DATA SHEET

FBL22041

3.3V BTL 7-bit Futurebus + transceiver (standard A-port)

Product specification
Supersedes data of 1998 Feb 02
IC23 Data Handbook

1998 Aug 12

Philips
Semiconductors

PHILIPS

3.3V BTL 7-bit Futurebus+ transceiver (standard A-port) FBL22041

FEATURES

- 7-bit BTL transceiver
- Separate I/O on TTL A-port
- Inverting
- Three separate pairs of driver enables in a 1 bit, 3 bit, 3 bit arrangement
- 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
- Controlled output ramp and multiple GND pins minimize ground bounce
- Each BTL driver has a dedicated Bus GND for a signal return
- 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
- The A port includes a series resistor of 30Ω making external terminating resistors unnecessary

DESCRIPTION

The FBL22041 is a 7-bit bidirectional BTL transceiver and is intended to provide the electrical interface to a high performance wired-OR bus. The FBL22041 is an inverting transceiver.

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 insure very good noise margins by limiting the switching threshold to a narrow region centered at 1.55V.

The FBL22041 is designed with a 30Ω series resistance in both the HIGH and LOW states of the output.

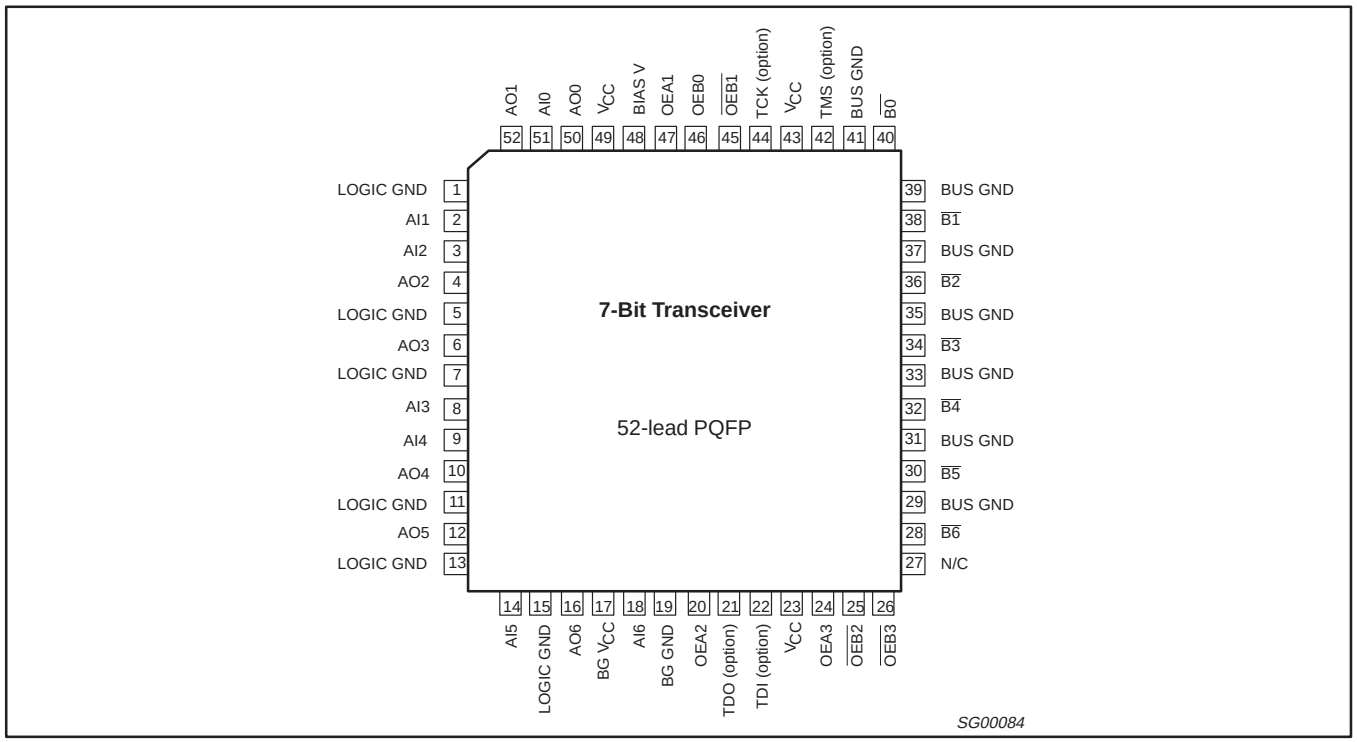
The FBL22041 is pin and function compatible with FB2041 but operates at a 3.3V supply voltage, greatly reducing power consumption.

QUICK REFERENCE DATA

SYMBOL	PARAMETER		TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay AIn to $\overline{Bn}$		4.1 3.6	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{Bn}$ to AOn		5.2 5.1	ns
C_{OB}	Output capacitance ($\overline{B0}$ - $\overline{B6}$ only)		6	pF
I_{OL}	Output current ($\overline{B0}$ - $\overline{B6}$ only)		100	mA
I_{CC}	Supply Current	Standby	6.0	mA
		AIn to $\overline{Bn}$ (outputs Low or High)	5.1	
		$\overline{Bn}$ to AOn (outputs Low)	13.4	
		$\overline{Bn}$ to AOn (outputs High)	10.6	

ORDERING INFORMATION

PACKAGE	COMMERCIAL RANGE V_{CC} = 3.3V±10%; T_{amb} = 0 to +70°C	DWG No.
52-pin Plastic Quad Flatpack	FBL22041BB	SOT379-1



The B-port interfaces to “Backplane Transceiver Logic” (See the IEEE 1194.1 BTL standard). BTL features low power consumption by reducing voltage swing (1Vp-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.

There are three separate pairs of driver enables in a 1 bit, 3 bit, 3 bit arrangement. The TTL/BTL output drivers for bit 0 are enabled with OEA1/$\overline{\text{OEB1}}$, output drivers for bits 1–2–3 are enabled with OEA2/$\overline{\text{OEB2}}$ and output drivers for bits 4–5–6 are enabled with OEA3/$\overline{\text{OEB3}}$.

The A-port operates at TTL levels with separate I/O. The 3-state A-port drivers are enabled when OEAn goes High after an extra 6ns delay which is built in to provide a break-before-make function. When OEAn goes Low, A-port drivers become High impedance without any extra delay. During power on/off cycles, the A-port drivers are held in a High impedance state when V_{CC} is below 1.3V.

The B-port has an output enable, $\overline{\text{OEB0}}$, which affects all seven drivers. When OEB0 is High and $\overline{\text{OEBn}}$ is Low the output driver will be enabled. When OEB0 is Low or if $\overline{\text{OEBn}}$ is High, the B-port drivers will be inactive and at the level of the backplane signal.

PIN DESCRIPTION

SYMBOL	PIN NUMBER	TYPE	NAME AND FUNCTION
ai0 – ai6	51, 2, 3, 8, 9, 14, 18	Input	Data inputs (TTL)
aO0 – aO6	50, 52, 4, 6, 10, 12, 16	Output	3-state outputs (TTL)
$\overline{b0}$ – $\overline{b6}$	40, 38, 36, 34, 32, 30, 28	i/o	Data inputs/Open Collector outputs, High current drive (BTL)
OEB0	46	Input	Enables the Bn outputs when High
OEB1	45	Input	Enables the B0 output when Low
OEB2	25	Input	Enables the B1 – B3 outputs when Low
OEB3	26	Input	Enables the B4 – B6 outputs when Low
OEA1	47	Input	Enables the A0 outputs when High
OEA2	20	Input	Enables the A1 – A3 outputs when High
OEA3	24	Input	Enables the A4 – A6 outputs when High
bus gnd	41, 39, 37, 35, 33, 31, 29	GND	Bus ground (0V)
LOGIC gnd	1, 5, 7, 11, 13, 15	GND	Logic ground (0V)
LOGIC/bus V_{CC}	23, 43, 49	Power	Positive supply voltage
BG V_{CC}	17	Power	Positive supply voltage BAND GAP
BIAS V	48	Power	Positive supply voltage
TMS	42	Input	Test Mode Select (no-connect)
Tck	44	Input	Test Clock (no-connect)
Tdi	22	Input	Test Data In (shorted to TDO)
Tdo	21	Output	Test Data Out (TDI)
BG GND	19	GND	BAND GAP GROUND (0V)

FUNCTION TABLE

MODE	INPUTS									OUTPUTS	
	AIn	$\overline{Bn}$*	OEB0	$\overline{OEB1}$	$\overline{OEB2}$	$\overline{OEB3}$	OEA1	OEA2	OEA3	AOn	$\overline{Bn}$*
AIn to $\overline{Bn}$	L	—	H	L	L	L	L	L	L	Z	H**
	H	—	H	L	L	L	L	L	L	Z	L
	L	—	H	L	L	L	H	H	H	L	H**
	H	—	H	L	L	L	H	H	H	H	L
AI0 to $\overline{B0}$	L	—	H	L	X	X	L	L	L	Z	H**
	H	—	H	L	X	X	L	L	L	Z	L
	L	—	H	L	X	X	H	H	H	L	H**
	H	—	H	L	X	X	H	H	H	H	L
AI1 – AI3 to $\overline{B1}$ – $\overline{B3}$	L	—	H	X	L	X	L	L	L	Z	H**
	H	—	H	X	L	X	L	L	L	Z	L
	L	—	H	X	L	X	H	H	H	L	H**
	H	—	H	X	L	X	H	H	H	H	L
AI4 – AI6 to $\overline{B4}$ – $\overline{B6}$	L	—	H	X	X	L	L	L	L	Z	H**
	H	—	H	X	X	L	L	L	L	Z	L
	L	—	H	X	X	L	H	H	H	L	H**
	H	—	H	X	X	L	H	H	H	H	L
Disable $\overline{Bn}$ outputs	X	X	L	X	X	X	X	X	X	X	H**
	X	X	X	H	H	H	X	X	X	X	H**
Disable $\overline{B0}$ outputs	X	X	H	H	X	X	X	X	X	X	H**
Disable $\overline{B1}$ – $\overline{B3}$ outputs	X	X	H	X	H	X	X	X	X	X	H**
Disable $\overline{B4}$ – $\overline{B6}$ outputs	X	X	H	X	X	H	X	X	X	X	H**
$\overline{Bn}$ to AOn	X	L	L	X	X	X	H	H	H	H	Input
	X	H	L	X	X	X	H	H	H	L	Input
	X	L	X	H	H	H	H	H	H	H	Input
	X	H	X	H	H	H	H	H	H	L	Input
$\overline{B0}$ to AO0	X	L	L	X	X	X	H	X	X	H	Input
	X	H	L	X	X	X	H	X	X	L	Input
	X	L	X	H	H	H	H	X	X	H	Input
	X	H	X	H	H	H	H	X	X	L	Input
$\overline{B1}$ – $\overline{B3}$ to AO1 – AO3	X	L	L	X	X	X	X	H	X	H	Input
	X	H	L	X	X	X	X	H	X	L	Input
	X	L	X	H	H	H	X	H	X	H	Input
	X	H	X	H	H	H	X	H	X	L	Input
$\overline{B4}$ – $\overline{B6}$ to AO4 – AO6	X	L	L	X	X	X	X	X	H	H	Input
	X	H	L	X	X	X	X	X	H	L	Input
	X	L	X	H	H	H	X	X	H	H	Input
	X	H	X	H	H	H	X	X	H	L	Input
Disable AOn outputs	X	X	X	X	X	X	L	L	L	Z	X
Disable AO0 outputs	X	X	X	X	X	X	L	X	X	Z	X
Disable AO1 – AO3 outputs	X	X	X	X	X	X	X	L	X	Z	X
Disable AO4 – AO6 outputs	X	X	X	X	X	X	X	X	L	Z	X

NOTES:

H = High voltage level
L = Low voltage level
X = Don't care
Z = High-impedance (OFF) state
— = Input not externally driven
H** = Goes to level of pull-up voltage
B* = Precaution should be taken to ensure B inputs do not float. If they do, they are equal to Low state.

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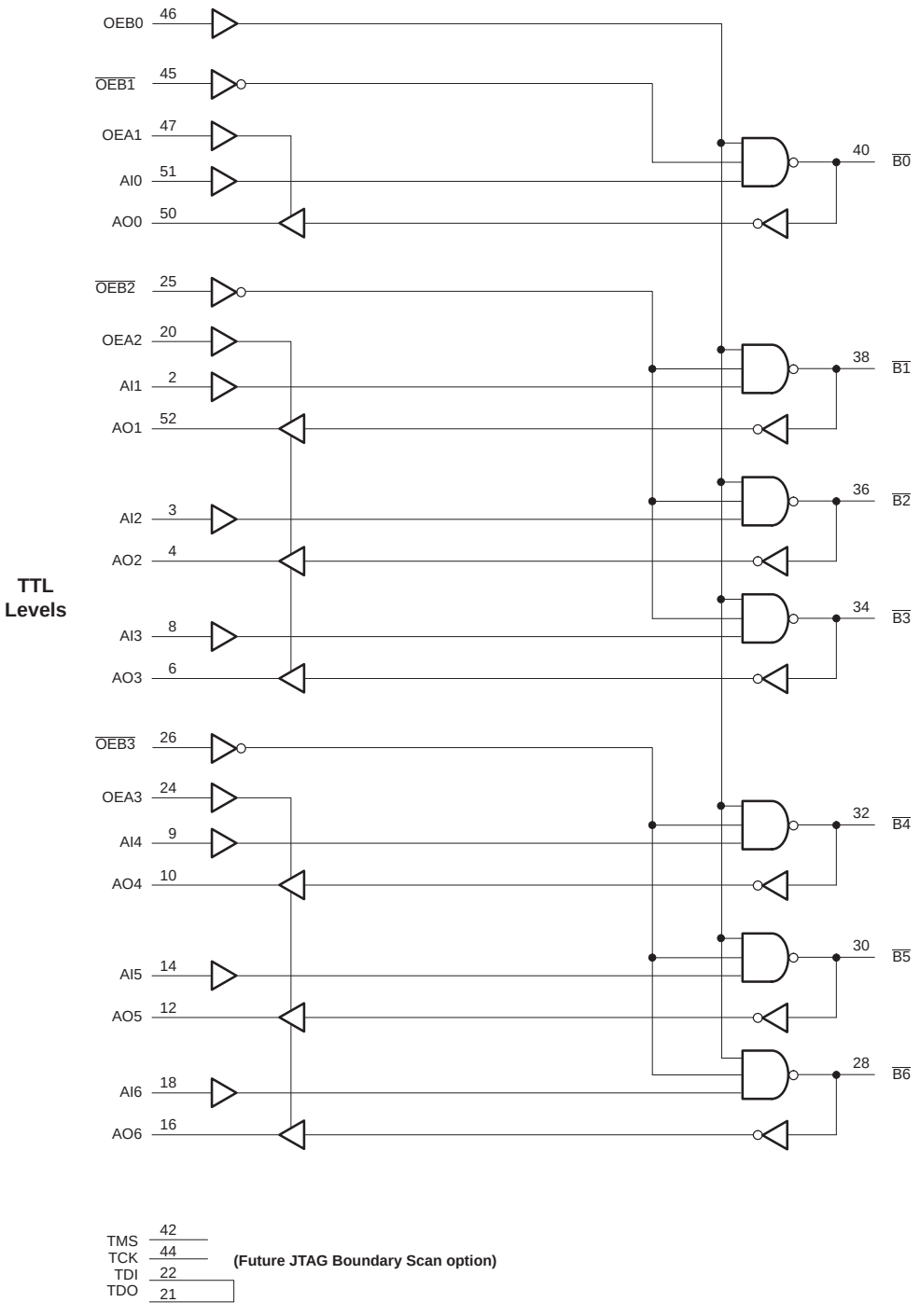
LOGIC DIAGRAM



LOGIC V_{CC} = 17, 49
LOGIC GND = 1, 5, 7, 11, 13, 15, 19
BUS V_{CC} = 23, 43
BUS GND = 27, 29, 31, 33, 35, 37, 39, 41
BIAS V = 48

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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	AI0 – AI6, OEB0, $\overline{OEBn}$, OEAn	-0.5 to +7.0	V
		$\overline{B0}$ – $\overline{B6}$	-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	AO0 – AO6	48, –24	mA
	Low output state/High output state	$\overline{B0}$ – $\overline{B6}$	200	
T_{STG}	Storage temperature		-65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER		COMMERCIAL LIMITS V_{CC} = 3.3V±10%; T_{amb} = 0 to +70°C			UNIT
			MIN	TYP	MAX	
V_{CC}	Supply voltage		3.0	3.3	3.6	V
V_{IH}	High-level input voltage	Except $\overline{B0}$–$\overline{B6}$	2.0			V
		$\overline{B0}$ – $\overline{B6}$	1.62	1.55		
V_{IL}	Low-level input voltage	Except $\overline{B0}$–$\overline{B6}$			0.8	V
		$\overline{B0}$ – $\overline{B6}$			1.47	
I_{IK}	Input clamp current				-18	mA
I_{OH}	High-level output current	AO0 – AO6			-12	mA
I_{OL}	Low-level output current	AO0 – AO6			12	mA
		$\overline{B0}$ – $\overline{B6}$			100	
C_{OB}	Output capacitance on B port			6	7	pF
T_{amb}	Operating free-air temperature range		0		+70	°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 V, Bias V = 3.6V			1.2	mA
		V_{CC} = 3.3V, Bias V = 3.6V			10	µA
$V_{\overline{Bn}}$	Bus voltage during prebias	$\overline{B0}$ – $\overline{B8}$ = 0V, Bias V = 3.3V	1.62		2.1	V
I_{LM}	Fall current during prebias	$\overline{B0}$ – $\overline{B8}$ = 2V, Bias V = 1.3 to 2.5V			1	µA
I_{HM}	Rise current during prebias	$\overline{B0}$ – $\overline{B8}$ = 1V, Bias V = 3 to 3.6V	-1			µA
$I_{\overline{Bn}PEAK}$	Peak bus current during insertion	V_{CC} = 0 to 3.3V, $\overline{B0}$ – $\overline{B8}$ = 0 to 2.0V, Bias V = 2.7 to 3.6V, OEB0 = 0.8V, t_r = 2ns			10	mA
$I_{OL}OFF$	Power up current	V_{CC} = 0 to 3.3V, OEB0 = 0.8V			100	µA
		V_{CC} = 0 to 1.2V, OEB0 = 0 to 5V			100	
t_{GR}	Input glitch rejection	V_{CC} = 3.3V	1.0	1.35		ns

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	$\overline{B0}$ – $\overline{B6}$	V_{CC} = MAX, V_{IL} = MAX, V_{OH} = 1.9V			100	µA
I_{OFF}	Power-off output current	$\overline{B0}$ – $\overline{B6}$	V_{CC} = 0V, V_{IL} = MAX, V_{OH} = 1.9V			100	µA
V_{OH}	High-level output voltage	AO0 – AO6 [3]	V_{CC} = MIN to MAX; I_{OH} = -100µA	V_{CC} –0.2			V
			V_{CC} = MIN; I_{OH} = -4mA	2.4			V
			V_{CC} = MIN; I_{OH} = -12mA	2.0			V
V_{OL}	Low-level output voltage	AO0 – AO6 [3]	V_{CC} = MIN; I_{OL} = 4mA			0.4	V
			V_{CC} = MIN; I_{OL} = 12mA			0.8	V
		$\overline{B0}$ – $\overline{B6}$	V_{CC} = MIN, I_{OL} = 4mA	0.5			V
			V_{CC} = MIN, I_{OL} = 100mA	0.75	1.0	1.20	
V_{IK}	Input clamp voltage		V_{CC} = MIN, I_I = I_{IK} = –18mA		–0.85	-1.2	V
I_I	Input leakage current	Control pins	V_{CC} = 3.6V; V_I = V_{CC} or GND			±1.0	µA
		Control/ AI0 – AI6	V_{CC} = 0V or 3.6V; V_I = 5.5V			10	
		AI0 – AI6	V_{CC} = 3.6V; V_I = V_{CC}			1	
		Note 4	V_{CC} = 3.6V; V_I = 0V			–5	
I_{IH}	High-level input current	$\overline{B0}$ – $\overline{B6}$	V_{CC} = MAX, V_I = 1.9V			100	µA
			V_{CC} = MAX, V_I = 3.5V, note 5	100			mA
			V_{CC} = MAX, V_I = 3.75V @ –40°C	100			mA
I_{IL}	Low-level input current	$\overline{B0}$ – $\overline{B6}$	V_{CC} = MAX, V_I = 0.75V			-100	µA
I_{OZH}	Off-state output current	AO0 – AO6	V_{CC} = MAX, V_O =3V			5	µA
I_{OZL}	Off-state output current	AO0 – AO6	V_{CC} = MAX, V_O = 0.5V			-5	µA
I_{CC}	Supply current (total)	I_{CCZ} (standby)	V_{CC} = MAX		6.0	13.0	mA
		I_{CCB}, AIn to $\overline{Bn}$	V_{CC} = MAX, outputs Low or High		5.1	10.0	
		I_{CCA}, $\overline{Bn}$ to AOn	V_{CC} = MAX, outputs Low		13.4	19.5	
		I_{CCA}, $\overline{Bn}$ to AOn	V_{CC} = MAX, outputs High		10.6	16.0	

NOTES:

1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operation conditions for the applicable type.
2. All typical values are at V_{CC} = 3.3V, T_A = 25°C.
3. Due to test equipment limitations, actual test conditions are V_{IH} = 1.8V and V_{IL} = 1.3V for the B side.
4. Unused pins are at V_{CC} or GND.
5. 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).

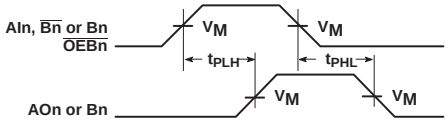
AC ELECTRICAL CHARACTERISTICS (Commercial)

SYMBOL	PARAMETER	TEST CONDITION	A PORT LIMITS					UNIT
			T_{amb} = +25°C, V_{CC} = 3.3V, C_L = 50pF, R_L = 500Ω			T_{amb} = 0 to 70°C, V_{CC} = 3.3V±10%, C_L = 50pF, R_L = 500Ω		
			MIN	TYP	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay, $\overline{Bn}$ to AOn	Waveform 1, 2	4.2 4.1	5.2 5.1	6.2 6.1	3.9 3.9	7.0 6.8	ns
t_{PZH} t_{PZL}	Output enable time, OEA to AOn	Waveform 4, 5	5.8 2.7	7.1 4.5	8.5 8.0	5.4 2.5	9.4 8.5	ns
t_{PHZ} t_{PLZ}	Output disable time, OEA to AOn	Waveform 4, 5	3.9 3.7	5.2 4.8	6.5 6.0	3.6 3.3	7.0 7.3	ns
t_{TLH} t_{THL}	Transition time, AOn Port (10% to 90% or 90% to 10%)	Test Circuit and Waveforms	0.8 0.6	1.6 1.1	2.8 1.7	0.7 0.5	3.0 2.0	ns
$t_{SK}(o)$	Output skew between receivers in same package[1]	Waveform 3		0.4	1.5		1.5	ns
SYMBOL	**PARAMETER**	**TEST CONDITION**	**B PORT LIMITS**					**UNIT**
			T_{amb} = +25°C, V_{CC} = 3.3V, C_D = 30pF, R_U = 9Ω			T_{amb} = 0 to 70°C, V_{CC} = 3.3V±10%, C_D = 30pF, R_U = 9Ω		
t_{PLH} t_{PHL}	Propagation delay, AIn to $\overline{Bn}$	Waveform 1, 2	3.2 2.9	4.1 3.6	5.0 4.4	2.9 2.7	5.8 4.9	ns
t_{PLH} t_{PHL}	Enable/disable time, OEB0 to $\overline{Bn}$	Waveform 2	3.9 3.5	4.7 4.4	5.5 5.4	3.5 3.2	6.4 5.9	ns
t_{PLH} t_{PHL}	Enable/disable time, $\overline{OEB1}$ to $\overline{Bn}$	Waveform 1	4.1 3.0	5.0 3.9	5.9 4.8	3.8 2.6	6.6 5.5	ns
t_{TLH} t_{THL}	Transition time, $\overline{Bn}$ Port (1.3V to 1.8V)	Test Circuit and Waveforms	1.3 0.4	1.9 0.8	2.8 1.4	1.2 0.4	3.0 1.5	ns
$t_{SK}(o)$	Output skew between drivers in same package[1]	Waveform 3		0.3	1.4		1.4	ns
SYMBOL	**PARAMETER**	**TEST CONDITION**	**R_U = 16.5Ω**			**R_U = 16.5Ω**		**UNIT**
t_{PLH} t_{PHL}	Propagation delay, AIn to $\overline{Bn}$	Waveform 1, 2	3.2 2.9	4.1 3.6	5.0 4.9	2.9 2.6	5.8 4.9	ns
t_{PLH} t_{PHL}	Enable/disable time, OEB0 to $\overline{Bn}$	Waveform 2	3.9 3.5	4.7 4.4	5.5 5.4	3.5 3.2	6.4 5.9	ns
t_{PLH} t_{PHL}	Enable/disable time, $\overline{OEB1}$ to $\overline{Bn}$	Waveform 1	4.1 3.0	5.0 3.9	5.9 4.8	3.8 2.6	6.6 5.5	ns
t_{TLH} t_{THL}	Transition time, $\overline{Bn}$ Port (1.3V to 1.8V)	Test Circuit and Waveforms	1.3 0.4	1.9 0.8	2.8 1.4	1.2 0.4	3.0 1.5	ns
$t_{SK}(o)$	Output skew between drivers in same package[1]	Waveform 3		0.3	1.4		1.4	ns

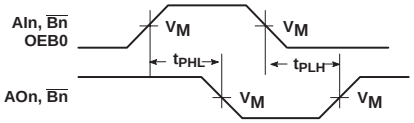
NOTES:

1. $|t_{PN}actual - t_{PM}actual|$ for any data input to output path compared to any other data input to output path where N and M are either LH or HL. Skew times are valid only under same test conditions (temperature, V_{CC}, loading, etc.).

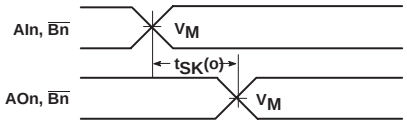
AC WAVEFORMS



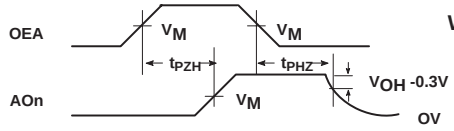
Waveform 1. Propagation Delay for Data or Output Enable to Output



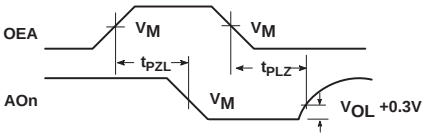
Waveform 2. Propagation Delay for Data or Output Enable to Output



Waveform 3. Output Skews



Waveform 4. 3-State Output Enable Time to High Level and Output Disable Time from High Level



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

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

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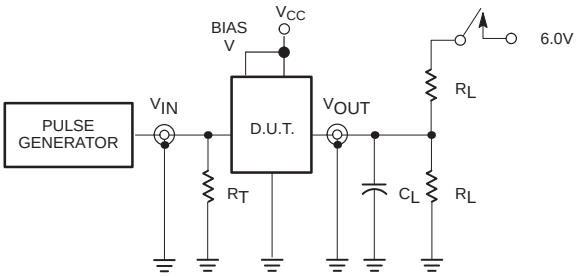
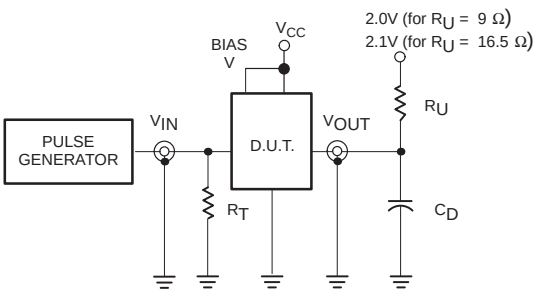
TEST CIRCUIT AND WAVEFORMS



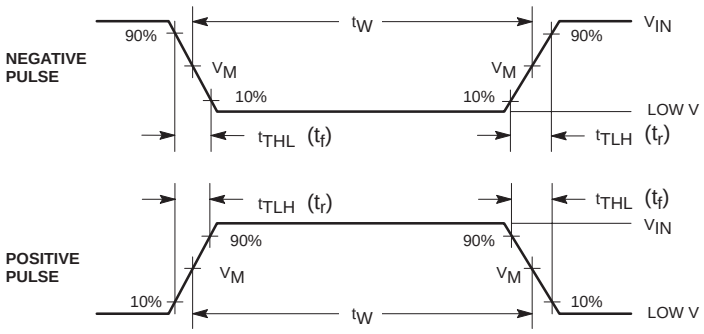
Test Circuit for 3-State Outputs on A Port

SWITCH POSITION FOR ALL A-PORTS

TEST	SWITCH
t_{PLH}, t_{PHL}	OPEN
t_{PLZ}, t_{PZL}	CLOSED
t_{PHZ}, t_{PZH}	GND



Test Circuit for Outputs on B Port



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

Input Pulse Definitions

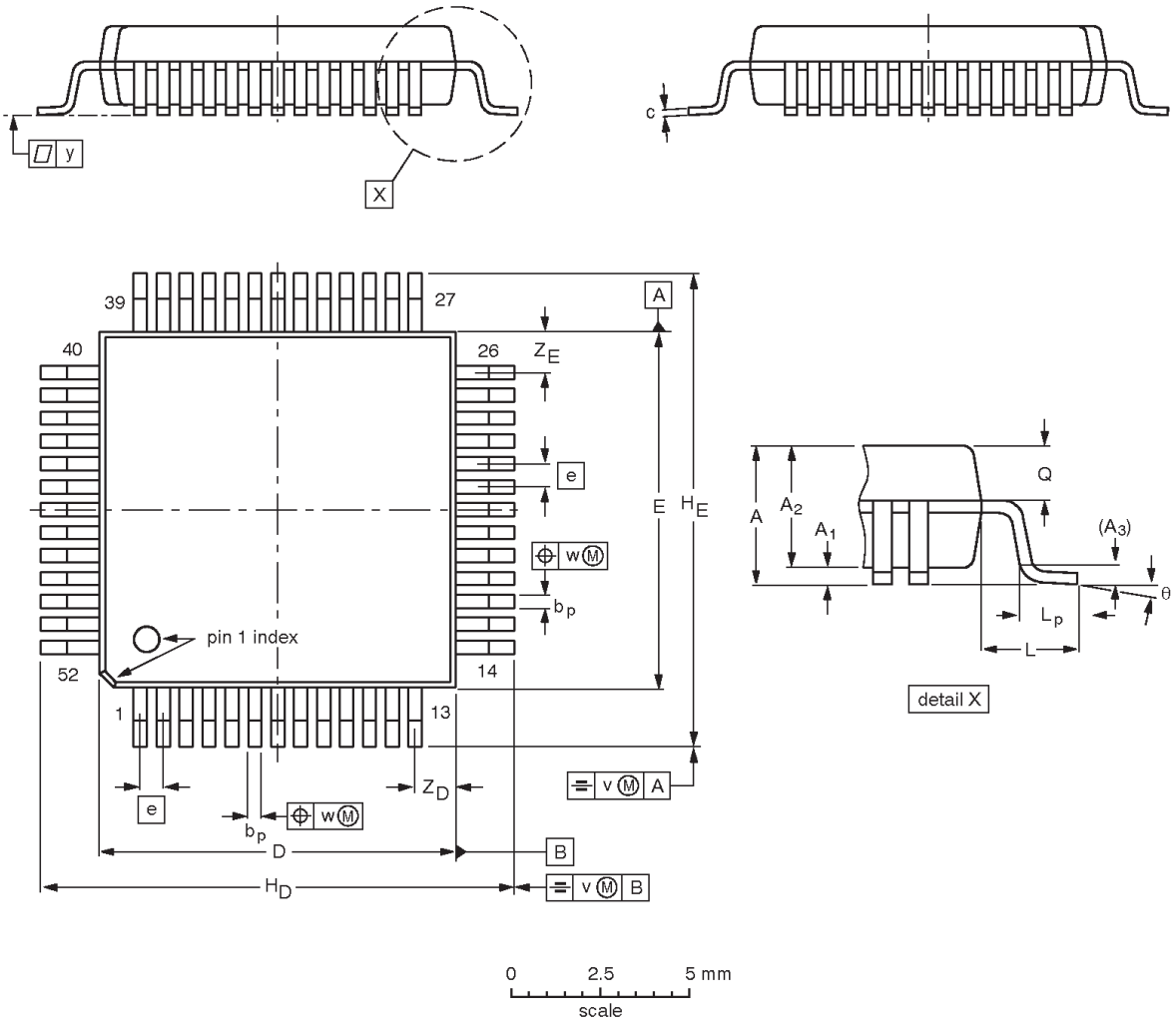
Family FB+	INPUT PULSE REQUIREMENTS					
	Amplitude	Low V	Rep. Rate	t_W	t_{TLH}	t_{THL}
A Port	3.0V	0.0V	1MHz	500ns	2.5ns	2.5ns
B Port	2.0V	1.0V	1MHz	500ns	2.5ns	2.5ns

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.

SG00090

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^o 0^o

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

NOTES

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

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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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