
The Virtual PMU

VPMU User Information

Force Range
 100 10 1 mV V

Force Value
Coarse: 1-10, Fine: 0-0.1

Measured Result
3.350V

Limits
PASS
Fail LT 2.4V

Test Results
PASS
VDD: ✓
Pins to Test: ✓
Preconditioning: ✓
Force Value: ✓
Fail GT Value: ✓
Fail LT Value: ✓

Specification						
Test Name	Description	Test Conditions	Min	Max	Units	Passed
VOH	Output HIGH voltage	VDD = 4.75V, IOH = -5.25mA, All outputs	2.4		V	✓

Precision Measurement Unit
Web Based Simulator

Using the Virtual PMU

To use the VPMU insert the CDROM, the VPMU control panel will auto-start. You can manually start the application by clicking on the CD_Start.exe file located on the CDROM.

Exercise won't start:

Some Popup blockers or Security software may not permit your browser to launch the VPMU exercises. If the VPMU control panel, or the individual exercises will not start you will need to disable your security software or set your software control to allow this particular link to run.

Save to Disc:

To Save this complete program interface and all of it's components including the VPMU Exercises to your local hard drive, click the "Save To Hard Drive" button on the right side of the control panel window, then select all of the files, right click and select "copy". Paste them to a location you can remember such as your Desktop or a folder you can remember such as "My Documents/VPMU". To run this application from your hard drive once you have copied it, click the CD_Start.exe program file to launch the control panel. You can also right click the CD_Start.exe file and select "Send To Desktop>Create Shortcut" so you can access it anytime directly from your desktop.

The Purpose of the VPMU

The VPMU exercises will improve your ability to interpret DC specifications, and will verify your knowledge of the various DC test methods. For each DC parameter you are required to correctly program all of the conditions needed to successfully implement the test. The DC test is then executed and a Pass/Fail result is displayed. Using the VPMU is very interactive and will reinforce your understanding of each DC test, and will also get you accustomed to programming the test system hardware. The DC tests include:

VOH – Voltage Output High
VOL – Voltage Output Low
IDD Gross Current
IDD Dynamic
IDD Static
IIH – Input Leakage Current High
IIL – Input Leakage Current Low
IOZL – Current Output High Impedance – Low
IOZH – Current Output High Impedance – High
IOS – Output Short Circuit Current
Opens & Shorts

As you read the help file, be sure to work through the VOH exercise. This Help file will provide step-by-step information on how to complete the VOH exercise. The remaining DC Test exercises are similar, but you will need to read the Specification section carefully for each parameter and then select the proper conditions for each test. Once the conditions are defined, you will Run the test and the VPMU will provide test results based upon your settings. If you have selected all of the proper conditions the test will pass, otherwise the test will fail and the VPMU will indicate the improper settings.

The last page of this document contains a work sheet for recording the measured result of each test. Be sure to record your answers as you complete each exercise.

The User Interface

The mouse is used to set parameters on the VPMU. Whenever the mouse is over an active control the cursor changes to a pointing finger. Click on the control to change its setting.

If the control is a button, e.g. VDD, Pins or Preconditioning, clicking on it brings up a list of settings. Choose the setting given in the Test Conditions section of the Specification, if the information is not included in the Specifications window, you will need to read the test method in the “*Fundamentals of Digital Semiconductor Testing*” text, not all conditions are defined in device specifications.

If the control is a Force value or Limit value, you must select polarity and adjust the range and value setting with the knobs and buttons in the Value Setting panel. This will be explained later in step-by-step instructions.

Using the mouse

Adjust a button setting by clicking on the button. If it is a radio button such as the Voltage/Current or Positive/Negative buttons, clicking once selects it. If it is a VDD/Pins/Precond button, clicking it displays a list of options; choose the one given in the Test Conditions section of the Specification.

Adjust a knob or slider with the mouse by clicking on it and moving the mouse while holding down the left mouse button.

Getting Started

To set the conditions for the DC test shown in the Specification window you will set:

1. The value of VDD
2. The pins to be tested for the selected test
3. How the device will be preconditioned prior to performing the test
4. The value to be forced on the pins being tested:
 - a. The force function--whether you will force voltage or current on the pins being tested
 - b. The force range--the best range for setting the force value (e.g. if you need mA, the uA range will not provide enough current)
 - c. The force polarity--whether the force value is positive or negative (with respect to the DUT)
 - d. The force value—the amount of voltage or current to be forced
5. The pass/fail limits (Fail Greater Than and/or Fail Less Than)
 - a. The limit to be set--Fail GT or Fail LT
 - b. The limit range--the best range for setting the limit value
 - c. The limit polarity--whether the limit value is positive or negative
 - d. The limit value--the point above which (for Fail GT) or below which (for Fail LT) the test will fail
6. Next, run the test and examine the results

The VOH specification is used as an example throughout this Help file.

From the VPMU control panel, select the first VPMU exercise which is the VOH test. The following instructions will take you through the process of using the VPMU for this exercise.

Specification						
Test Name	Description	Test Conditions	Min	Max	Units	Passed
VOH	Output HIGH voltage	VDD = 4.75V, IOH = -5.25mA, All outputs	2.4		V	<input type="checkbox"/>

Before programming the VPMU, review the device specification for the DC test as displayed in the Specification window. This example uses the VOH specification; notice that VDD must be set to 4.75 volts. The VOH test method states that the pins under test must be preconditioned to a logic one state and the device specification states that all output pins will be tested.

During the VOH test, the VPMU will force -5.2mA of current and the VOH voltage will be measured. A pass/fail limit must be set to fail if the measured voltage is less than 2.4 volts.

Setting the Pins



To set the VDD supply voltage for the DUT:

VDD: Click the VDD button and select the proper value of VDD for the DC test as displayed in the Specification window. This value may be found in the device specification or it may be defined in the test method description in the “*Fundamentals of Digital Semiconductor Testing*” text. The value of VDD, as a test condition, is not always defined in the device specification.

Example: for VOH set VDD to "Min (4.75V)"

To set which DUT pins are to be tested for this DC test:

Pins: Click the Pins button. From the Pins menu select the appropriate pin or pin group to be tested. Think about the test being performed and which DUT pins should be tested for that particular test.

Example: for VOH select "All Outputs"

To set the proper preconditioning of the DUT. Remember that many DC tests require setting the inputs or outputs to a specific logic state before the test is performed. Consider the test being performed and look at the specification to determine how the pins under test should be condition.

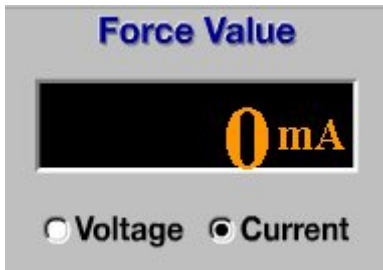
Precond: Click the Precond button. From the Preconditioning menu select the proper preconditioning for the test as displayed in the Specification window.

Example: for VOH select "Set Outputs High"

To verify your selections, you can click the appropriate button and your selection will be shown with a check mark. Once VDD, Pins and Preconditioning have been selected, the PMU forcing conditions must be programmed.

Setting the Forcing Conditions

The PMU must be programmed to supply the correct value of voltage or current for any given test. Follow these steps:



1. Select the forcing mode.

Force Mode: Click on either Voltage or Current to select the proper forcing mode. Note that if you change the force mode after setting a force value and/or limits, the force value and limits will be cleared.

Example: for VOH select Current, specification indicates forcing -5.2mA current



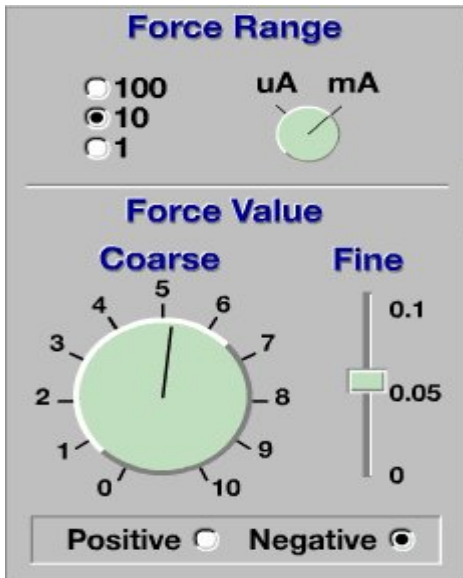
2. Set the forcing range with the 1, 10 or 100 Range buttons and the magnitude of the range $\mu\text{A}/\text{mA}$ or mV/V Range Knob

Force Range: Click to select either the 1, 10 or 100 range. This sets the maximum value that can be programmed with the Coarse and Fine knobs

Example: for VOH select "10", specification indicates forcing -5.2mA

Range Knob: If the PMU is in current mode, click on the "uA" or "mA" knob. If the PMU is in voltage mode, click on the "mV" or "V" knob. Choose the proper selection based on the Test Conditions displayed in the Specification window.

Example: for VOH select "mA"



3. Select the polarity of the forced value.

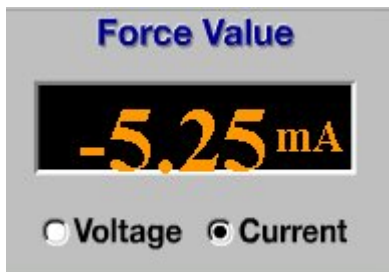
Polarity: click either Positive or Negative to select the polarity of the forcing value.

Example: for VOH select "Negative"

4. Set the exact value of the forced voltage or current.

Coarse: Click on the Coarse adjustment knob and drag the outside of the knob until the proper value is shown in the Forcing Value display window. The correct value can be found in the Specification window.

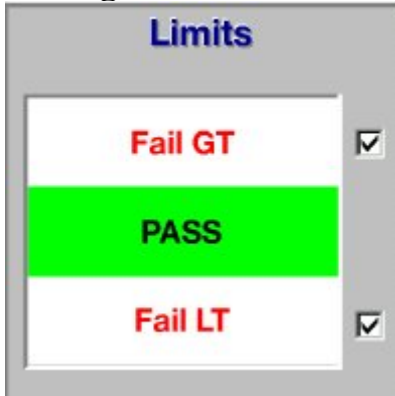
Example: for VOH select "-5.25"



Fine: It may be necessary to use the fine adjustment slider knob to select the proper Forcing Value. Click and depress the left mouse button to select the Fine slider control and drag the slider until the proper value is shown in the Forcing Value display window.

Example: for VOH use the "Fine" slider control to set the forcing value to -5.25

Setting the Pass/Fail Limits



Once the PMU forcing mode is programmed, the Pass/Fail limits must be set. At least one of the check boxes on the right side must be selected. If a check box on the right is unselected, that limit will be disabled - this will be the case of single limit tests. Click either Fail GT (upper limit) or Fail LT (lower limit) in the Limits panel to allow the Range and Value knobs to set Fail GT or Fail LT limits. Notice that the Limits panel pops out to indicate that the Range knobs will now adjust the limit value, not forcing value. To program the limits, follow these steps:

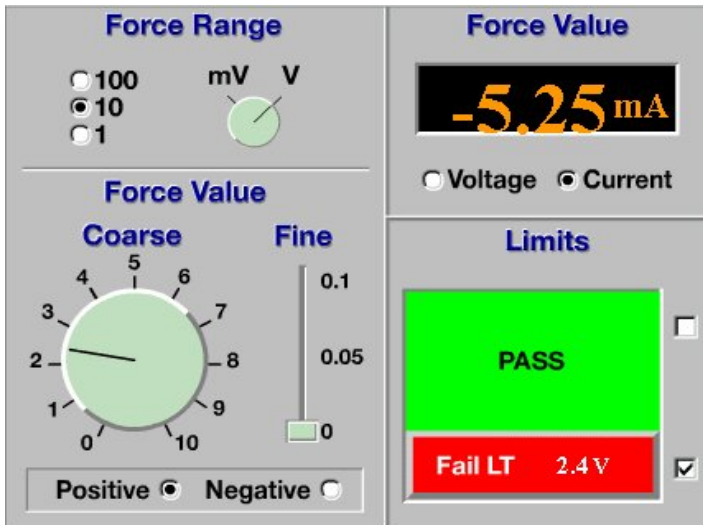
1. Click on the red fail zone for the limit you wish to set (Fail GT or Fail LT). The red fail zone for the limit to be set pops out to indicate what is being adjusted. The check box on the right must be checked in order for the limit to become active.

Limit Selection: Examine the device specification to determine how to set the test limits. Select the upper limit when a “Fail if Greater Than” limit is required (often indicated as a maximum limit in the device specification). Select the lower limit when a “Fail if Less Than” limit is required (often indicated as a minimum limit in the device specification).

Example: for VOH select Fail LT, there is no upper limit for this parameter.

Limit Enable/Disable: The Limits panel of the PMU will initially show both an upper and a lower limit. Read the device specification to determine the appropriate limit setting for each test. If a limit is not required for a test it must be disabled before the test can be run, otherwise the test will fail. To enable or disable a limit, click on the small selection box located to the right of the limit. When a limit is disabled its red fail zone is replaced by a green pass zone.

Example: for VOH disable Fail GT



2. Set the limit range with the 1, 10 or 100 range buttons and the magnitude of the range uA/mA or mV/V Range Knob. If the forcing mode is Voltage, the limits mode will be current; conversely if the forcing mode is current, the limits mode will be voltage.

Range Knob: If the PMU is in current forcing mode, click on the mV or V knob. If the PMU is in voltage forcing mode, click on the uA or mA knob. Choose the proper selection based on the Test Conditions displayed in the Specification window.

Example: for VOH select "V"

Range Value: click to select either the 1, 10 or 100 range.

Example: for VOH select "10"

3. Select the polarity of the forced value.

Polarity: Click either Positive or Negative to select the polarity of the limit value.

Example: for VOH select "Positive"

4. Set the exact limit value with the Coarse and Fine knobs.

Coarse: To select the Limit Value, first click on the "Coarse" knob. Then drag the outside of the knob until the proper value is shown in the red fail zone of the selected limit, adjust the Fine knob as needed. The correct limit value can be found in the device specification.

Example: for VOH select "2.4"

Fine: It may be necessary to use the Fine adjustment slider knob to select the proper Limit Value. Click once on the "Fine" slider control to select it, then click again and drag the slider until the proper value is displayed. You can also click above or below the slider to change it by 1 or use the arrow keys on the keyboard after selecting the Fine slider knob.

Example: for VOH it is unnecessary to use the "Fine" slider control



Running the Test

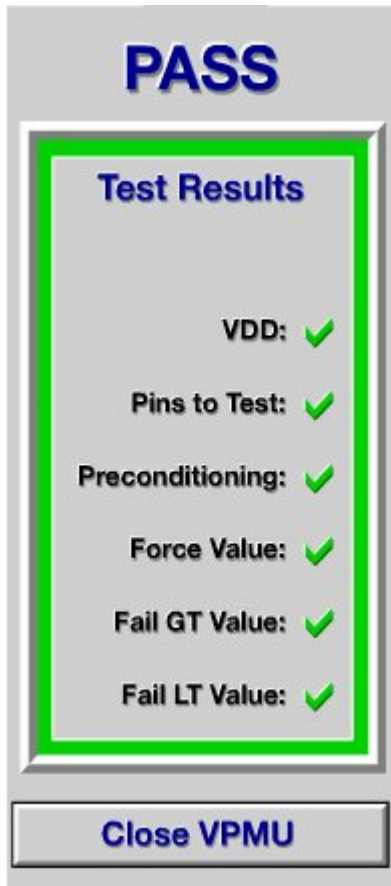
Once all of the programming steps have been completed, the DC test may be executed by clicking on the Run button. When the Run button is selected the PMU settings are compared against the expected answers and the results are displayed in the Test Results window. You will pass the exercise only if all of the test conditions are set correctly.

Run Button: Click the Run button to execute the test and see the test results.

Pass/Fail Light: When you click the Run button, the Pass/Fail Light turns green if the measured value is less than the Fail GT limit and more than the Fail LT limit. It turns red if the measured value is not within these pass/fail limits.

Measured Result Panel After the RUN button is pressed, the value measured by the DC test will show in the Measured Result panel LCD display. This value is produced by a calculation based on the programmed settings of the PMU.

Test Results Window After the RUN button is pressed; the Test Results window shows the conditions of the test that were correctly and incorrectly set. If all conditions are correct the window is framed with a green border. If an incorrect setting has been programmed, the window is framed with a red border and the failing parameter(s) indicated with the no symbol--. Any failing parameters should be corrected and the Run button pressed again until all parameters are correctly set.



Test Results Window

After setting all of the test conditions according to the specification, press the Run button to execute the test. The Results window shows whether the VPMU conditions you set are correct or not. If all conditions are correct the window has a green border and looks like the dialog above. If you get any conditions wrong, there is a red border and incorrect conditions are indicated with a red universal no symbol

There is also another result from running a test, the **Measured Result**



Measured Result Panel

The VPMU simulates an actual device under test. It uses the values you program to calculate a measurement on the simulated device and displays that measurement in the Measured Result panel shown above. In addition to an actual measurement, this panel may also display an over range condition with “- - - OR” in the situation where the measurement is greater than the available display range or a required parameter is not set (e.g. you forgot to set VDD).

The Pass/Fail light is similar to those seen on a digital tester and indicates whether the measured result is within the Fail GT and Fail LT limits.

For additional information regarding Soft Test training, products, videos, and publications please visit our web site at:

<http://www.soft-test.com>

VPMU Exercise Work-Sheet

After completing each VPMU exercise, record the test result value as displayed in the Measured Result window

Test Name	Measured Result
VOH – Voltage Output High	
VOL – Voltage Output Low	
IDD Gross Current	
IDD Dynamic	
IDD Static	
IIH – Input Leakage Current High	
IIL – Input Leakage Current Low	
IOZL – Current Output High Impedance – Low	
IOZH – Current Output High Impedance – High	
IOS – Output Short Circuit Current	
Opens & Shorts	