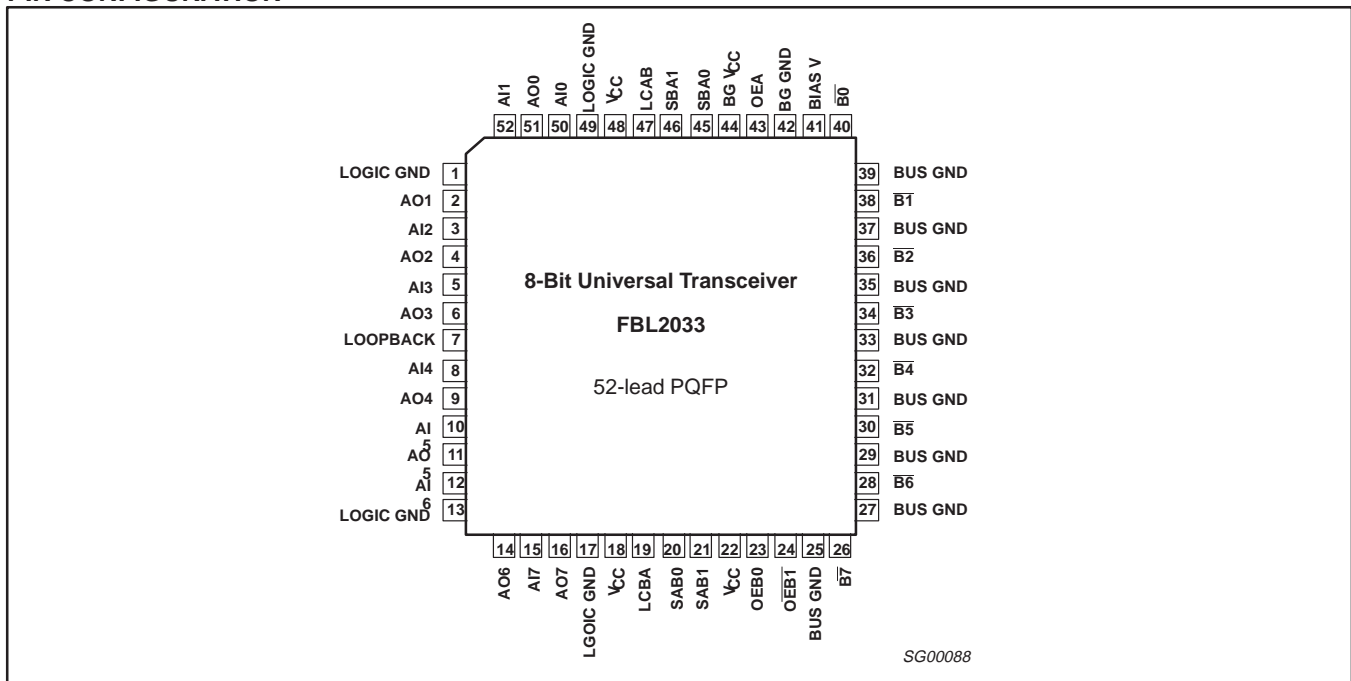
SYMBOL	PARAMETER		TYPICAL	UNIT
t _{PLH} t _{PHL}	Propagation delay A _{In} to B _n		3.0 3.0	ns
t _{PLH} t _{PHL}	Propagation delay B _n to A _{On}		5.0 5.3	ns
C _{OB}	Output capacitance (B ₀ – B _n only)		6	pF
I _{OL}	Output current (B ₀ – B _n only)		100	mA
I _{CC}	Supply current	A _{In} to B _n outputs Low	9	mA
		outputs High	14	
		B _n to A _{On} (outputs Low)	17	
		B _n to A _{On} (outputs High)	14	

ORDERING INFORMATION

PACKAGE	COMMERCIAL RANGE V _{CC} = 3.3V±10%; T _{amb} = -40°C to +85°C	DWG No.
52-pin Plastic Quad Flat Pack (PQFP)	FBL2033BB	SOT379-1

NOTE: Thermal mounting or forced air is recommended

PIN CONFIGURATION



3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

DESCRIPTION

The FBL2033 is an 8-bit transceiver featuring a split input (AI) and output (AO) bus on the TTL-level side.

The common I/O, open collector B port operates at BTL signal levels. The logic element for data flow in each direction is controlled by two pairs of mode select inputs (SBA0 and SBA1 for B-to-A, SAB0 and SAB1 for A-to-B). It can be configured as a buffer, a register, or a D-type latch.

When configured in the buffer mode, the inverse of the input data appears at the output port. In the flip-flop mode, data is stored on the rising edge of the appropriate clock input (LCAB or LCBA). In the latch mode, clock pins serve as transparent-High latch enables. Regardless of the mode, data is inverted from input to output.

Data flow in the B-to-A direction, regardless of the logic element selected, is further controlled by the Loopback input. When the Loopback input is High the output of the selected A-to-B logic element (not inverted) becomes the B-to-A input.

The 3-State AO port is enabled by asserting a High level on OEA. The B port has two output enables, OEB0 and $\overline{\text{OEB1}}$. Only when OEB0 is High and $\overline{\text{OEB1}}$ is Low is the output enabled. When either OEB0 is Low or $\overline{\text{OEB1}}$ is High, the B-port is inactive and is pulled to the level of the pull-up voltage. New data can be entered in the flip-flop and latched modes or can be retained while the associated outputs are in 3-State (AO port) or inactive (B port).

The B-port drivers are Low-capacitance open collectors with controlled ramp and are designed to sink 100mA. Precision band gap references on the B-port ensure very good noise margins by limiting the switching threshold to a narrow region centered at 1.55V.

The B-port interfaces to "Backplane Transceiver Logic" (see the IEEE 1194.1 BTL standard). BTL features low power consumption

by reducing voltage swing (1V p-p, between 1V and 2V) and reduced capacitive loading by placing an internal series diode on the drivers. BTL also provides incident wave switching, a necessity for high performance backplanes.

Output clamps are provided on the BTL outputs to further reduce switching noise. The " V_{OH} " clamp reduces inductive ringing effects during a Low-to-High transition. The " V_{OH} " clamp is always active. The other clamp, the "trapped reflection" clamp, clamps out ringing below the BTL 0.5V V_{OL} level. This clamp remains active for approximately 100ns after a High-to-Low transition.

To support live insertion, OEB0 is held Low during power on/off cycles to ensure glitch-free B port drivers. Proper bias for B port drivers during live insertion is provided by the BIAS V pin when at a 3.3V level while V_{CC} is Low. The BIAS V pin is a low current input which will reverse-bias the BTL driver series Schottky diode, and also bias the B port output pins to a voltage between 1.62V and 2.1V. This bias function is in accordance with IEEE BTL Standard 1194.1. If live insertion is not a requirement, the BIAS V pin should be tied to a V_{CC} pin.

The LOGIC GND and BUS GND pins are isolated inside the package to minimize noise coupling between the BTL and TTL sides. These pins should be tied to a common ground external to the package.

Each BTL driver has an associated BUS GND pin that acts as a signal return path and these BUS GND pins are internally isolated from each other. In the event of a ground return fault, a "hard" signal failure occurs instead of a pattern dependent error that may be very infrequent and impossible to trouble-shoot.

As with any high power device thermal considerations are critical. It is recommended that airflow (300lfpm) and/or thermal mounting be used to ensure proper junction temperature.

PIN DESCRIPTION

SYMBOL	PIN NUMBER	TYPE	NAME AND FUNCTION
AI0 – AI7	50, 52, 3, 5, 8, 10, 12, 15	Input	Data inputs (TTL)
AO0 – AO7	51, 2, 4, 6, 9, 11, 14, 16	Output	3-State outputs (TTL)
$\overline{\text{B0}} - \overline{\text{B7}}$	40, 38, 36, 34, 32, 30, 28, 26	I/O	Data inputs/Open Collector outputs, High current drive (BTL)
OEB0	23	Input	Enables the B outputs when High
$\overline{\text{OEB1}}$	24	Input	Enables the B outputs when Low
OEA	43	Input	Enables the AO outputs when High
BUS GND	39, 37, 35, 33, 31, 29, 27, 25	GND	Bus ground (0V)
LOGIC GND	1, 13, 17, 49	GND	Logic ground (0V)
V_{CC}	18, 22, 48	Power	Positive supply voltage
BIAS V	41	Power	Live insertion pre-bias pin
BG V_{CC}	44	Power	Band Gap threshold voltage reference
BG GND	42	GND	Band Gap threshold voltage reference ground
SABn	20, 21	Input	Mode select from AI to $\overline{\text{B}}$
SBA $\overline{\text{n}}$	45, 46	Input	Mode select from $\overline{\text{B}}$ to AO
LCAB	47	Input	A-to-B clock/latch enable (transparent latch when High)
LCBA	19	Input	B-to-A clock/latch enable (transparent latch when High)
Loopback	7	Input	Enables loopback function when High (from AI $\overline{\text{n}}$ to AO $\overline{\text{n}}$)

3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

FUNCTION TABLE

MODE	INPUTS									OUTPUTS	
	AIn	\overline{Bn}^*	OEB0	$\overline{OEB1}$	OEA	LCAB	LCBA	SAB ₀	SBA ₀	AOn	\overline{Bn}
AIn to \overline{Bn} thru mode	L	—	H	L	L	X	X	LL	XX	Z	H**
	H	—	H	L	L	X	X	LL	XX	Z	L
AIn to \overline{Bn} transparent latch	L	—	H	L	L	H	X	HX	XX	Z	H**
	H	—	H	L	L	H	X	HX	XX	Z	L
AIn to \overline{Bn} latch and read	l	—	H	L	L	↓	X	HX	XX	Z	H**
	h	—	H	L	L	↓	X	HX	XX	Z	L
AIn to \overline{Bn} register	L	—	H	L	L	↑	X	LH	XX	Z	H**
	H	—	H	L	L	↑	X	LH	XX	Z	L
\overline{Bn} outputs latched and read (preconditioned latch)	X	—	H	L	L	L	X	HX	XX	Z	latched data
\overline{Bn} to AOn thru mode	X	L	L	H	H	X	X	XX	LL	H	input
	X	H	L	H	H	X	X	XX	LL	L	input
\overline{Bn} to AOn transparent latch	X	L	L	H	H	X	H	XX	HX	H	input
	X	H	L	H	H	X	H	XX	HX	L	input
\overline{Bn} to AOn latch and read	X	l	L	H	H	X	↓	XX	HX	H	input
	X	h	L	H	H	X	↓	XX	HX	L	input
\overline{Bn} to AOn register	X	L	L	H	H	X	↑	XX	LH	H	input
	X	H	L	H	H	X	↑	XX	LH	L	input
AOn outputs latched and read (preconditioned latch)	X	X	L	H	H	X	L	XX	HX	latched data	X
Disable \overline{Bn} outputs	X	X	L	X	X	X	X	XX	XX	X	H**
	X	X	X	H	X	X	X	XX	XX	X	H**
Disable AOn outputs	X	X	X	X	L	X	X	XX	XX	Z	X

FUNCTION SELECT TABLE

MODE SELECTED	SXX1	SXX0
Thru mode	L	L
Register mode	L	H
Latch mode	H	X

NOTES:

H = High voltage level

L = Low voltage level

h = High voltage level one set-up time prior to the High-to-Low LCXX transition

l = Low voltage level one set-up time prior to the High-to-Low LCXX transition

X = Don't care

Z = High-impedance (OFF) state

— = Input not externally driven

↑ = Low-to-High transition

↓ = High-to-Low transition

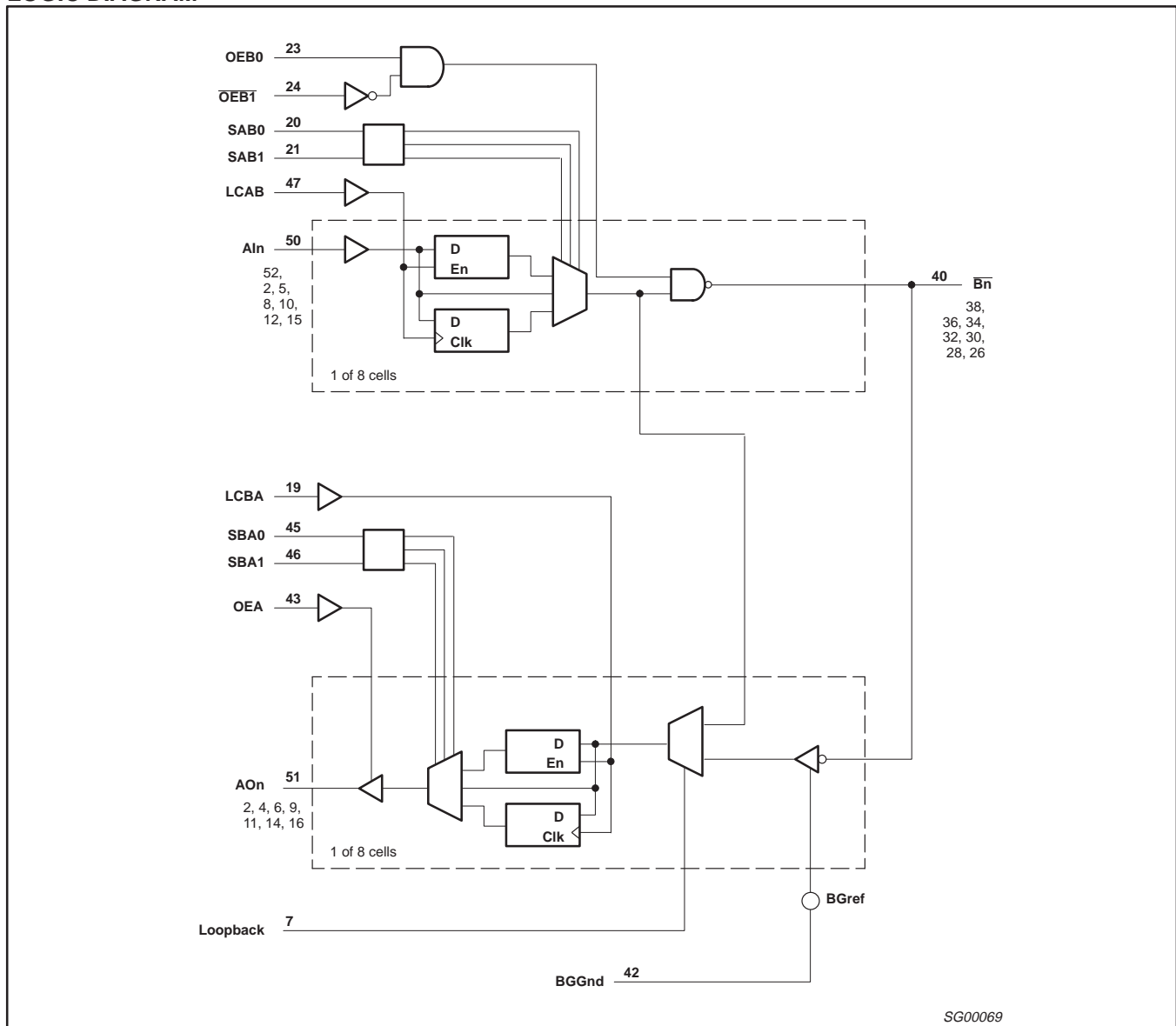
H** = Goes to level of pull-up voltage

 \overline{Bn}^* = Precaution should be taken to ensure B inputs do not float. If they do, they are equal to Low state.In Loopback mode (Loopback = High), AIn inputs are routed to the AOn outputs. The \overline{Bn} inputs are blocked out.

3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

LOGIC DIAGRAM



SG00069

ABSOLUTE MAXIMUM RATINGS

Operation beyond the limits set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free-air temperature range.

SYMBOL	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	-0.5 to +4.6	V
V_{IN}	Input voltage	A10 – A17, OEBO, $\overline{OE}Bn$, OEAn	-0.5 to +7.0
		B0 – B7	-0.5 to +3.5
I_{IN}	Input current	$V_{IN} < 0$	-50
V_{OUT}	Voltage applied to output in High output state	-0.5 to +7.0	V
I_{OUT}	Current applied to output in Low output state/High output state	A00 – A07	64, -64
		B0 – B7	200
T_{STG}	Storage temperature	-65 to +150	°C

3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER		COMMERCIAL LIMITS $V_{CC} = 3.3V \pm 10\%$; $T_{amb} = -40 \text{ to } +85^\circ\text{C}$			UNIT
			MIN	TYP	MAX	
V_{CC}	Supply voltage		3.0	3.3	3.6	V
V_{IH}	High-level input voltage	Except $\overline{B0}$ – $\overline{B7}$	2.0			V
		$B0$ – $B7$	1.62	1.55		
V_{IL}	Low-level input voltage	Except $\overline{B0}$ – $\overline{B7}$			0.8	V
		$\overline{B0}$ – $\overline{B7}$			1.47	
I_{IK}	Input clamp current				-18	mA
I_{OH}	High-level output current	A00 – A07			-12	mA
I_{OL}	Low-level output current	A00 – A07			+12	mA
		$\overline{B0}$ – $\overline{B7}$			100	
C_{OB}	Output capacitance on B port			6	7	pF
T_{amb}	Operating free-air temperature range		0		+70	$^\circ\text{C}$

LIVE INSERTION SPECIFICATIONS

SYMBOL	PARAMETER		LIMITS			UNIT
			MIN	TYP	MAX	
V_{BIASV}	Bias pin voltage	Voltage difference between the Bias voltage and V_{CC} after the PCB is plugged in.	–	–	0.5	V
I_{BIASV}	Bias pin (I_{BIASV}) input DC current	$V_{CC} = 0 \text{ V}$, Bias $V = 3.6 \text{ V}$			1.2	mA
		$V_{CC} = 3.3 \text{ V}$, Bias $V = 3.6 \text{ V}$			10	μA
$V_{\overline{Bn}}$	Bus voltage during prebias	$\overline{B0}$ – $\overline{B7} = 0 \text{ V}$, Bias $V = 3.3 \text{ V}$	1.62		2.1	V
I_{LM}	Fall current during prebias	$\overline{B0}$ – $\overline{B7} = 2 \text{ V}$, Bias $V = 1.3 \text{ to } 2.5 \text{ V}$			1	μA
I_{HM}	Rise current during prebias	$\overline{B0}$ – $\overline{B7} = 1 \text{ V}$, Bias $V = 3 \text{ to } 3.6 \text{ V}$	-1			μA
$I_{\overline{Bn}}^{\text{PEAK}}$	Peak bus current during insertion	$V_{CC} = 0 \text{ to } 3.3 \text{ V}$, $\overline{B0}$ – $\overline{B7} = 0 \text{ to } 2.0 \text{ V}$, Bias $V = 2.7 \text{ to } 3.6 \text{ V}$, $OEB0 = 0.8 \text{ V}$, $t_r = 2 \text{ ns}$			10	mA
$I_{OL\text{OFF}}$	Power up current	$V_{CC} = 0 \text{ to } 3.3 \text{ V}$, $OEB0 = 0.8 \text{ V}$			100	μA
		$V_{CC} = 0 \text{ to } 1.2 \text{ V}$, $OEB0 = 0 \text{ to } 5 \text{ V}$			100	
t_{GR}	Input glitch rejection	$V_{CC} = 3.3 \text{ V}$	1.0	1.35		ns

3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

DC ELECTRICAL CHARACTERISTICS

Over recommended operating free-air temperature range unless otherwise noted.

symbol	parameter		test conditions ¹	limits			unit
				min	typ ²	max	
I_{OH}	High level output current	$\overline{B0} - \overline{B7}$	$V_{CC} = \text{MAX}, V_{IL} = \text{MAX}, V_{OH} = 1.9\text{V}$			100	μA
I_{OFF}	Power-off output current	$\overline{B0} - \overline{B7}$	$V_{CC} = 0\text{V}, V_{IL} = \text{MAX}, V_{OH} = 1.9\text{V}$			100	μA
			$V_{CC} = 0\text{V}, V_{IL} = \text{MAX}, V_{OH} = 1.9\text{V}@85^\circ\text{C}$			300	
V_{OH}	High-level output voltage	AO0 – AO7 ³	$V_{CC} = \text{MIN to MAX}; I_{OH} = -100\mu\text{A}$	V_{CC} -0.2			V
			$V_{CC} = \text{MIN}; I_{OH} = -8\text{mA}$	2.4			V
			$V_{CC} = \text{MIN}; I_{OH} = -32\text{mA}$	2.0			V
V_{OL}	Low-level output voltage	AO0 – AO7 ³	$V_{CC} = \text{MIN}; I_{OL} = 16\text{mA}$			0.4	V
			$V_{CC} = \text{MIN}; I_{OL} = 32\text{mA}$			0.5	V
		$\overline{B0} - \overline{B7}$	$V_{CC} = \text{MIN}, I_{OL} = 4\text{mA}$	0.5			V
			$V_{CC} = \text{MIN}, I_{OL} = 100\text{mA}$	0.75	1.0	1.20	
V_{IK}	Input clamp voltage		$V_{CC} = \text{MIN}, I_I = I_{IK} = -18\text{mA}$		-0.85	-1.2	V
I_I	Input leakage current	Control pins	$V_{CC} = 3.6\text{V}; V_I = V_{CC} \text{ or } 300\text{mV}$			± 1.0	μA
		Control/ AI0 – AI7	$V_{CC} = 0\text{V} \text{ or } 3.6\text{V}; V_I = 5.5\text{V}$			10	
		AI0 – AI7	$V_{CC} = 3.6\text{V}; V_I = V_{CC}$			1	
		Note 4	$V_{CC} = 3.6\text{V}; V_I = 300\text{mV}$			-5	
I_{IH}	High-level input current	$\overline{B0} - \overline{B7}$	$V_{CC} = \text{MAX}, V_I = 1.9\text{V}$			100	μA
			$V_{CC} = \text{MAX}, V_I = 3.5\text{V}, \text{note } 5$	100			
			$V_{CC} = \text{MAX}, V_I = 3.75\text{V}, \text{Note } 5 @ -40^\circ\text{C}$	100			
I_{IL}	Low-level input current	$\overline{B0} - \overline{B7}$	$V_{CC} = \text{MAX}, V_I = 0.75\text{V}$			-100	μA
I_{OZH}	Off-state output current	AO0 – AO7	$V_{CC} = \text{MAX}, V_O = 3\text{V}$			5	μA
I_{OZL}	Off-state output current	AO0 – AO7	$V_{CC} = \text{MAX}, V_O = 0.5\text{V}$			-5	μA
I_{CCH} I_{CCL}	Supply current (total)	B→A	$V_{CC} = \text{MAX}, \text{ outputs High}$		14	31	mA
			$V_{CC} = \text{MAX}, \text{ outputs Low}$		17	38	
I_{CCZ}	Supply current			$V_{CC} = \text{MAX}$		22	55
I_{CCH} I_{CCL}	Supply current (total)	A→B	$V_{CC} = \text{MAX}, \text{ outputs High}$		14	32	mA
			$V_{CC} = \text{MAX}, \text{ outputs Low}$		9	18	
I_{CCZ}	Supply current			$V_{CC} = \text{MAX}$		14	33

NOTES:

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operation conditions for the applicable type.
- All typical values are at $V_{CC} = 3.3\text{V}, T_A = 25^\circ\text{C}$.
- Due to test equipment limitations, actual test conditions are $V_{IH} = 1.8\text{V}$ and $V_{IL} = 1.3\text{V}$ for the B side.
- Unused pins are at V_{CC} or GND.
- For B port input voltage between 3 and 5 volt; I_{IH} will be greater than 100mA but the part will continue to function normally (clamping circuit is active).

3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

AC ELECTRICAL CHARACTERISTICS INDUSTRIAL AND COMMERCIAL (A TO B)

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	MIN	MAX	UNIT
t_{PLH} t_{PHL}	Propagation delay, An to $\bar{B}n$ through latch		1.2 1.2	2.7 2.6	4.8 4.3	1.0 1.0	5.3 4.9	ns
t_{PLH} t_{PHL}	Propagation delay, An to $\bar{B}n$ transparent latch		1.3 1.8	3.2 3.7	5.2 5.6	1.0 1.6	6.1 6.3	ns
t_{PLH} t_{PHL}	Propagation delay, LCAB to $\bar{B}n$ latch		2.0 2.3	3.8 4.3	5.8 6.3	1.2 1.8	7.0 7.3	ns
t_{PLH} t_{PHL}	Propagation delay, LCAB to $\bar{B}n$ register		2.1 2.0	3.8 4.3	5.7 6.5	1.4 1.8	6.9 7.3	ns
t_{PLH} t_{PHL}	Propagation delay, SABX to $\bar{B}n$ inverting		1.2 2.3	4.3 5.1	7.6 8.0	1.0 2.0	9.2 8.7	ns
t_{PLH} t_{PHL}	Propagation delay, SABX to $\bar{B}n$ non-inverting		1.8 1.8	4.0 5.0	6.4 8.5	1.1 1.6	8.0 9.8	ns
t_{PLH} t_{PHL}	OE $\bar{B}n$ to $\bar{B}n$		1.5 1.6	3.4 3.4	5.4 5.3	1.0 1.0	6.0 7.2	ns

AC ELECTRICAL CHARACTERISTICS INDUSTRIAL AND COMMERCIAL (A TO B)

SYMBOL	PARAMETER	TEST CONDITION	$T_{amb} = +25^{\circ}C, V_{CC} = 3.3V,$ $R_L = 16.5\Omega$			$T_{amb} = -40 \text{ to } +85^{\circ}C,$ $V_{CC} = 3.3V \pm 10\%,$ $R_L = 16.5\Omega$		UNIT
			MIN	TYP	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay, An to $\bar{B}n$ through latch		1.2 1.2	2.8 2.4	4.5 4.0	1.0 1.0	5.7 4.6	ns
t_{PLH} t_{PHL}	Propagation delay, An to $\bar{B}n$ transparent latch		1.4 1.7	3.2 3.5	5.1 5.4	1.0 1.3	6.1 5.9	ns
t_{PLH} t_{PHL}	Propagation delay, LCAB to $\bar{B}n$ latch		2.0 2.2	3.8 4.1	5.6 6.1	1.3 1.6	6.9 7.0	ns
t_{PLH} t_{PHL}	Propagation delay, LCAB to $\bar{B}n$ register		2.0 2.2	3.9 4.1	5.9 6.1	1.2 1.6	7.7 7.0	ns
t_{PLH} t_{PHL}	Propagation delay, SABX to $\bar{B}n$ inverting		1.2 1.8	4.6 4.7	8.6 7.9	1.0 1.6	10.4 8.7	ns
t_{PLH} t_{PHL}	Propagation delay, SABX to $\bar{B}n$ non-inverting		1.3 1.5	4.5 4.6	8.2 8.2	1.0 1.2	10.0 9.1	ns
t_{PLH} t_{PHL}	OE $\bar{B}n$ to $\bar{B}n$		1.5 1.5	3.4 3.2	6.0 7.2	1.0 1.0	6.3 7.0	ns

3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

AC ELECTRICAL CHARACTERISTICS INDUSTRIAL AND COMMERCIAL (B TO A)

SYMBOL	PARAMETER	TEST CONDITION	$T_{amb} = +25^{\circ}\text{C}, V_{CC} = 3.3\text{V}$			$T_{amb} = -40 \text{ to } +85^{\circ}\text{C}, V_{CC} = 3.3\text{V} \pm 10\%$		UNIT
			MIN	TYP	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay, \bar{B}_n to A_n through mode		2.5 3.0	4.5 5.1	6.5 7.3	1.6 2.6	7.8 9.1	ns
t_{PLH} t_{PHL}	Propagation delay, \bar{B}_n to A_n transparent latch		3.4 3.2	5.4 5.4	7.6 7.6	2.2 2.7	9.2 9.3	ns
t_{PLH} t_{PHL}	Propagation delay, LCAB to A_n latch		2.1 1.6	3.9 3.3	5.8 5.0	1.3 1.2	7.2 5.9	ns
t_{PLH} t_{PHL}	Propagation delay, LCAB to A_n register		1.9 2.3	3.7 4.1	5.7 6.0	1.1 1.8	6.8 7.0	ns
t_{PLH} t_{PHL}	Propagation delay, SABX to A_n inverting		2.3 2.5	4.2 4.5	6.4 6.5	1.3 2.0	7.9 7.4	ns
t_{PLH} t_{PHL}	Propagation delay, SABX to A_n non-inverting		1.4 1.9	3.9 4.0	8.7 6.1	1.0 1.5	9.8 7.1	ns
t_{PLH} t_{PHL}	Propagation delay, A_{In} to A_{On} loopback		2.4 2.3	4.3 4.4	6.3 6.6	1.6 1.6	8.1 7.6	ns
t_{PLH} t_{PHL}	Propagation delay, LPBK to A_n non-inverting or inverting		2.0 1.3	4.3 4.9	7.0 9.4	1.4 1.5	8.9 11.3	ns
t_{PZH} t_{PHZ}	Propagation delay, OEA to A_n		2.4 3.1	4.3 5.3	6.3 7.6	1.9 2.5	7.3 8.9	ns
t_{PZH} t_{PHZ}	Propagation delay, OEA to A_n		2.1 1.4	4.0 2.7	6.2 4.4	1.7 1.0	6.9 5.2	ns

3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

AC SETUP REQUIREMENTS INDUSTRIAL AND COMMERCIAL

SYMBOL	PARAMETER	TEST CONDITION	LIMITS		UNIT
			$T_{amb} = +25^{\circ}\text{C}, V_{CC} = 3.3\text{V}$	$T_{amb} = -40 \text{ to } +85^{\circ}\text{C}, V_{CC} = 3.3\text{V} \pm 10\%$	
			$C_L = 50\text{pF (A side)} / C_D = 30\text{pF (B side)}$ $R_L = 500\Omega \text{ (A side)} / R_U = 9\Omega \text{ (B side)}$		
			MIN	MIN	
$t_s(H)$ $t_s(L)$	Setup time AIn to LCAB or \overline{Bn} to LCBA		3.0 3.0	4.0 4.0	ns
$t_h(H)$ $t_h(L)$	Hold time (latch mode) AIn to LCAB		6.0 5.0	6.5 5.5	ns
$t_h(H)$ $t_h(L)$	Hold time (register mode) AIn to LCAB		1.0 1.0	1.3 1.3	ns
$t_h(H)$ $t_h(L)$	Hold time (latch mode) \overline{Bn} to LCAB		1.5 1.5	2.0 2.0	ns
$t_h(H)$ $t_h(L)$	Hold time (register mode) \overline{Bn} to LCAB		1.0 1.0	1.3 1.3	ns
$t_w(H)$ $t_w(L)$	Pulse width, High or Low AIn to LCAB or \overline{Bn} to LCBA		3.0 3.0	4.0 4.0	ns

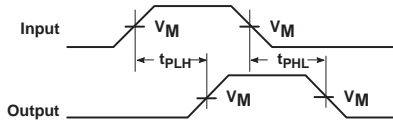
AC SETUP REQUIREMENTS INDUSTRIAL AND COMMERCIAL

SYMBOL	PARAMETER	TEST CONDITION	LIMITS		UNIT
			$T_{amb} = +25^{\circ}\text{C}, V_{CC} = 3.3\text{V}$	$T_{amb} = -40 \text{ to } +85^{\circ}\text{C}, V_{CC} = 3.3\text{V} \pm 10\%$	
			$C_L = 50\text{pF (A side)} / C_D = 30\text{pF (B side)}$ $R_L = 500\Omega \text{ (A side)} / R_U = 16.5\Omega \text{ (B side)}$		
			MIN	MIN	
$t_s(H)$ $t_s(L)$	Setup time AIn to LCAB or \overline{Bn} to LCBA		3.0 3.0	4.0 4.0	ns
$t_h(H)$ $t_h(L)$	Hold time (latch mode) AIn to LCAB		6.0 5.0	6.5 5.5	ns
$t_h(H)$ $t_h(L)$	Hold time (register mode) AIn to LCAB		1.0 1.0	1.3 1.3	ns
$t_h(H)$ $t_h(L)$	Hold time (latch mode) \overline{Bn} to LCAB		1.5 1.5	2.0 2.0	ns
$t_h(H)$ $t_h(L)$	Hold time (register mode) \overline{Bn} to LCAB		1.0 1.0	1.3 1.3	ns
$t_w(H)$ $t_w(L)$	Pulse width, High or Low AIn to LCAB or \overline{Bn} to LCBA		3.0 3.0	4.0 4.0	ns

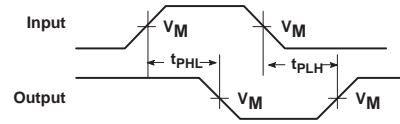
3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

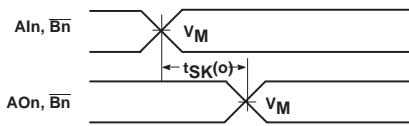
AC WAVEFORMS



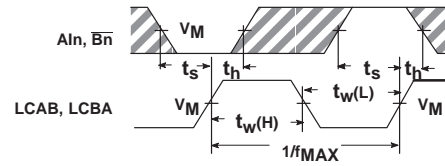
Waveform 1. Propagation Delay for Data or Output Enable to Output



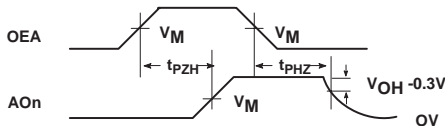
Waveform 2. Propagation Delay for Data or Output Enable to Output



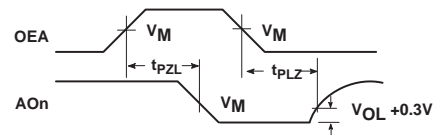
Waveform 3. Output to Output Skew



Waveform 4. Setup and Hold Times, Pulse Widths and Maximum Frequency



Waveform 5. 3-State Output Enable Time to High Level and Output Disable Time from High Level



Waveform 6. 3-State Output Enable Time to Low Level and Output Disable Time from Low Level

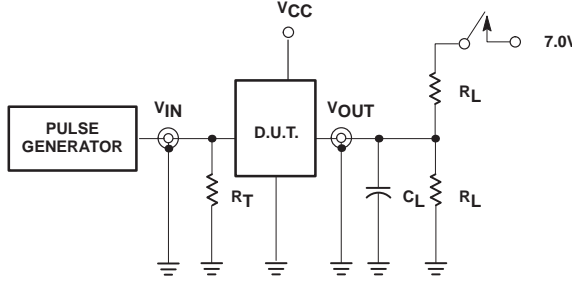
NOTE: The shaded areas indicate when the input is permitted to change for predictable output performance.

SG00070

3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

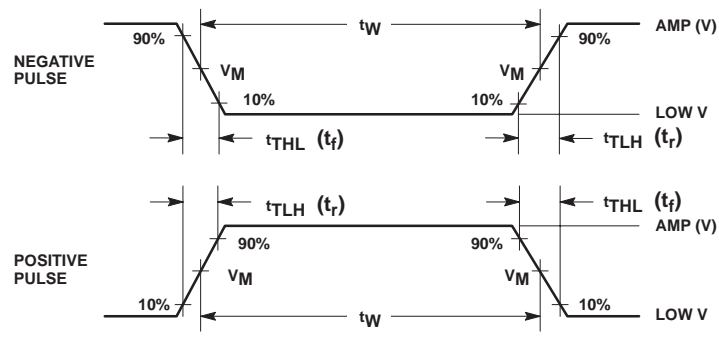
FBL2033

TEST CIRCUIT AND WAVEFORMS



Test Circuit for 3-State Outputs on A Port

The circuit shows a Pulse Generator connected to the input (VIN) of a D.U.T. through a termination resistor (RT). The output (VOUT) is connected to a load resistor (RL) and a load capacitor (CL). A switch is connected to the output through another load resistor (RL) and is controlled by a 7.0V signal. The supply voltage is VCC.



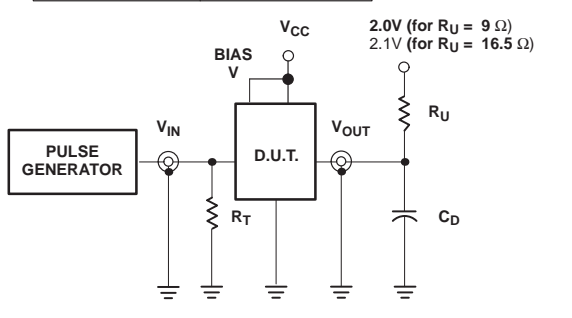
Input Pulse Definitions

The waveforms show a negative pulse (top) and a positive pulse (bottom). Key parameters are labeled: pulse width (tW), high-level time (tTHL (tf)), low-level time (tTLH (tr)), and voltage levels (VM, 90%, 10%, AMP (V), LOW V).

$V_M = 1.55V$ for \overline{Bn} , $V_M = 1.5V$ for all others.

SWITCH POSITION

TEST	SWITCH
t _{PLZ} , t _{PZL}	closed
All other	open



Test Circuit for Outputs on B Port

The circuit shows a Pulse Generator connected to the input (VIN) of a D.U.T. through a termination resistor (RT). The output (VOUT) is connected to a pull-up resistor (RU) and a load capacitor (CD). A BIAS V signal is applied to the output. The supply voltage is VCC. Pull-up resistor values are specified as 2.0V for RU = 9Ω and 2.1V for RU = 16.5Ω.

Family FB+	INPUT PULSE REQUIREMENTS					
	Amplitude	Low V	Rep. Rate	t _W	t _{TLH}	t _{THL}
A Port	3.0V	0.0V	1MHz	500ns	2.5ns	2.5ns
B Port	2.0V	1.0V	1MHz	500ns	2.0ns	2.0ns

DEFINITIONS:

- R_L = Load Resistor; see AC CHARACTERISTICS for value.
- C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.
- R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.
- C_D = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.
- R_U = Pull up resistor; see AC CHARACTERISTICS for value.

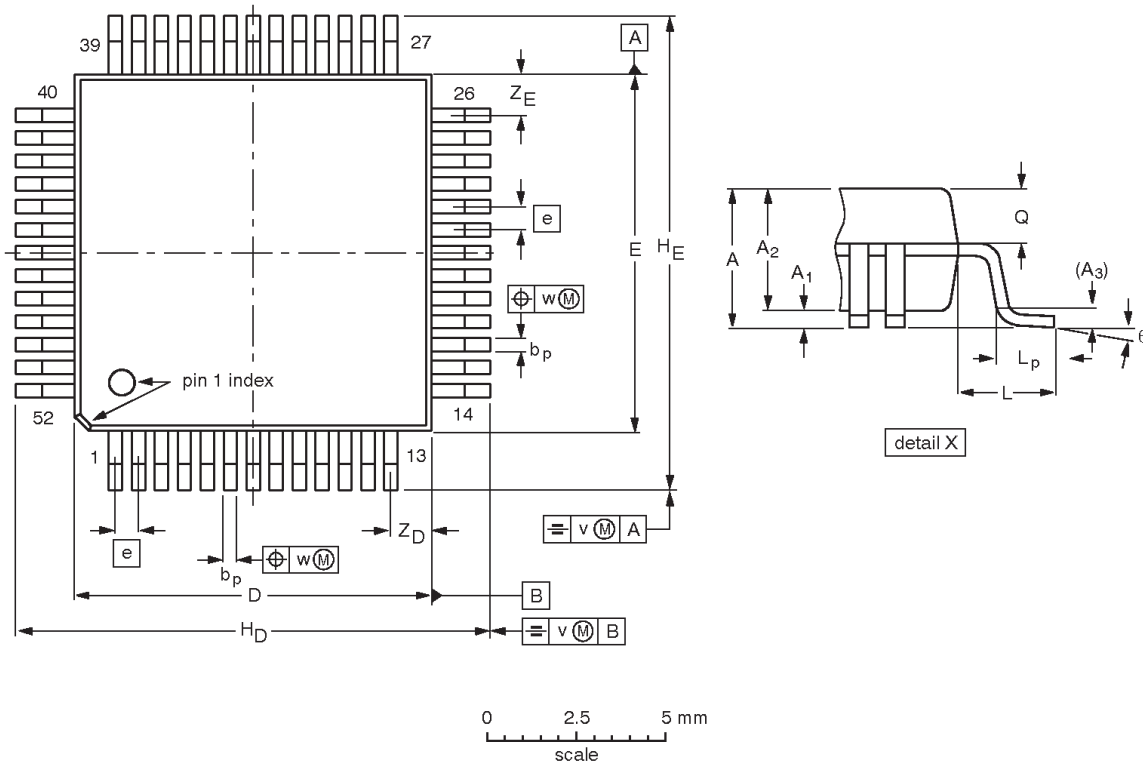
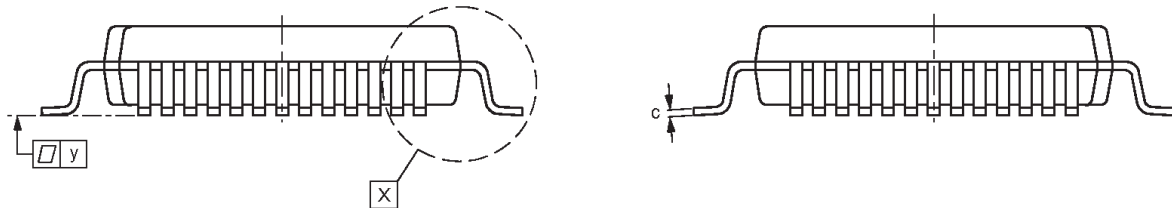
SG00063

3.3V BTL 8-bit latched/registered/pass-thru
Futurebus+ universal interface transceiver

FBL2033

QFP52: plastic quad flat package; 52 leads (lead length 1.6 mm); body 10 x 10 x 2.0 mm

SOT379-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _D	H _E	L	L _p	Q	v	w	y	Z _D ⁽¹⁾	Z _E ⁽¹⁾	θ
mm	2.45	0.45 0.25	2.10 1.95	0.25	0.38 0.22	0.23 0.13	10.1 9.9	10.1 9.9	0.65	13.45 12.95	13.45 12.95	1.60	0.95 0.65	1.05 0.90	0.20	0.12	0.10	1.24 0.95	1.24 0.95	7° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT379-1		MO-108				95-02-04

3.3V BTL 8-bit latched/registered/pass-thru universal transceiver

FBL2033

Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

[1] Please consult the most recently issued datasheet before initiating or completing a design.

Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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