

Advanced BiCMOS features

Advanced BiCMOS Features

With the advent of the newer BiCMOS and 3 volt technologies, product feature sets have been enhanced from the standard features found in previous logic families. With the newer technologies came capabilities of hot plugging and operating in mixed voltage systems just to name a couple. Special features and device parameters exist for these newer families such as Power-up 3-State, Power-up Reset, Bus Hold, Input Disable, and 5 volt tolerant I/O's in addition to existing parameters. Following is a summary of these features and their associated data sheet parameters. Tables on following pages show which features are available for the various part types.

Live Insertion Capability and Power-up/Down 3-State

Glitches or signal degradation can occur on an active bus when circuit boards are plugged into or extracted from a powered up system or when a power-up and down cycle is used during system maintenance. Signal degradation is kept to a minimum by keeping the outputs of devices in the high impedance state where the current is very low. The advanced BiCMOS logic families employ a power-up and power-down 3-State circuit that facilitates live insertion up to 1.2 V V_{CC} or 2.1 V V_{CC} as shown in Figure 1.

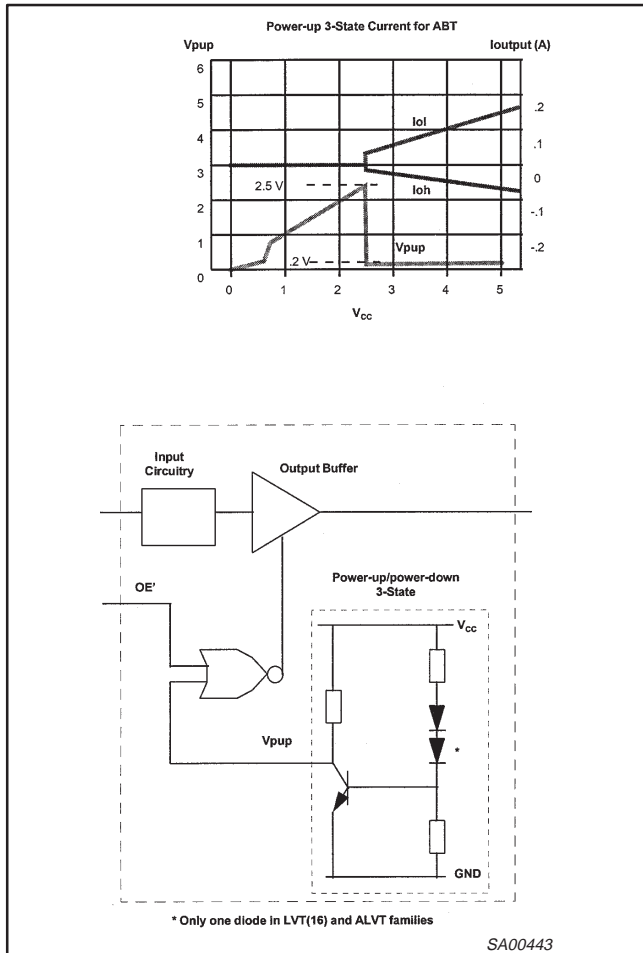


Figure 1. Power-up/power-down 3-State circuit and output 3-State current

During V_{CC} ramp up or ramp down, the outputs are guaranteed to remain 3-State up to 2.1 V for ABT and MULTIBYTE™ families and 1.2 V for LVT(16) and ALVT families, regardless of the voltage level of the data or enable input pins. Output leakage current is limited to $\pm 100 \mu A$ depending on the product family. Refer to the I_{PU}/I_{PD} specification in the data sheet.

Live insertion capability is available on most of the 3-State bus interface functions.

Bus Hold

Used or unused CMOS device inputs should not be left floating. Floating inputs can cause extra current to flow through the input structure, causing extra wasted power dissipation, or they can cause high frequency oscillations, generating heat that may eventually damage the part. A common solution for this is to connect the input to V_{CC} or ground through a pull-up or pull-down resistor. The disadvantage of this is an extra component is needed as well as extra board space, and the resistor dissipates extra power.

The ABT16 and low voltage BiCMOS logic families use an integrated bus hold circuit which eliminates the need for external resistors and saves board space. The circuit is shown in Figure 2.

The bus hold circuit holds the last known valid state of the input when the bus starts to float. There is a minimum hold current (I_{HOLD}) of 75 μA at the input switching levels of 2.0 V and 0.8 V. An overdrive current of +450 μA –450 μA is required to toggle the bus hold cell into the LOW or HIGH state. The circuit has minimal impact to input/output capacitance and is about 0.5 pF. This adds a slight increase to the driver's propagation delay of about 40 ps for 8 mA drivers and about 15 ps for 24 mA drivers per each bus hold input. For further reference, please refer to Application Note 2022, *The Behavior of Integrated Bus Hold Circuits*, document number 9397–750–00798.

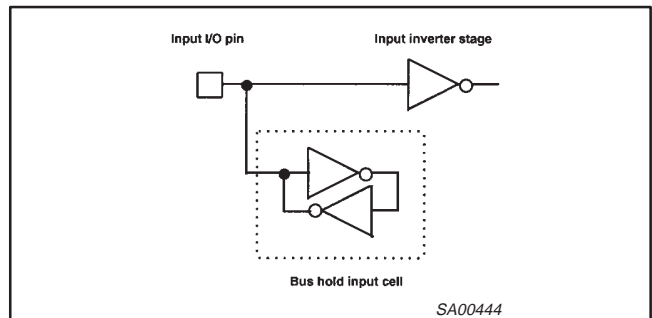


Figure 2. Integrated bus hold circuit

Input Disable Circuit

ABT and MULTIBYTE™ products provide a solution for floating CMOS inputs different from the bus hold solution. They employ a feature called Input Disable which disables the input structure whenever the output is in the 3-State condition. When disabled, no current flows through the input structure from V_{CC} to ground. This allows inputs to float without the need for an input pull-up or pull-down resistor to V_{CC} or ground. This feature is included only on buffers and transceivers and not on parts with latches or flip-flops.

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Power-up Reset

The Power-up Reset feature is found in parts with latches or flip-flops. This feature ensures that the output is in the logic LOW state after power-up. This provides a known valid state after power-up and eliminates any need for a reset cycle. The guaranteed V_{OL} voltage (V_{RST}) is 0.55 V.

I_{OFF}

I_{OFF} is the power-off leakage current on the input or output when V_{CC} is 0 V. The current is limited to 100 μ A or less, depending on the product family, and the feature helps support applications that have a suspend or power-down mode.

5 V Tolerant I/O's

With the trend of 3.3 V and lower processors, memories, and ASIC's comes the need for devices to operate in mixed voltage systems. Current systems often use a mix of 3 V and 5 V components besides using only pure 5 V or pure 3 V components. This requires a 3 V device's input and output pins to be able to reliably tolerate 5 V signals as well as 3 V signals. Pure bipolar structures have no problem with this, however, parts with classic CMOS input and output structures have diodes—thus a current path—to VCC, thereby not allowing 5 V signals.

The 3 V BiCMOS logic families use designs that allow 5 V signals on inputs and outputs shown in Figures 3 and 4.

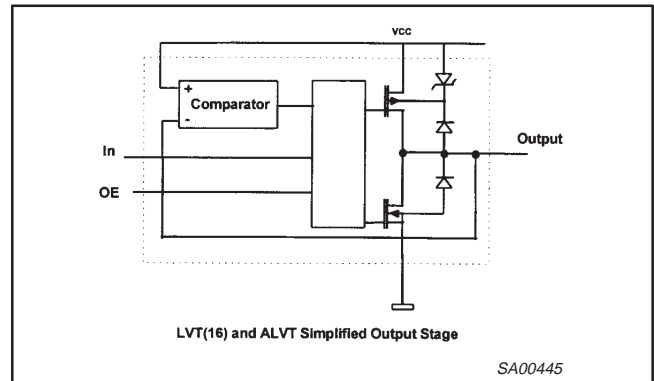


Figure 4. 5 V tolerant output circuit

The comparator turns off and protects the LVT and ALVT upper PMOS transistor in the active HIGH state when the output is 0.5 V greater than V_{CC} . The output current (I_{EX}) is limited to 125 μ A. In the 3-State mode, the reversed biased Schottky diode prevents current flow to the 3.3 V supply if a 5 V signal is applied to the output. For further reference, please refer to Application Note 240, *Interfacing 3V and 5V Systems*, document number 9397-750-00282.

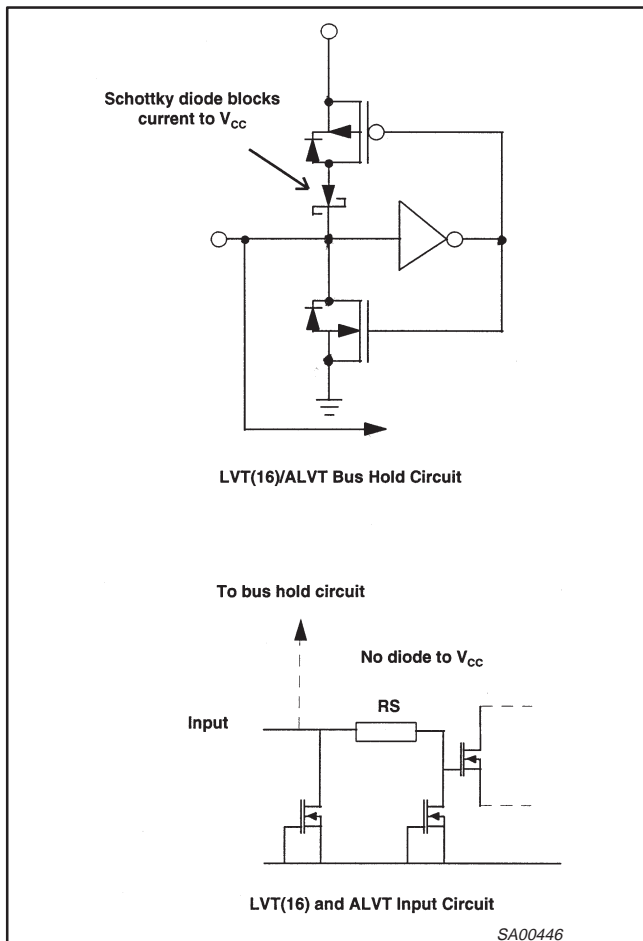


Figure 3. 5 V tolerant input circuits

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PRODUCT	INPUT DISABLE CIRCUIT	LIVE INSERTION CAPABILITY	POWER-UP RESET	SPLIT-LEAD GROUND	INPUT BUS HOLD CIRCUIT	64 mA OUTPUT DRIVE	5-VOLT COMPATIBLE I/O
74ABT00	NO	NO	NO	NO	NO	NO	YES
74ABT02	NO	NO	NO	NO	NO	NO	YES
74ABT04	NO	NO	NO	NO	NO	NO	YES
74ABT08	NO	NO	NO	NO	NO	NO	YES
74ABT10	NO	NO	NO	NO	NO	NO	YES
74ABT20	NO	NO	NO	NO	NO	NO	YES
74ABT32	NO	NO	NO	NO	NO	NO	YES
74ABT74	NO	NO	NO	NO	NO	NO	YES
74ABT125	YES	YES	NO	YES	NO	YES	YES
74ABT126	YES	YES	NO	YES	NO	YES	YES
74ABT240	NO	YES	NO	YES	NO	YES	YES
74ABT2240	NO	YES	NO	YES	NO	NO	YES
74ABT241	YES	YES	NO	YES	NO	YES	YES
74ABT2241	YES	YES	NO	YES	NO	NO	YES
74ABT244	YES	YES	NO	YES	NO	YES	YES
74ABT2244	YES	YES	NO	YES	NO	NO	YES
74ABT245	YES	YES	NO	YES	NO	YES	YES
74ABT2245	YES	YES	NO	YES	NO	NO	YES
74ABT273A	NO	NO	YES	YES	NO	YES	YES
74ABT373A	NO	YES	YES	YES	NO	YES	YES
74ABT374A	NO	YES	YES	YES	NO	YES	YES
74ABT377A	NO	NO	YES	YES	NO	YES	YES
74ABT534A	NO	YES	YES	YES	NO	YES	YES
74ABT540	NO	YES	NO	YES	NO	YES	YES
74ABT541	YES	YES	NO	YES	NO	YES	YES
74ABT543A	NO	YES	YES	YES	NO	YES	YES
74ABT544	NO	YES	YES	NO	NO	YES	YES
74ABT573A	NO	YES	YES	YES	NO	YES	YES
74ABT574A	NO	YES	YES	YES	NO	YES	YES
74ABT620	NO	YES	NO	YES	NO	YES	YES
74ABT623	YES	YES	NO	YES	NO	YES	YES
74ABT640	NO	YES	NO	YES	NO	YES	YES
74ABT646A	NO	YES	YES	YES	NO	YES	YES
74ABT648	NO	YES	YES	NO	NO	YES	YES
74ABT651	NO	YES	YES	YES	NO	YES	YES
74ABT652A	NO	YES	YES	YES	NO	YES	YES
74ABT657	YES ²	NO	NO	NO ³	NO	YES	YES
74ABT821	NO	NO	NO	YES	NO	YES	YES
74ABT823	NO	NO	NO	YES	NO	YES	YES
74ABT827	YES	NO	NO	YES	NO	YES	YES
74ABT833	NO	YES	NO	YES	NO	YES	YES
74ABT841	NO	NO	NO	YES	NO	YES	YES

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PRODUCT	INPUT DISABLE CIRCUIT	LIVE INSERTION CAPABILITY	POWER-UP RESET	SPLIT-LEAD GROUND	INPUT BUS HOLD CIRCUIT	64 mA OUTPUT DRIVE	5-VOLT COMPATIBLE I/O
74ABT845	NO	NO	NO	YES	NO	YES	YES
74ABT853	NO	YES	NO	YES	NO	YES	YES
74ABT861	YES	NO	NO	YES	NO	YES	YES
74ABT863	YES	YES	NO	NO	NO	YES	YES
74ABT899	NO	YES	YES	YES	NO	YES	YES
74ABT2952	NO	YES	YES	YES	NO	YES	YES
74ABT2953	NO	YES	YES	NO	NO	YES	YES
74ABT5074	NO	NO	NO	NO	NO	NO	YES
74ABTH16240A	NO	YES	NO	NO ³	YES	YES	YES
74ABTH162240	NO	YES	NO	NO ³	YES	NO	YES
74ABTH16241A	NO	YES	NO	NO ³	YES	YES	YES
74ABTH16244A	NO	YES	NO	NO ³	YES	YES	YES
74ABTH162244	NO	YES	NO	NO ³	YES	NO	YES
74ABTH16245B	NO	YES	NO	NO ³	YES	YES	YES
74ABTH162245A	NO	YES	NO	NO ³	YES	NO	YES
74ABTH16260	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16273	NO	NO	YES	NO ³	YES	YES	YES
74ABTH16373B	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16374B	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16500C	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16501A	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16541	NO	YES	NO	NO ³	YES	YES	YES
74ABTH16543	NO	YES	YES	NO ³	YES	YES	YES
74ABTH161543	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16646	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16652	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16821A	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16823A	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16825A	NO	YES	NO	NO ³	YES	YES	YES
74ABTH16827A	NO	YES	NO	NO ³	YES	YES	YES
74ABTH162827A	NO	YES	NO	NO ³	YES	NO	YES
74ABTH16841A	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16899	NO	YES	YES	NO ³	YES	YES	YES
74ABTH16952	NO	YES	YES	NO ³	YES	YES	YES
74ABT16240A	NO	YES	NO	NO ³	NO	YES	YES
74ABT162240	NO	YES	NO	NO ³	NO	YES	YES
74ABT16241A	NO	YES	NO	NO ³	NO	YES	YES
74ABT16244A	YES	YES	NO	NO ³	NO	YES	YES
74ABT162244	YES	YES	NO	NO ³	NO	YES	YES
74ABT16245B	YES	YES	NO	NO ³	NO	YES	YES
74ABT162245A	YES	YES	NO	NO ³	NO	YES	YES
74ABT16260	NO	YES	YES	NO ³	NO	YES	YES

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PRODUCT	INPUT DISABLE CIRCUIT	LIVE INSERTION CAPABILITY	POWER-UP RESET	SPLIT-LEAD GROUND	INPUT BUS HOLD CIRCUIT	64 mA OUTPUT DRIVE	5-VOLT COMPATIBLE I/O
74ABT16273	NO	NO	YES	NO ³	NO	YES	YES
74ABT16373B	NO	YES	YES	NO ³	NO	YES	YES
74ABT16374B	NO	YES	YES	NO ³	NO	YES	YES
74ABT16500C	NO	YES	YES	NO ³	NO	YES	YES
74ABT16501A	NO	YES	YES	NO ³	NO	YES	YES
74ABT16541	NO	YES	NO	NO ³	NO	YES	YES
74ABT16543	NO	YES	YES	NO ³	NO	YES	YES
74ABT161543	NO	YES	YES	NO ³	NO	YES	YES
74ABT16646	NO	YES	YES	NO ³	NO	YES	YES
74ABT16652	NO	YES	YES	NO ³	NO	YES	YES
74ABT16821A	NO	YES	YES	NO ³	NO	YES	YES
74ABT16823A	NO	YES	YES	NO ³	NO	YES	YES
74ABT16825A	NO	YES	NO	NO ³	NO	YES	YES
74ABT16827A	NO	YES	NO	NO ³	NO	YES	YES
74ABT162827A	NO	YES	NO	NO ³	NO	NO	YES
74ABT16841A	NO	YES	YES	NO ³	NO	YES	YES
74ABT16899	NO	YES	YES	NO ³	NO	YES	YES
74ABT16952	NO	YES	YES	NO ³	NO	YES	YES
MB2052	NO	YES	YES	NO ³	NO	YES	YES
MB2240	NO	YES	NO	NO ³	NO	YES	YES
MB2241	YES	YES	NO	NO ³	NO	YES	YES
MB2244	YES	YES	NO	NO ³	NO	YES	YES
MB2245	YES	YES	NO	NO ³	NO	YES	YES
MB2373	NO	YES	YES	NO ³	NO	YES	YES
MB2374	NO	YES	YES	NO ³	NO	YES	YES
MB2377	NO	NO	YES	NO ³	NO	YES	YES
MB2541	YES	YES	NO	NO ³	NO	YES	YES
MB2543	NO	YES	YES	NO ³	NO	YES	YES
MB2623	YES	YES	NO	NO ³	NO	YES	YES
MB2646	NO	YES	YES	NO ³	NO	YES	YES
MB2652	NO	YES	YES	NO ³	NO	YES	YES
MB2821	NO	YES	YES	NO ³	NO	YES	YES
MB2823	NO	YES	YES	NO ³	NO	YES	YES
MB2827	NO	YES	NO	NO ³	NO	YES	YES
MB2841	NO	YES	YES	NO ³	NO	YES	YES
MB2861	NO	YES	NO	NO ³	NO	YES	YES
74LVT00	NO	NO	NO	NO	NO	NO	YES
74LVT02	NO	NO	NO	NO	NO	NO	YES
74LVT04	NO	NO	NO	NO	NO	NO	YES
74LVT08	NO	NO	NO	NO	NO	NO	YES
74LVT10	NO	NO	NO	NO	NO	NO	YES
74LVT14	NO	NO	NO	NO	NO	NO	YES

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PRODUCT	INPUT DISABLE CIRCUIT	LIVE INSERTION CAPABILITY	POWER-UP RESET	SPLIT-LEAD GROUND	INPUT BUS HOLD CIRCUIT	64 mA OUTPUT DRIVE	5-VOLT COMPATIBLE I/O
74LVT20	NO	NO	NO	NO	NO	NO	YES
74LVT32	NO	NO	NO	NO	NO	NO	YES
74LVT74	NO	NO	NO	NO	NO	NO	YES
74LVT86	NO	NO	NO	NO	NO	NO	YES
74LVT125	NO	YES	NO	YES	YES	YES	YES
74LVT126	NO	YES	NO	YES	YES	YES	YES
74LVT240	NO	YES	NO	YES	YES	YES	YES
74LVT241	NO	YES	NO	YES	YES	YES	YES
74LVT2241	NO	YES	NO	YES	YES	YES	YES
74LVT244A	NO	YES	NO	YES	YES	YES	YES
74LVT2244	NO	YES	NO	YES	YES	NO	YES
74LVT245	NO	YES	NO	YES	YES	YES	YES
74LVT2245	NO	YES	NO	YES	YES	NO	YES
74LVT273	NO	NO	YES	YES	YES	YES	YES
74LVT374	NO	YES	YES	YES	YES	YES	YES
74LVT534	NO	YES	YES	YES	YES	YES	YES
74LVT543	NO	YES	YES	YES	YES	YES	YES
74LVT573	NO	YES	YES	YES	YES	YES	YES
74LVT574	NO	YES	YES	YES	YES	YES	YES
74LVT623	NO	YES	NO	YES	YES	YES	YES
74LVT640	NO	YES	NO	YES	YES	YES	YES
74LVT646	NO	YES	YES	YES	YES	YES	YES
74LVT652	NO	YES	YES	YES	YES	YES	YES
74LVT2952	NO	YES	YES	YES	YES	YES	YES
74LVT16240A	NO	YES	NO	NO ³	YES	YES	YES
74LVT162240A	NO	YES	NO	NO ³	YES	YES	YES
74LVT16244B	NO	YES	NO	NO ³	YES	YES	YES
74LVT162244B	NO	YES	NO	NO ³	YES	YES	YES
74LVT16245B	NO	YES	NO	NO ³	YES	YES	YES
74LVT162245B	NO	YES	NO	NO ³	YES	YES	YES
74LVT16373A	NO	YES	YES	NO ³	YES	YES	YES
74LVT16374A	NO	YES	YES	NO ³	YES	YES	YES
74LVT16500A	NO	YES	YES	NO ³	YES	YES	YES
74LVT16501A	NO	YES	YES	NO ³	YES	YES	YES
74LVT16543A	NO	YES	YES	NO ³	YES	YES	YES
74LVT16646A	NO	YES	YES	NO ³	YES	YES	YES
74LVT16652A	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16240	NO	YES	NO	NO ³	YES	YES	YES
74ALVT162240	NO	YES	NO	NO ³	YES	YES	YES
74ALVT16241	NO	YES	NO	NO ³	YES	YES	YES
74ALVT162241	NO	YES	NO	NO ³	YES	NO	YES
74ALVT16244	NO	YES	NO	NO ³	YES	YES	YES

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PRODUCT	INPUT DISABLE CIRCUIT	LIVE INSERTION CAPABILITY	POWER-UP RESET	SPLIT-LEAD GROUND	INPUT BUS HOLD CIRCUIT	64 mA OUTPUT DRIVE	5-VOLT COMPATIBLE I/O
74ALVT162244	NO	YES	NO	NO ³	YES	YES	YES
74ALVT16245	NO	YES	NO	NO ³	YES	YES	YES
74ALVT162245	NO	YES	NO	NO ³	YES	YES	YES
74ALVT16344	NO	YES	NO	NO ³	YES	YES	YES
74ALVT162344	NO	YES	NO	NO ³	YES	NO	YES
74ALVT16373	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16374	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16500	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16501	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16541	NO	YES	NO	NO ³	YES	YES	YES
74ALVT16543	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16600	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16601	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16646	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16652	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16731	NO	YES	YES	NO ³	YES	YES	YES
74ALVT162731	NO	YES	YES	NO ³	YES	NO	YES
74ALVT16821	NO	YES	YES	NO ³	YES	YES	YES
74ALVT162821	NO	YES	YES	NO ³	YES	NO	YES
74ALVT16823	NO	YES	YES	NO ³	YES	YES	YES
74ALVT162823	NO	YES	YES	NO ³	YES	NO	YES
74ALVT16827	NO	YES	NO	NO ³	YES	YES	YES
74ALVT162827	NO	YES	NO	NO ³	YES	YES	YES
74ALVT16841	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16899	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16952	NO	YES	YES	NO ³	YES	YES	YES
74ALVT16953	NO	YES	YES	NO ³	YES	YES	YES

NOTES:

1. OE inputs must be at the proper level for the outputs to be in the 3-State condition.
2. Only on Bn I/O pins.
3. These devices have multiple GROUND pins.