WinTIDIG Help System - Main Index

WinTIDIG

How to reach Texas Instruments

(You can activate the Help System from WinTIDIG's '?' menu, by pressing the F1 key, or by clicking the  button)

How to reach Texas Instruments

Please select a region.

USA, Canada, Central and South America

Europe, Africa, Middle East

Asia and Australia

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WinTIDIG was developed using **Borland C++** V 3.1 and **Object Windows** [(C) Borland International]. WinTIDIG **SETUP** was developed using Microsoft **Visual Basic** V3.0 [(C) Microsoft Corporation].

General information about WinTIDIG

Please select a topic:

How to use WinTIDIG

Please select a topic:

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Device information

Please select one area of device information. Several topics are available for each of them.

Device functions

Advanced logic families
Advanced Bus Interface functions
Dedicated System Logic functions

Device features

Parameters
Packages

(You can activate the Device Information from WinTIDIG's '?' menu, by pressing the 

+


key combination, or by clicking the

button)

Remarks by the author

WinTIDIG is a software project I have developed to promote Texas Instruments' **Advanced System Logic** circuits (I can't deny it!), but also to give users a lot of fun when using it. (I hope I achieved this objective as well ...)

Comments & suggestions for improvement will be very much appreciated. Please write to:

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(If you liked this software, feel free to donate **$1,000,000** to a charitable organisation of your choice,
or to buy all your future **Advanced System Logic** circuits from Texas Instruments, whichever you prefer!)

What is WinTIDIG ?

WinTIDIG is an information retrieval software for Texas Instruments' **Advanced System Logic** circuits. As such it comprises a data base with (almost) all these circuits.

The data base is grouped into fourteen different Device Ranges, each of which is a separate file on the disk.

The purpose of **WinTIDIG** is to have an easy-to-access '**paperware replacement**' which provides on-line PC support for all information needs a designer, qualification engineer, or other logic user may have when looking for devices or other logic circuit information. While **WinTIDIG** can of course not replace the databook, it is powerful enough to be a much better alternative to 'Pocket Guides', 'Device Selection Guides' etc.

If you are new to WinTIDIG, you may find the 'Device search by name' and 'Quick device list selection' functions most helpful. Both are very convenient to use, and will make looking for application solutions a great deal easier.

The Device Range concept

Because of the differences between the various kinds of circuits in this databank, so-called **Device Ranges** are used, each of which contains several circuits that have a certain common functionality. Examples are '**Bus Interface Circuits**' or '**Gates**'.

Each Device Range comprises many circuits. For further sorting, a sub-criterion is used which is '**Function group**'. The 'Gates' Device Range, for example, comprises AND, OR, NAND and NOR gates, Inverters, and many other function groups. You will find that all devices in a Device Range list are shown one function group after the other.

Only one of the Device Ranges can be kept in the computer memory at a time. A Device Range can be loaded by clicking its name in the 'File' menu or in the menu that appears if the 'Change Device Range' button was clicked.

Note that several things will change in **WinTIDIG** after you loaded a new Device Range:

- The **name** of the new Device Range is displayed in the main window title line of **WinTIDIG**.
- The main screen will show the new Device Range's circuits with their specific parameters. Different kinds of devices will have different parameters. For example, information like the '**tri-state propagation delay**' times makes sense for a **bus interface circuit** but is meaningless for a **gate** as gates don't feature tri-state output capability. Instead, there may be information about the '**Boolean logic**' given for the gate which is of no interest for the bus interface part. And so forth ...
- The new Device Range's name is greyed in the 'File' menu. It cannot be activated again until you've changed to another Device Range.
- The '**Extended device list selection**' submenu in the 'Search' menu will have changed. This again reflects the different device parameters: a new set of selection parameters is required for each Device Range.

Certain **WinTIDIG** functions will only be executed using the Device Range currently active (like '**Quick device list selection**'), others make use of all ranges (like '**Print family data**') or offer the choice between using only the current or all Device Ranges (like '**Print functional index**').

Copying WinTIDIG

WinTIDIG is what is usually called a **freeware** program. This means that **no charge** is due for purchasing and/or using this software.

Copying **WinTIDIG** and all its associated files, either for own backup purposes or to give it to others, is therefore allowed. However, there is one restriction: **charging others for using or copying WinTIDIG is illegal**.

For services like mailboxes, it is permissible to offer the program with all its parts as a **free** download software. This is valid also if the mailbox has a user service fee per time period or a membership fee. However, under no condition may the mailbox operator charge a fee per use or download of **WinTIDIG**.

Users are encouraged to copy the software and distribute it to others, or to recommend to others to get their copy from Texas Instruments.

When **copying WinTIDIG**, make sure not to give viruses any chance !

It is best to use a reliable virus checker software to check your copy.

A word about VIRUSES

Viruses, programmes that attach themselves to other software or make themselves comfortable in system memory and that may cause serious trouble and damage when distributed, have become a real risk for professional computer users.

Texas Instruments (TI) has done its best to eliminate the virus risk from **WinTIDIG**. All virus-infectable files on the disk have been checked for viruses with at least two state-of-the-art virus checkers during the production process.

However, for obvious reasons (100% virus safety will never be technically feasible), **TI cannot assume any liability for any direct or indirect damage or loss of data** caused by any part of **WinTIDIG**.

The user is therefore recommended to take his own virus protection measures if deemed necessary.

What's new ?

If you have been using a version of **TIDIG**, the MS-DOS predecessor of **WinTIDIG**, or even **TIBIC** which is **WinTIDIG**'s 'grandfather', you might be interested in a brief summary of differences between these programs:

Additional functions in WinTIDIG (V3.1) compared to TIDIG (V2.0):

a) As **WinTIDIG** is a WINDOWS software, it features several **user interface elements** that are hard or even impossible to realise in DOS and which have therefore not been included in TIDIG. Examples are the function buttons.

Also, certain methods applied in the user interface have been reworked based on user inputs.

b) One of the functions most often criticised in TIDIG was **the way the user could select components** from the data base. While it allowed selecting from a wide range of different parameters, it was often felt that using the function was rather cumbersome, especially for users not familiar with logic circuits in great detail. In order to maintain the detailed selection capability, the 'old' way of selecting parts is still supported in **WinTIDIG** (it is now called Extended device list selection). In addition, a completely new and much easier alternative, called Quick device list selection, has been added. While somewhat less flexible than the extended selection, it provides **immediate access to a variety of device selection parameters**. As only those parameters / criteria can be chosen which will positively lead to one or more matches in the data base, there is no risk of unsuccessful selections.

c) The print functions have been expanded such that **WinTIDIG** now also **prints functional index lists** (in addition to TIDIG's numerical lists).

d) As graphics functions can be used in **WinTIDIG** (while TIDIG worked only in text mode), it has now been possible to include a display function for **mechanical package data**.

e) **No additional setup** program (other than the basic installation one) is now necessary for **WinTIDIG**. Display and printer installations can be made using Windows Setup, or the WinTIDIG main

menu; the setup for 'handling of N/A information' is now included in the 'Search' menu.

f) The **Help System** has been significantly expanded and improved. Making use of cross references and indexing represents a very quick way to get started with the programme, or to locate particular information.

The big penalty is that three of the four languages that were supported by TIDIG are no longer available (German, French and Italian). This decision was taken in favour of the extensive information system and help texts which could otherwise not have been implemented in a project like this one.

Additional functions in WinTIDIG (V3.1) compared to TIBIC (V1.0):

(In addition to the above)

a) TIBIC did not feature anything comparable to the **Device Range** concept. The only data base supported there was what is now the 'Bus Interface Circuits' Device Range.

b) In the '**File**' menu, you will find a new function called '**Select function group**'.

c) The '**Print family data**' and '**Print numerical index**' functions did not exist in TIBIC.

How to use WinTIDIG: Introduction

Like most other Windows software, **WinTIDIG** often leaves the choice between using the program's menu, a mouse action (like clicking one of the buttons or the left or right mouse key somewhere on the main screen), and a shortcut (pressing a key or a combination of keys) to activate a function.

If you are **new to Windows** and are uncertain about what the above expressions mean, or others used in this Help System, it may be a good idea to read the Windows manual or to start the **Windows tutorial** in the 'Help' menu of the program manager before using **WinTIDIG**. (After starting Windows, click on 'Help' in the second text line of the window, then click on 'Windows tutorial' and follow the instructions given there).

If uncertain how to use this Help System, click on **How to use Help** in the 'Help' menu of this page (second line from top; 'Help').

How to use WinTIDIG: Main screen

The main screen is what you see after you started **WinTIDIG**.

On the main screen, you can display one of these three options:

- **Single device information**
- **Device list information** (left half of list)
- **Device list information** (right half of list)

When starting **WinTIDIG** for the first time, the main screen will be in <device list, left half> display mode. However, **WinTIDIG** will memorise the actual display mode when leaving the program, so when starting it again you will have the same display mode (and will see the same Device Range) you had before leaving.

From the main screen there are several things you can do:

Activate one of the sub-menus: 'File', 'Search', 'Display'

Click one of the buttons

Activate a shortcut

Activate this **Help System**

Actions that will directly change the information displayed on the main screen are:

- Activating '**Single device**' or '**Device list**' in the 'Display' menu will change the display mode. The same can be achieved by pressing function key F7 ; the main screen will toggle between the two display modes. Switching back from single device to device list display mode will always bring you back to the half of the list you had before.

- Clicking on the  button will switch from single display mode or from the right half of the device list to its left half.

- Clicking on the  button will switch from single display mode or from the left half of the device list to its right half.

- Clicking on the  button will switch to single display mode.

- Using the  cursor key will switch to the left half of the device list (only if in device list mode).

- Using the  cursor key will switch to the right half of the device list. (only if in device list mode)

How to use WinTIDIG: 'File' menu

The **File** menu allows you to

Select and load another Device Range
Access the print functions: Print
Setup the printer: Print setup or to

Exit **WinTIDIG**.

Other menus:

'Search' menu
'Display' menu

How to use WinTIDIG: 'Print ...' functions

After activating '**Print ...**' from the 'File' menu (or pressing F5, or clicking the  button), the **Print** dialogue box will appear.

It offers several print options:

Print single device data

Selecting '**Single device data**' in the '**Print what ?**' section. After clicking '**OK**', **WinTIDIG** will print a one-page Product Information sheet that gives a comprehensive overview for the device that is currently active (e.g. full device name, pinning, order codes, certain device parameters, ...).

Print a complete or selected device list

Select '**Device list**' in the '**Print what ?**' section. In the '**Device list options**' section, choose '**Complete list**' or '**Selected list**' (if available). Then click '**OK**'.

WinTIDIG will print a list (one or more pages) giving device codes and description, and all available parameters for the devices in the complete or selected list in the current Device Range.

Note that the '**Selected list**' option will only be available if you selected a device list using the Device search by name, Quick device list selection, Extended device list selection, or Select a function group functions prior to calling '**Print**'.

Print family data

Select '**Device list**' in the '**Print what ?**' section. In the '**Device list options**' section, choose '**List by family**' and determine whether you want to cover all Device Ranges or only the currently active one.

After clicking '**OK**', another dialog will appear which shows the available logic families. Click the one you want to print and click '**OK**'. Note that the options are exclusive, i.e. only one family can be selected.

WinTIDIG will then print a list (one or more pages) similar to the complete or selected list as explained above, but this time only for the logic family you selected.

Print a functional index

Select '**Device list**' in the '**Print what ?**' section. In the '**Device list options**' section, choose '**Functional index list**' and determine whether you want to cover all Device Ranges or only the currently active one.

After clicking '**OK**', **WinTIDIG** will print one or more pages showing the devices sorted by function group. This list provides a quick overview if a particular device function is required.

Print a numerical index

Select '**Device list**' in the '**Print what ?**' section. In the '**Device list options**' section, choose '**Numerical index list**' and determine whether you want to cover all Device Ranges or only the currently active one.

After clicking '**OK**', **WinTIDIG** will print a list (one or more pages) sorted by device number. For each number the list will show the device function, the technologies (= families) in which this function is available or planned, the output type and the number of pins.

The name of the printer to be used is displayed on the right side of the '**Print**' dialog. Use the '**Print setup...**' button if you want to change it.

How to use WinTIDIG: 'Print setup'

Print setup can be accessed from the 'File' menu or by clicking the corresponding button in the Print functions dialog box.

You will see a list of the printers that are installed and available in your Windows system. Select the printer you would like to use for printing from **WinTIDIG** and then click '**OK**' to confirm.

Pressing the '**Setup...**' button leads to another dialog where you can select printer-specific settings (such as paper orientation, print quality, number of copies, ...).

How to use WinTIDIG: 'Search' menu

The **Search** menu allows

- Device search by name
- Quick device list selection
- Extended device list selection
- Select a function group
- Clear a selection
- Define the handling of N/A information

Other menus:

- 'File' menu
- 'Display' menu

How to use WinTIDIG: 'Device search by name'

After activating one of the two submenu functions (**Search this Device Range only** or **Search all Device Ranges**) a dialog box will open where you can input a **device name** or a **search pattern**.

A device name could be '**SN74LS00**' or '**ABT245**' or something like this. (Note that 'SN' or 'SN74' is optional).

A **search pattern** is a combination of parts of a device name with one of these characters:

*****	to substitute any chain of characters,
?	to substitute any single character, and
&	as a placeholder for any family

Examples (the following examples assume that the current Device Range is 'Bus Interface Circuits'):

'**ABT***' would find all members of the ABT family,

'**ABT2??**' would find the ABT240, ABT241, ABT244, ABT245, ABT273 (but not the ABT2244, ABT2245, ...)

'**&2952**' would find the BCT2952, the ABT2952, and the LVT2952 (but not the ABT32952 !!)

Note that there may be some differences between search patterns that appear the same at first glance. For instance,

'**&245**' will find the SN74245, the LS245, S245, ..., but not the ACT16245, the ABT16245, and so on.

'***245**' will find these and also the BCT25245, the ABT32245 and others.

'**?245**' will only find the S245 and the F245 as these are the only '245-type functions with a single-letter family denominator.

After you confirmed '**OK**', **WinTIDIG** will execute the search and will come up with the device that has been searched, or a list of devices if a search pattern is used.

If you activated '**Search all Device Ranges**' (which you can also do by

pressing F2 , or by clicking the  button)**, WinTIDIG** will search the currently active Device Range first and will then search the other Device Ranges one by one. If a hit is encountered, the corresponding Device Range will be loaded and thus becomes the new active one.
Similar to the Quick device list selection and Extended device list selection functions, the result of this function will be a selected list. If you want to return to the unselected device list (i.e. the complete list of all devices in the current Device Range), use the Clear selection function.

These functions can be activated from the 'Search' menu. The '**Search all Device Ranges**' one can also be activated by pressing F2 , or by clicking the  button.

How to use WinTIDIG: 'Quick device list selection'

After activating this function a dialog box will open which offers several selection options. This selection is device-range specific in that the device list selection will only work inside the current Device Range.

In the dialog box you will find nine different sections which allow selecting parameters:

- **Logic family**
- **Function group**
- **Number of bits**
- **Logic function**
- Supply voltage
- **Drive capability** (output current)
- **Type of output**
- Supply current
- **Circuit speed** (propagation delays)

Each of these sections offers several options that can be selected by clicking them with the mouse. **Square** boxes mean that more than one option can be selected; "**Don't care**" will reset all other options in the section if clicked.

Options that are not available for selection (because none of the devices in the present list feature this option) are grayed and cannot be selected. When selecting an option you may notice that others which had been available are suddenly grayed. This is because **WinTIDIG** checks after every single action in **'Quick device list selection'** whether the remaining options still find matching devices in the present list if selected. By this it is made sure that you will always get a meaningful selection result when using this function.

Function group plays a special role in that you are given access to different selection levels here. The first option, "**All ...** (name of Device Range)", leaves all the devices in the current Device Range available for selection. The second option, "**Only ...**" allows you to explicitly choose just one of the function groups in the current Device Range (for instance 'Transceivers' in Device Range 'Bus Interface Circuits'). Lastly, you are also given the option to choose a random function group from all those available in **WinTIDIG**'s data base. After clicking "**Select from all**", the Select a function group dialog box will appear, presenting all the available function groups. If you chose one from another Device Range, **WinTIDIG** will first load it into

memory and then return to the **Quick device list selection** dialog box.

Choosing '**OK**' after you defined all the criteria you are looking for will lead to the selected list being displayed.

If you want to return to the unselected device list (i.e. the complete list of all devices in the current Device Range) or to start a completely new selection, use the Clear selection function.

The '**Quick device list selection**' function can be activated from the 'Search' menu, by pressing the F3 key, or by clicking the  button.

How to use WinTIDIG: 'Extended device list selection'

After activating this function a so-called '**popup**' menu will appear. This menu is device-range specific (and also the device list selection will only work inside the current Device Range), so no complete description can be given here.

The concept is always the same in that the first menu item leads to a submenu where you can choose a **Function** (or more than one if you enter the submenu repeatedly). The second menu item leads to the **Search device name** dialog box described above. However, when leaving this dialog by clicking '**OK**' or '**Cancel**' you will notice that no device search is started. Instead, the popup menu returns.

The following menu items in the popup menu reflect several device parameter selections, for instance **Propagation delay**, **Input current**, **Supply current**, and so forth. They all lead to a submenu where you have the choice of different categories. For example, for 'Supply current' you can select '0 - 1 mA', '0 - 10 mA', ...

All menu items where you have done a selection show a checkmark in front of the item name. If you activate its submenu again and click on an already checkmarked selection, the checkmark will be removed, so you have de-selected the corresponding parameter.

The last menu item is always **Start selection**. You will now probably guess what the function does: you can select device parameters first and will then get a list only of those parts that meet your selected criteria.

Note that it is not only possible but also **strongly advisable to leave some of the selection criteria open**. Otherwise you will hardly ever get any result as it is very likely to set up requirements no device can fulfil. Try to concentrate only on those you really need.

Let's try an **example** (the following examples assume that the current Device Range is 'Bus Interface Circuits'):

> For a new system development, you are looking for a transceiver (click '**Transceiver**' in the 'Function' submenu). Your design demands a part that features true logic and 3-state output capability (click these in the '**Logic**' and '**Output**' submenus respectively). System timing doesn't allow much for the part's propagation delay, so you click '0 - 5 ns' in the '**Propagation delay, active**' submenu.
>
> If you now click '**Start selection**', you will get a list of several different parts meeting your criteria. At this point you may want to refine your selection. No problem: just activate '**Select device**

list' again and you will see that all your selected criteria are still valid, so that you can add or modify criteria. In our example, you could for instance select '**Device**' and enter the search pattern 'ABT*'. After clicking '**Start selection**' again, you will find that only the ABT devices are left from the previous list.

If your selection is not successful, i.e. none of the devices in the current Device Range meets your selection criteria, **WinTIDIG** will attempt to give some advice what you could change. It will for example tell if a certain combination of parameters does not make sense. If **WinTIDIG** lacks a good explanation why the selection failed, it will give you an overview of those parameters where most devices failed during the selection, and will suggest to reduce the number of selected criteria.

If you want to return to the unselected device list (i.e. the complete list of all devices in the current Device Range) or to start a completely new selection, use the Clear selection function.

The '**Extended device list selection**' function can only be activated from the 'Search' menu.

How to use WinTIDIG: 'Select a function group'

After activating this function a selection box will appear that shows you all the different **function groups** in **WinTIDIG**'s data base (i.e. the functions groups from other Device Ranges will also be shown). You can select one of them by double-clicking it with the left mouse key or by selecting it and activating '**OK**'. The box will close and the new function group will be loaded.

Similar to the Quick device list selection function, the result of this function will be a selected list. If you want to return to the unselected device list (i.e. the complete list of all devices in the current Device Range), use the Clear selection function.

The '**Select a function group**' function can be activated from the 'Search' menu or by clicking the  button.

How to use WinTIDIG: 'Clear a selection'

After you have executed the 'Device search by name', 'Quick device list selection', 'Extended device list selection' or 'Select a function group' function (which all result in a selected list if successful), you may want to return to the unselected device list (i.e. the complete list of all devices in the current Device Range).

You can do this by activating '**Clear selection**' from the 'Search' menu, by pressing the F4 key, or by clicking the  button.

How to use WinTIDIG: 'Handling of N/A information'

In the Quick device list selection and Extended device list selection functions where you can select devices by parameter, there is one problem associated with devices which are currently under development as well as some other device groups: certain **information may be missing** (value given is '-') or **may not be applicable** (empty value, e.g. tristate power consumption of Open Collector circuits). This is called '**N/A**' = '**not applicable**' .

Depending on the purpose of the selection, some people may want these devices also to be included in the selected list in case all other selection criteria are met. In other cases, these devices are of no help, so one would prefer not to have them in the selected list to avoid distraction.

The '**Handling of N/A information**' item in the 'Search' menu allows to determine how these devices shall be handled.

How to use WinTIDIG: 'Display' menu

The **Display** menu allows you to

Display a **single device** / a **device list**

This function toggles between the two display mode each time the menu item is selected. (See also main screen).

Display **package information**

After activation an info box will appear that shows the current device's pinning (only if less than 64 pins), the available package options and their order codes. You can click onto the buttons showing the package options to show the package's mechanical data (option not available for Dual In-Line Package, DIP).

Display **mechanical data** for a certain package type

After selecting the package type in the submenu you will get the mechanical data in an info box.

Display information about the **Symbolisation** system

After activation an info box will appear that shows and explains Texas Instruments' Symbolisation system.

Other menus:

'File' menu
'Search' menu

How to use WinTIDIG: 'Package information'

After activation from the 'Display' menu, by pressing F9, or by clicking the

 button, the package information info dialog shows the current device's **pinning**, available **package options** and their **order codes**. You can click the package option buttons to show the package's mechanical data.

Note that for some devices (e.g. for those with more than 64 pins) the pinning information may not be available. Also, some of the package buttons cannot be activated as the corresponding mechanical data are not available (e.g. for Dual In-Line Packages, DIP).

How to use WinTIDIG: Buttons

On the main screen of **WinTIDIG** you will see several buttons that can be activated ('clicked') with the mouse.

These buttons provide a way to quickly activate some of the program functions.

Change Device Range

Displays a 'popup menu' which allows you to select and load another Device Range.

Main screen display mode

Changes to device list display mode (left side).

Main screen display mode

Changes to device list display mode (right side).

Main screen display mode

Changes from device list display mode to single device list display mode.

Device search by name [all Device Ranges]

Activates device search (Same as if  was pressed.)

Quick device list selection

Activates quick device list selection. (Same as if  was pressed.)

Select function group

Activates function group selection.

Clear selection

Clear all selections; complete Device Range will be displayed again. (Same as if  was pressed.) This button is only available if one of the selection functions has been executed.

Package information

Shows the currently selected device's package information. (Same as if  was pressed.)

Mechanical data

Displays a 'popup menu' which allows you to select a package type and display its mechanical data.

Symbolisation

Displays a window informing about Texas Instruments' symbolisation code system.

Print functions

Displays a 'popup menu' which shows the different print options and allows to select and execute one of them.

Device information

Activates the Help System to display device information: functions, parameters, packages. (Same as if  +  was pressed.)

Help system

Activates the main index screen of the Help System. (Same as if  was pressed.)

How to use WinTIDIG: Shortcuts

Shortcut means a key or a combination of keys which can be used, for example instead of clicking a menu item, to activate a function.

WinTIDIG supports these shortcuts:


Activates the main index screen of the Help System.


Activates device search by name.


Activates quick device list selection.


Clears all selections; complete Device Range will be displayed again.


Activates the Print functions dialog.


,  ,


Toggles the main screen display between **single device** and **device list** modes.


Shows the currently selected device's pinning and ordering information.


Activate the main menu (Windows function).


+  Activates the Help System to display device information: functions, parameters, packages.


Changes from the right half to the left half of the device list on the main screen. No function in single device display mode.

Changes from the left half to the right half of the device list on the main screen. No function in single device display mode.

Move inside the current Device Range.

Note that shortcuts can only be used if you are on the main screen of **WinTIDIG**. In all other program states, you need to return to the main screen first.

Advanced logic families

Please select a topic.

ABT, Advanced BiCMOS Technology
ACL, Advanced CMOS Logic
BCT, BiCMOS Technology

LV, Low-Voltage HCMOS (3.3V logic)
LVC, Low-Voltage CMOS (3.3V logic)
ALVC, Advanced Low-Voltage CMOS (3.3V logic)
LVT, Low-Voltage BiCMOS Technology (3.3V logic)

Advanced Bus Interface functions

Please select a topic.

Dedicated System Logic functions

Please select a topic.

Parameters

Please select a topic.

Packages

Please select a topic.

DIP, Dual In-line Package
PLCC, Plastic Leaded Chip Carrier
QFP, Quad Flat Package
SOIC, Small Outline IC
SSOP, Shrink Small Outline Package
TQFP, Thin Quad Flat Package
TSSOP, Thin Shrink Small Outline Package

WIDEBUS
WIDEBUS+
Shrink-WIDEBUS

ABT, Advanced BiCMOS Technology

This **0.8-micron BiCMOS** technology offers shortest propagation delays with very low power consumption and -32/64 mA drive capability.

The **SN74ABT** family comprises numerous bus interface functions [standard, WIDEBUS and WIDEBUS+], flip-flops and latches, and special devices like clock distribution circuits, memory drivers, BTL™ drivers or highest-performance FIFO memories.

ACL, Advanced CMOS Logic

This **one-micron EPIC CMOS** technology offers short propagation delays (comparable with SN74F circuits) with lowest power consumption and -24/24 mA drive capability.

There are two different groups of circuits, **74AC** devices which have CMOS-level-compatible inputs and **74ACT** devices which have TTL-level-compatible inputs.

The **74AC/ACT** family comprises numerous gates, flip-flops and latches, MSI- and bus interface functions [standard and WIDEBUS], and special devices like clock drivers, memory drivers or high-performance FIFO memories.

For the standard functions (74AC/ACT11xxx), Texas Instruments has provided so-called '**Multiple Center-Pin**' arrangement for the V_{CC} and GND power supply pins in order to reduce the devices' noise during output switching.

BCT, BiCMOS Technology

This **1.5-micron BiCMOS** technology offers short propagation delays (comparable with SN74F circuits) with low power consumption and -15/64 mA drive capability.

The **SN74BCT** family comprises numerous bus interface functions, flip-flops and latches, and special devices like BTL™ drivers.

It also offers several **SN74BCT25xxx** low-impedance line drivers which allow fast signal transmission even in highly-loaded bus systems. (IWS drivers)

3.3V logic families

Similar to the 5-Volt range where there are three different 'speed classes' (slow: SN74LS/SN74HC, medium: SN74F/SN74BCT/74AC, fast: SN74ABT), Texas Instruments offers logic families for all three speed ranges which are designed for operation at a 2.7 - 3.6 V supply voltage. These are SN74LVxxx, SN74LVCxxx , SN74ALVCxxx and SN74LVTxxx.

LV, LVC and ALVC are pure CMOS technologies while LVT is a high-performance BiCMOS technology. Texas Instruments has closed alternate-source agreements with other companies for all three families.

LV, Low-Voltage HCMOS (3.3V logic)

Texas Instruments' **SN74LVxxx** family is a series of 3 micron CMOS devices that support 2.7 - 3.6 V supply voltage.

Speed is comparable to the 5-Volt **SN74HCxxx** series. Output drive currents are +/- 6 or +/-8 mA.

LVC, Low-Voltage CMOS, and ALVC, Advanced Low-Voltage CMOS (3.3V logic)

Texas Instruments' **SN74LVCxxx** family is a series of **0.8 micron CMOS** devices that support 2.7 - 3.6V supply voltage.

Speed of LVC devices is comparable to (while somewhat faster than) the 5-Volt SN74Fxxx or 74ACxxx series. Output drive currents are +/- 24 mA.

The **SN74LVC16xxx** WIDEBUS circuits are 3.3V equivalents to the 5V 74AC/74ACT16xxx devices.

TI also offers **0.6 micron SN74ALVC16xxx** 'Advanced Low-Voltage CMOS' versions which offers similar features but extremely short propagation delays (Tpd, typ = 2ns). These parts are only available in WIDEBUS versions.

LVT, Low-Voltage BiCMOS Technology (3.3V logic)

Texas Instruments' **SN74LVTxxx** family is a series of **0.8 micron BiCMOS** devices that support 2.7 - 3.6 V supply voltage as well as full interfacing capabilities to 5 Volt signals.

Speed is comparable to the 5-Volt SN74ABT series. Output drive currents are -32/64 mA.

The **SN74LVT16xxx** WIDEBUS circuits are 3.3V equivalents to the 5V SN74ABT16xxx devices.

A special feature of this series is the Bus Hold circuit that has been implemented on all bus inputs. It will prevent the connected bus from floating (by holding the last logic level) if all drivers connected to the bus are switched into the high-impedance mode.

WIDEBUS

To address the ever increasing pressure for higher packing density and to ease the design of wide-word data buses, Texas Instruments introduced the **ACL WIDEBUS** series in 1989.

These devices are 16-, 18- and 20-bit bus interface functions that are based on a **48-pin or 56-pin SSOP** (Shrink Small Outline Package). Because of the small area required for this package, designers can save up to 50% of PCB space if using a WIDEBUS part instead of two standard devices.

Today, Texas Instruments offers four different technologies, Advanced CMOS (SN74AC16xxx, SN74ACT16xxx) , Advanced BiCMOS (SN74ABT16xxx), Low-Voltage Advanced CMOS (SN74ALVC16xxx) and Low-Voltage Technology (SN74LVT16xxx) in WIDEBUS versions.

In addition, various functions are being offered as **Shrink-WIDEBUS** versions. The package used here is the TSSOP (Thin Shrink Small Outline Package) which offers even smaller outline dimensions together with a package height of only 1.1 mm.

WIDEBUS+

The **Widebus+** series of 32-/36-bit wide bus interface functions has been introduced by Texas Instruments in 1992.

The parts are denominated **SN74ABT32xxx**. They are based on the Advanced BiCMOS process technology (0.8 micron), and offer same output currents and similar speed and power characteristics as the 16-/18-/20-bit ABT Widebus devices.

All Widebus+ circuits are packaged in 80-pin or 100-pin TQFP packages. Thus, they provide the smallest solution for a 32- or 36-bit single-device bus interface that is available in the market today.

BTA, Bus Termination Arrays

These 8- to 16-bit **arrays** or **networks** offer improved signal characteristics in certain line termination applications. Arrays are multiple diodes with a common GND, networks are multiple diodes with common GND and VCC.

The **SN74S105x** devices are Schottky diode arrays / networks while the **SN74ACT107x** devices are diode networks that also contain a dedicated bus hold circuit to ease the design of CMOS buses.

No data are provided for these devices in this databank, so please contact any Texas Instruments office or distributor if you would like to receive further information.

BTL, BackplaneTransceiver Logic™

The **IEEE 1194.1-1990 Specification** sets a standard for transmission signal levels that are based on the so-called **BTL** (Backplane Transceiver Logic) proposal. Low-level voltage is approximately one Volt, High-level 2.1 Volts. This taken together with trapezoidal signal waveforms improves the noise characteristics of such systems.

The **Futurebus+** specification defines a protocol standard for high-performance backplane-based computing that permits architectural consistency across a broad range of computer products. It provides a 64-bit architecture with a compatible 32-bit subset and data path extensions to 128 or 256 bits. For further information about Futurebus+, refer to the **IEEE 896.1-1991** standard description.

Texas Instruments offers chipsets and also several **SN74FB2xxx** bus interface functions which support the BTL / Futurebus+ standards. The latter ones are based on ABT technology.

CBT, Crossbar Switch Technology

In certain applications there is a need for an interface function which can be switched into the tri-state mode so that it separates the two connected buses. If there is no need for additional line buffering and driving, standard bus interface devices (for instance an SN74xx245) can do the job but are not ideal as they will add propagation delay, consume additional power, and so forth.

For these applications Texas Instruments has developed the **SN74CBTxxx** series of crossbar switches. These CMOS circuits combine the described functionality with almost-zero power consumption and <250 ps active propagation delay. Examples are the **SN74CBT3244**/**3245** ('244/245 function), the **SN74CBT3383** and the **SN74CBT3384**.

Also, there are several **SN74CBT16xxx** WIDEBUS crossbar switch versions.

IWS, Incident Wave Switching devices

Incident Wave Switching means to switch a signal on a transmission line with the first (incident) wave instead of having to wait for reflected waves before the line is switched.

The **SN74BCT25xxx** and **SN74ABT25xxx** IWS circuits are designed such that they can achieve IWS even if a line with an impedance of only 25 Ohms is to be driven. This is feasible because of the very high drive currents (-80/188 mA) of these circuits. They combine the low power consumption of the BCT and ABT series with high circuit speed.

These circuits thus assure fast data transmission even in very highly-loaded bus interface environments.

Memory drivers

Driving memories or memory arrays usually requires special means to prevent the occurence of excessive over- and undershoots. This is usually realised by adding series resistors to the outputs of the memory line drivers ('**Series termination**').

To ease such applications and to improve the performance, Texas Instruments has developed several Memory Drivers which feature integrated 25-Ohm series output resistors. There are various 8- to 16-bit (WIDEBUS) versions offered in BCT and ABT technologies (**BCT2xxx**, **ABT2xxx**, **ABT54xx**, **ABT162xxx**).

UBT, Universal Bus Transceivers

The concept of a **universal bus transceiver** is to provide a bus transceiver that supports bidirectional transparent, latched, and clocked operation modes. This allows the flexible use of these UBT's both in high-performance applications and in systems where various functions are to be performed by such a device.

Several UBT's are available in ABT, LVC and LVT technologies. Examples are the **ABT16500**/**501**, **ABT16600**/**601** or the **ABT32500**/**501**.

CDC, Clock Distribution Circuits

With the growing use of processors clocked with high frequencies, there is an intensified need to assure distribution of clock signals across the system with a tight, low Skew time. This has lead to the introduction of dedicated clock distribution circuits (**CDCxxx**) which feature a guaranteed maximum value of one or various skew time parameters.

Texas Instruments offers several clock drivers either as

clock line drivers
(some of which feature programmable signal inversion) or as

clock signal dividers and drivers.

FIFO, First-In First-Out memories

Having been a supplier of 'small' First-In First-Out (FIFO) Memories for a long time, Texas Instruments expanded its product range such that it now also covers a broad spectrum of wide (**up to 36 bits**) and deep (**up to 4 kB**) high-performance FIFO's.

These are based on Advanced CMOS (**SN74ACT22xx**, **SN74ACT36xx**, **SN74ACT72xxx**, **SN74ACT78xx**) or Advanced BiCMOS (**SN74ABT78xx**) technologies, and offer speed versions **up to 80 MHz**.

Most of these high-performance FIFO's are being offered in both **strobed** and **clocked** versions. Basically, a strobed FIFO which is the 'classical' type operates with handshake signals indicating that data have been read or written, while a clocked FIFO operates 'quasi-synchronously' as both sides of the FIFO have independent, continuously-running clock signals that can be synchronised to different system clocks, for example. (See also Flags)

Special 1-bit wide and 32-/36-bit wide FIFO versions are also available whose architecture is tailored for high-performance **Telecom and DSP/Internetworking** applications.

JTAG/SCOPE testability devices

Texas Instruments has released several BCT, ABT and ACL circuits (8-, 16-, 18-bit) that support the **IEEE 1149.1** '**JTAG**' testability standard. These so-called **SCOPE** ('System Controllability and Observability Partitioning Environment') devices all use device numbers starting with '8xxx' or '18xxx' [SCOPE WIDEBUS parts].

Some special SCOPE devices like the **SN74ACT8990** Test Bus Controller or the **SN74ACT8994** Digital Bus Monitor are not contained in this databank. Please contact any Texas Instruments office or distributor if you would like to receive further information.

Bus Hold

All SN74LVT series (3.3 Volt logic) devices, and all the 32-/36-bit **SN74ABT32xxx** WIDEBUS+ devices feature a Bus Hold circuit provided on all inputs that makes sure a bus that is connected to these inputs will not float if the bus goes into the high-impedance (Tristate) mode.

A similar feature is also implemented in the **SN74ACT107x** bus hold and termination circuits (see 'BTAs').

Flags

Some or all of these 'flags' are usually provided in FIFO memories. They perform as signal outputs indicating the load status of the FIFO memory.

Empty and **Full** indicate that no data are available in the FIFO memory (Empty) or that the FIFO memory is completely filled with data (Full). **Half** indicates that 50 percent of the total FIFO memory space is filled with valid data.

Programmable flags allow a user-defined setting of the percentage of memory space usage at which the flag gets activated. Thus, 'almost full' or 'almost empty' flags can be realised, for example.

Input current

The value represents the I_I data input current. This is the value at maximum input voltage for LS, S, ALS, AS, F or BCT circuits. For CMOS families, i.e. HC, HCT, AC, ACT, LV and LVC, and for the ABT and LVT BiCMOS devices, the values for $V_I=V_{CC}$ and $V_I=0$ are identical.

Unless otherwise stated in the datasheet, the following measurement conditions apply:

- V_{CC}=max,	V_I=7.0V	for LS, ALS, AS, F
- V_{CC}=max,	V_I=5.5V	for S, BCT
- V_{CC}=6V,	$V_I=V_{CC}$ or 0V	for HC
- V_{CC}=5.5V,	$V_I=V_{CC}$ or 0V	for HCT, AC, ACT, ABT
- V_{CC}=3.6V,	$V_I=V_{CC}$ or 0V	for LVT.

Further information on the particular circuit is given in the device datasheet, the

Bus Interface Circuits Application and Data Book

and in the family-specific databooks from Texas Instruments.

Input threshold and hysteresis

Input threshold is the voltage level at which the input of a logic circuit will switch the device from one logic state to the other.

Typical values at V_{CC} = 5V are

1.0 V for TTL and LS,
1.4 V for S, ALS, F, AS,
1.5 V for HCT, ACT, BCT, ABT, LV, LVC and LVT, and
2.5 V for HC and AC devices.

In addition, all AC/ACT, ABT, LVC, LVT, and also some BCT circuits feature a 100-200 mV **input voltage hysteresis** to improve the circuits' noise characteristics. Note that several special devices are being offered that feature a '**Schmitt-trigger**' characteristic, i.e. a much higher input hysteresis.

The input threshold voltage levels are not tested nor guaranteed for any technology. While they should be considered for system noise considerations, it is not at all advisable to consider signals that violate the **V_{IL}** or **V_{IH}** specifications as 'safe' even if they still do not exceed the threshold voltage.

Output current

The values represent the I_{OH} and I_{OL} maximum data output currents. For transceiver circuits, two pairs of values are given for the A and B outputs, respectively.

Further information on the particular circuit is given in the device datasheet, the

Bus Interface Circuits Application and Data Book

and in the family-specific databooks from Texas Instruments.

Power On Demand (POD)

The patented **Power on demand** circuit which is implemented in most ABT WIDEBUS, LVT WIDEBUS and ABT WIDEBUS+ circuits provides an **output-load-controlled I_{CCL}** value.

It reduces the circuits' power consumption significantly if the output loading is low (for instance if only 24 mA instead of the nominal 64 mA flow through the output stage). As a result, a 16-bit ABT WIDEBUS circuit, for example, will typically consume significantly less power under standard output load conditions than the two standard ABT octal devices it can replace.

Propagation delays

The following values may be given in the databank:

Active:

T_{PLH} (L-to-H propagation delay)
T_{PHL} (H-to-L propagation delay)

T_{PD} = 1/2 * (T_{PLH} + T_{PHL})

Tristate:

T_{PZH} (Z-to-H enable delay)
T_{PZL} (Z-to-L enable delay)
T_{PHZ} (H-to-Z disable delay)
T_{PLZ} (L-to-Z disable delay)

T_{EN} = 1/2 * (T_{PZH} + T_{PZL})
T_{DIS} = 1/2 * (T_{PHZ} + T_{PLZ}).

Load circuit, voltage waveforms, and further information on the particular circuit are given in the device datasheet, the

Bus Interface Circuits Application and Data Book

and in the family-specific databooks from Texas Instruments.

Pulse width, setup & hold time

Pulse width (duration) is the time interval between specified reference points on the leading and trailing edges of the pulse waveform.

Setup time is the time interval between the application of a signal at a specified input terminal and a subsequent active transition at another specified input terminal.

Hold time is the time interval during which the signal is retained at a specified input terminal after an active transition occurs at another specified input terminal.

Skew times

Skew time is the maximum difference between two signals in a device or a system. Skew times are given as guaranteed maximum parameters in clock distribution circuits.

There are various definitions:

Input skew is the variation of propagation delay to one output from different input signals.

Output skew is the variation between different outputs driven by the same input signal.

Pulse skew is the variation of the H-L and the L-H propagation delay on one output. This determines the rectangularity of the signal.

Sometimes a fourth skew time is referenced to as '**package skew**'. This is the variance of propagation delay across different devices, i.e. the difference between $T_{PD,min}$ and $T_{PD,max}$ as given in the datasheet.

Supply current

The values represent the maximum total circuit current, **I_{CC}**.
The active mode value **$I_{CC,act}$** is given by

- 1/2 * (I_{CCH} + I_{CCL}), V_{CC}=5.5V for LS, S, ALS, AS, F, BCT, ABT
- 1/2 * (I_{CCH} + I_{CCL}), V_{CC}=3.6V for LV, LVC, LVT
- I_{CC}, V_{CC}=6V for HC and HCT
- I_{CC}, V_{CC}=5.5V for AC and ACT.

The tristate mode value **$I_{CC,tri}$** is given by

- I_{CCZ}, V_{CC}=5.5V for LS, S, ALS, AS, F, BCT, ABT
- I_{CCZ}, V_{CC}=3.6V for LVT
- I_{CCZ}, V_{CC}=6V for HC
- I_{CCZ}, V_{CC}=5.5V for HCT, AC, ACT.

Delta I_{CC} is the increase in supply current for each input that is at a TTL voltage level rather than 0V or V_{CC} in case of HCT, ACT, ABT and LVT circuits. Total circuit current will therefore increase if the inputs are driven by TTL-level signals.

Load conditions for the single logic families are shown in the device datasheet, the

Bus Interface Circuits Application and Data Book

and in the family-specific databooks from Texas Instruments.

Supply voltage

The range represents the family-specific maximum allowable supply voltage swing.

This is:

- 4.75	- 5.25	V	for	LS, S
- 4.5	- 5.5	V	for	ALS, AS, F, HCT, ACT, BCT, ABT
- 2	- 6	V	for	HC
- 3	- 5.5	V	for	AC
- 2.7	- 3.6	V	for	LV, LVC, LVT.

Exceptions to these value ranges are possible.

No electrical or switching characteristics are specified for AC circuits at V_{CC} < 3V. Operation between 2V and 3V is not recommended, but within that range a device output will maintain a previously established logic level.

Further information on the particular circuit is given in the device datasheet, the

Bus Interface Circuits Application and Data Book

and in the family-specific databooks from Texas Instruments.

DIP, Dual In-Line Package

The **Dual In-Line Package** is being offered as one option for most of the SN74... standard logic and bus interface functions.

Its lead pitch is 2.54 mm (100 mil), and its body width is 375 mil. The package denominator used by Texas Instruments is '**N**' for up to 20 pins and '**NT**' for 24 pins.

SN74LVxxx, SN74LVCxxx, SN74LVTxxx and SN74CBTxxx devices (as well as several special functions) are not being offered in DIP.

PLCC, Plastic Chip Carrier

The **Plastic Chip Carrier Package** is being offered as one package option for several FIFO memories and some other logic circuits contained in this databank.

The lead pitch is 1.27 mm (50 mil). Available pincounts are 20, 28, 44, 68 and 84. The package denominator used by Texas Instruments is '**FN**'.

QFP, Quad Flat Package

The **Quad Flat Package** (52-pin) is being used for all the SN74FB2xxx Futurebus+ transceivers and for some special circuits contained in this databank.

The lead pitch is 0.65 mm (25.6 mil). The package denominator used by Texas Instruments is '**RC**'.

SOIC, Small Outline IC

The **Small Outline IC** is being offered as a package option for most of the SN74.. standard logic and bus interface functions.

Its lead pitch is 1.27 mm (50 mil). The package denominator used by Texas Instruments is '**D**' for up to 16 pins, '**DW**' for 20, 24 and 28 pins.

SSOP, Shrink Small Outline Package

The **Shrink Small Outline Package** has initially been introduced in 48- and 56-pin versions with a 0.635 mm (25 mil) lead pitch for the WIDEBUS series functions. The package denominator used by Texas Instruments for these is '**DL**'.

Meanwhile, there are also smaller pincount (8- to 28-pin, '**DB**') versions available for many standard devices.

TQFP, Thin Quad Flat Package

The **Thin Quad Flat Package** is being used for all the **SN74ABT32xxx** WIDEBUS+ circuits and for some of the Clock Distribution Circuits and FIFO memories contained in this databank.

The lead pitch is 0.5 mm (19.7 mil) for the 64-, 80- and 100-, and 0.4 mm (15.7 mil) for the 120-pin versions. Outline dimensions are 12x12 mm (470x470 mil) for the 64-pin, 14x14 mm (550x550 mil) for the 80-pin, and 16x16 mm (630x630 mil) for both the 100- and the 120-pin versions. The package denominators used by Texas Instruments are '**PM**', '**PN**', '**PZ**' and '**PCM**'.

In case of the **64-pin** version, there is also an even thinner **TQFP** version denominated '**PAG**'. This package is 1.2 mm high, versus 1.5 mm for the '**PM**' version.

TSSOP, Thin Shrink Small Outline Package

The **Thin Shrink Small Outline Package** has initially been introduced in 8- to 28-pin versions with a 0.65 mm (25.6 mil) lead pitch. The package denominator used by Texas Instruments for these is '**PW**'.

Texas Instruments has also released 48- and 56-pin TSSOP packages (package denominator '**DGG**') for the so-called Shrink-WIDEBUS 16-bit devices (SN74AC/ACT16xxx, SN74ABT16xxx, SN74LVC16xxx, SN74ALVC16xxx, SN74LVT16xxx).

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