SLLS125A − OCTOBER 1990 − REVISED NOVEMBER 1993

- **Supports Distributed Arbitration for Futurebus+ Master Selection**
- **Supports Arbitrated Messages in Distributed and Central Modes**
- **Enables Use of a Common Hardware and Software Interface for Both Distributed and Central Modes**
- **Requires No Hardware Modifications for Changing Between Distributed and Central Modes**
- **Provides a CSR Bus Interface for Easy Integration into the Futurebus+ CSR Address Space**
- **Has Two Bus Request Lines That Each May Be Assigned Any One of 256 Priority Levels**
- **Supports Round-Robin Fairness Arbitration Within Two Separate Priority Levels to Avoid Starvation of Any Single Module**
- **Supports Distributed-Mode Bus Parking to Improve Performance of Successive Bus Acquisitions By a Single Module During Idle Bus Conditions**
- **Offers Accurate Arbitration Settling Time and Glitch Filter Programmability to Allow Optimal Arbitration Bus Performance**
- **Provides a FIFO for Capturing up to Four Incoming Arbitrated Messages**
- **Provides Hardware Support of Targeted Interrupts**
- **Supports Power-Fail Message Indication With a Separate Terminal and Interrupt**
- **Provides On-Chip Error Time-Out Detection**
- **Has a JTAG Test Port**

description

The TFB2010 arbitration bus controller (ABC) is a member of the Texas Instruments Futurebus+ chip set. This chip set provides an integrated approach to the Futurebus+ interface that reduces new-product design time, allows more functionality per circuit board, improves overall interface reliability, and reduces end-user down time through built-in test capabilities.

The TFB2010 performs the Futurebus+ distributed-arbitration protocol to gain tenure of the bus (distributed mode only), to send and receive arbitrated messages (central or distributed mode), and to update central-mode arbiter priorities (central mode only).

The TFB2010 can be used in conjunction with a central-bus arbiter as an arbitrated-message controller to program the central-bus arbiter, send asynchronous interrupts, or send event messages or interrupts to other modules. In the case of a failure in the central-bus arbiter or if distributed arbitration is desired, it can be used as a distributed-arbitration controller without a change in the host software. Priority changes are sent to the central arbiter as arbitrated messages. This device monitors the bus for arbitration messages, storing these in a FIFO or in the targeted interrupt register for reference by the processor. It also provides the necessary control functions to gain control of the Futurebus+ for a module attempting to perform a bus transaction when operating in the distributed-arbitration mode.

The TFB2010 is offered in a 100-pin plastic quad flat package (PJM) to enhance interface capability. The TFB2010 is characterized for operation over the commercial temperature range of 0°C to 70°C.

NOTE: To maintain consistency with the notation used in the Futurebus+ standard (IEEE Std 896.1−1991), an active low-signal is denoted herein by use of the trailing asterisk (*) on the signal name.

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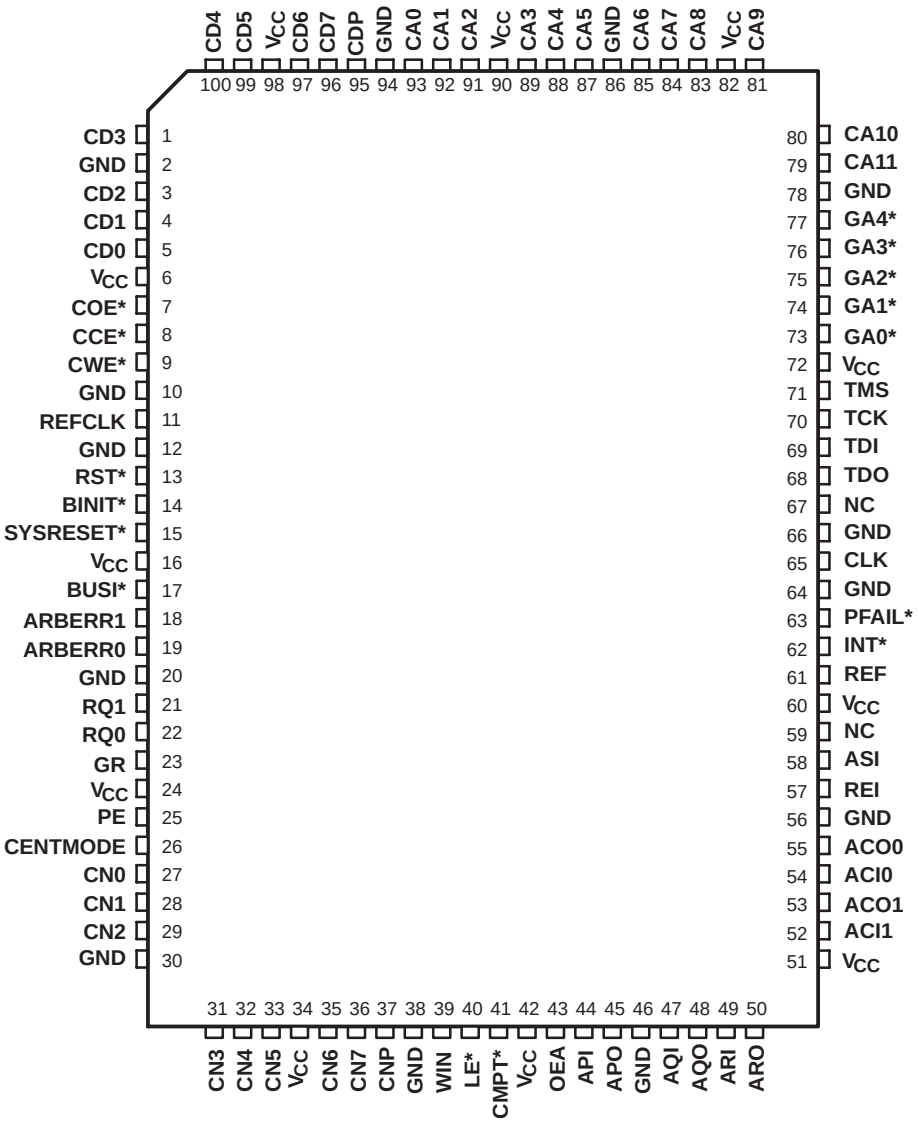
terminal assignments

PJM . . . PACKAGE
(TOP VIEW)



NC − No internal connection

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Terminal Functions

CSR bus

TERMINAL NAME	TERMINAL NO.	I/O	FROM/TO	DESCRIPTION
CA<11:0>	79,80,81,83, 84,85,87,88, 89,91,92,93	I	CSR bus	CSR bus address inputs
CCE*	8	I	CSR bus	CSR bus chip enable input
CD<7:0>	96,97,99, 100,1,3,4,5	I/O	CSR bus	CSR bus data
CDP	95	I/O	CSR bus	CSR bus data odd parity
COE*	7	I	CSR bus	CSR bus output enable input
CWE*	9	I	CSR bus	CSR bus write enable input

protocol controller interface

TERMINAL NAME	TERMINAL NO.	I/O	FROM/TO	DESCRIPTION
ARBERR<1:0>	18,19	O		Arbitration error outputs: LL No error LH AC0 and AC1 asserted during phase 3 HL Arbitration comparison error or parity error HH Arbitration time-out error (phase 2 or 4)
GR	23	O		Futurebus+ mastership has been granted output (bus tenure may begin). This signal remains in the high-impedance state while in the central-bus arbitration mode.
PE	25	I/O		In distributed mode when this device is the bus master, the TFB2010 asserts PE to indicate that a module with a higher priority has become the master elect. PE is released along with GR when RQ1 and RQ0 are released. In central mode, the TFB2010 puts this output in a high-impedance state to allow the central-arbitration controller to control preemption. PE is monitored by the TFB2010 during a Futurebus+ system reset to determine the system operational mode (central or distributed) following the reset.
RQ<1:0>	21,22	I		Futurebus+ mastership is requested in centralized mode input: RQ0 asserted: use arbitration number in the RQ0 priority register RQ1 asserted: use arbitration number in the RQ1 priority register Once a request is asserted, it is not released until GR* has been asserted (the TI protocol controllers perform this handshake internally). Once GR* is asserted, RQn* may be released at any time after AS has been asserted by the module in the last bus transaction (AS may already be released if no further transactions are to take place). Both request lines must be released prior to release of GR*. Another RQn* can be asserted after GR* and PE have been released.

Terminal Functions

other module interfaces

TERMINAL NAME	TERMINAL NO.	I/O	FROM/TO	DESCRIPTION
CLK	65	I		Clock input. CLK is used by the CSR bus master(s).
INT*	62	O (open-collector)		Host interrupt output. When an enabled interrupt condition occurs, INT is driven low. Interrupts are cleared by writing a zero to the appropriate bit in the interrupt register. The interrupt goes high during the write cycle to the interrupt register even if another interrupt is pending.
PFAIL*	63	O		Power-fail message received output
REFCLK	11	I	Module	Clock input. The recommended frequency and duty cycle are 33 MHz, 50%±5%; 25 MHz to 33 MHz and 50% ±5% can be tolerated.

JTAG test port

TERMINAL NAME	TERMINAL NO.	I/O	FROM/TO	DESCRIPTION
TCK	70	I	Module	JTAG test clock input
TDI	69	I	Module	JTAG test data input
TDO	68	O	Module	JTAG test data output
TMS	71	I	Module	JTAG test mode select input

reset port

TERMINAL NAME	TERMINAL NO.	I/O	FROM/TO	DESCRIPTION
BINIT*	14	I	Module	Bus interface reset input. BINIT is an open-collector signal indicating that a bus interface reset is required
BUSI*	17	I		Bus has been idle for longer than 1 μs, and reset is asserted by this module.
REF	61	O		Futurebus+ reset filtered output
REI	57	I		Futurebus+ reset input
RST*	13	I	Module	Module power-up reset input. RST resets all logic; output signals go to their inactive states; 3-state outputs and bidirectionals go to the high-impedance state (for live-insertion considerations).
SYSRESET*	15	I	Module	System reset input. SYSRESET* signal indicates that a system reset is required.

Terminal Functions

Futurebus+ interface

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
ACI<1:0>	52,54	I	Futurebus+ arbitration condition input
ACO<1:0>	53,55	O	Futurebus+ arbitration condition output
API, AQI, ARI	44,47,49	I	Futurebus+ arbitration handshake input
APO, AQO, ARO	45,48,50	O	Futurebus+ arbitration handshake output
ASI	58	I	Futurebus+ address handshake input
CENTMODE	26	O	Central-mode operation is in effect output
CMPT*	41	O	Arbitration contest logic compete indication output. Connects to $\overline{\text{COMPETE}}$ and $\overline{\text{OEB}}$ on the competition transceiver.
CN<7:0>, CNP	36,35,33,32,31, 29,28,27,37	I/O	Futurebus+ contest number and parity
GA<4:0>*	77,76,75,74,73	I	Futurebus+ geographical address input
LE*	40	O	Enable latch on competition transceiver output (1 = competition number latched)
OEA	43	O	Enable TTL drivers on competition transceiver output
WIN	39	I	Arbitration contest logic win indication input

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

Supply voltage range, V_{CC} (see Note 1) . . . . . −0.5 V to 7 V
Input voltage range, V_I . . . . . −0.5 V to 7 V
Output voltage range, V_O . . . . . −0.5 V to 7 V
Continuous total power dissipation . . . . . See Dissipation Rating Table
Power dissipation . . . . . 500 mW
Operating free-air temperature range, T_A . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C
Case temperature for 10 seconds . . . . . 260°C

NOTE 1: All voltage values are with respect to GND.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING
PJM	1500 mW	12 mW/°C	960 mW

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}	4.75	5	5.25	V
High-level input voltage, V_{IH}	2		V_{CC}	V
Low-level input voltage, V_{IL}	−0.5		0.8	V
Operating free-air temperature range, T_A	0		70	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		MACRO	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IT}	Input threshold voltage	IPI04LK	V_I = V_{CC} or 0 V, I_I = ± 1 µA, C_L = 7.4 pF		1.3		V
V_{IT+}	Positive-going input threshold voltage	IPI09LK			1.6		V
V_{IT-}	Negative-going input threshold voltage	IPI09LK			1.2		V
V_{OH}	High-level output voltage	OPJ43LK	I_{OH} = −4 mA	3.7			V
V_{OL}	Low-level output voltage		I_{OL} = 4 mA			0.5	V
V_{OH}	High-level output voltage	OPJ83LK	I_{OH} = −8 mA	3.7			V
V_{OL}	Low-level output voltage		I_{OL} = 8 mA			0.5	V
V_{OH}	High-level output voltage	OPI43LK	I_{OH} = −4 mA	3.7			V
V_{OL}	Low-level output voltage		I_{OL} = 4 mA			0.5	V
V_{OL}	Low-level output voltage	OPI42LK	I_{OL} = 4 mA			0.5	V

macros

Table 1 lists the internal and external buffer macros used in the TFB2010 design. To use this table, find the pin of interest and note the macro name(s). If there is an entry only in the input macro column, the pin is an input. If there is an entry only in the output macro column, the pin is an output. If there is an entry in both columns, this is a 3-state bidirectional pin. The macro(s) are also listed in the electrical characteristics table.

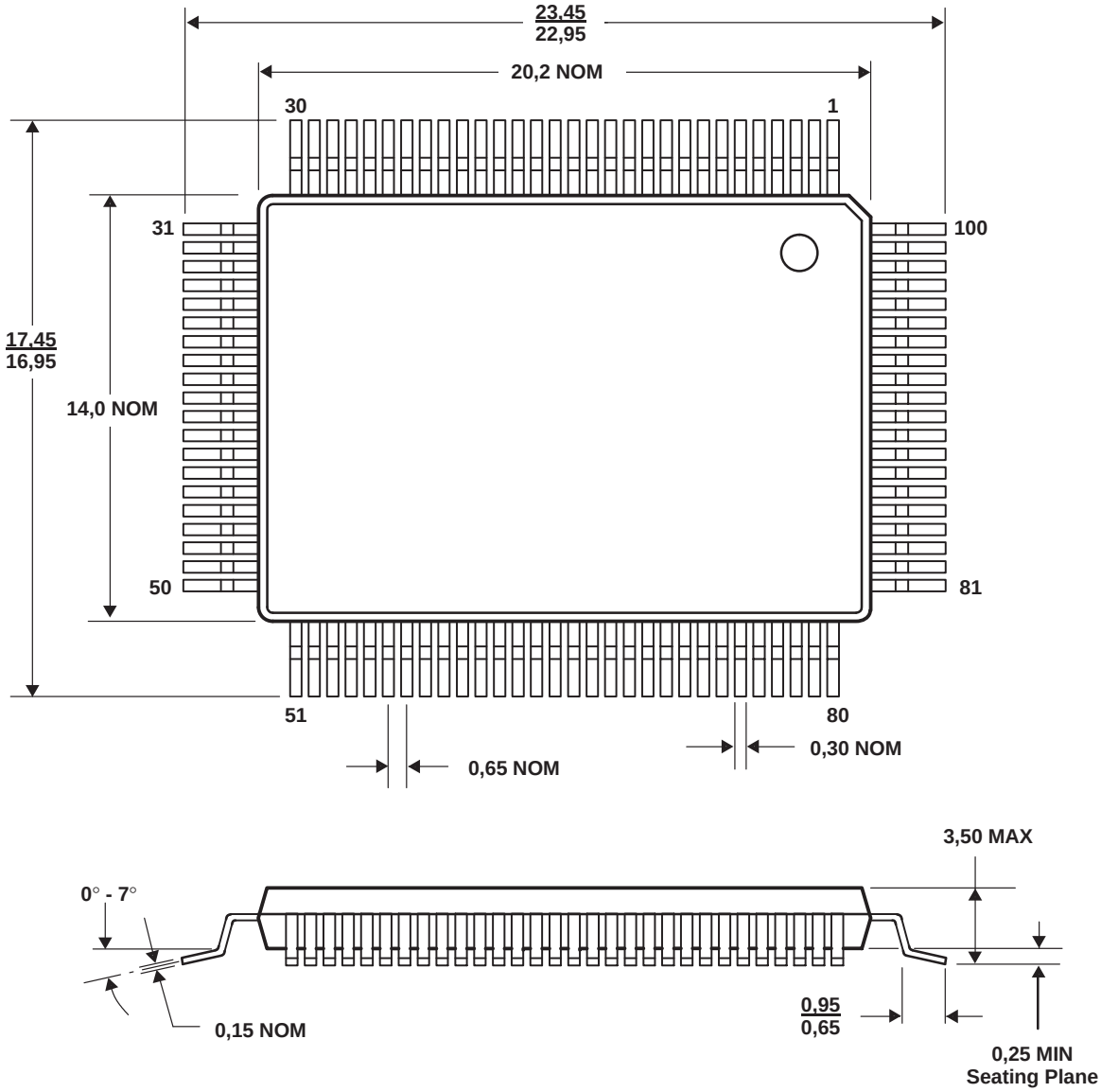
Table 1. TFB2010 (ABC) Pin Names and Macro Numbers

PIN NAME	INPUT MACRO	OUTPUT MACRO
ACI<1:0>	IPI04LK	
ACO<1:0>		OPI43LK
API	IPI04LK	
APO		OPI43LK
AQI	IPI04LK	
AQO		OPI43LK
ARBERR<1:0>		OPI43LK
ARI	IPI04LK	
ARO		OPI43LK
ASI	IPI04LK	
BINIT*	IPI09LK	
BUSI*	IPI09LK	
CA<11:0>	IPI04LK	
CCE*	IPI04LK	
CD<7:0>	IPI04LK	OPJ83LK
CDP	IPI04LK	OPJ83LK
CENTMODE		OPI43LK
CLK	IPI04LK	
CMPT*		OPI43LK
CN<7:0>	IPI04LK	OPI43LK
CNP	IPI04LK	OPI43LK

PIN NAME	INPUT MACRO	OUTPUT MACRO
COE*	IPI04LK	
CWE*	IPI04LK	
GA<4:0>*	IPI04LK	
GR		OPI43LK
INT*		OPI42LK
LE*		OPI43LK
OEA		OPI43LK
PE	IPI04LK	OPI43LK
PFAIL*		OPI43LK
REF		OPI43LK
REFCLK	IPI04LK	
REI	IPI04LK	
RQ<1:0>	IPI04LK	
RST*	IPI09LK	
SYSRESET*	IPI09LK	
TCK	IPI04LK	
TDI	IPI04LK	
TDO		OPI43LK
TMS	IPI04LK	
WIN	IPI04LK	

MECHANICAL DATA

100-Pin Plastic Quad Flat Package (PJM Package)



Leads are coplanar to within 0,1 mm.

ALL LINEAR DIMENSIONS ARE IN MILLIMETERS.

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