Pluto VOH/VOL/IOH/IOL Application Note

Rev A02: 04/14/04

Document Revision History

Revision	Date	Description
A01	4/12/04	Initial Draft
A02	4/14/04	• Use DVH/DVL to real-time toggle between VOH/VOL • Show COMPA/B on output waveform graph • Added 'How to Measure VOH/VOL at IOH/IOL', section 1.2
A03	In Progress	• Updated for Rev 6+ support; no longer support real-time DVH/DVL

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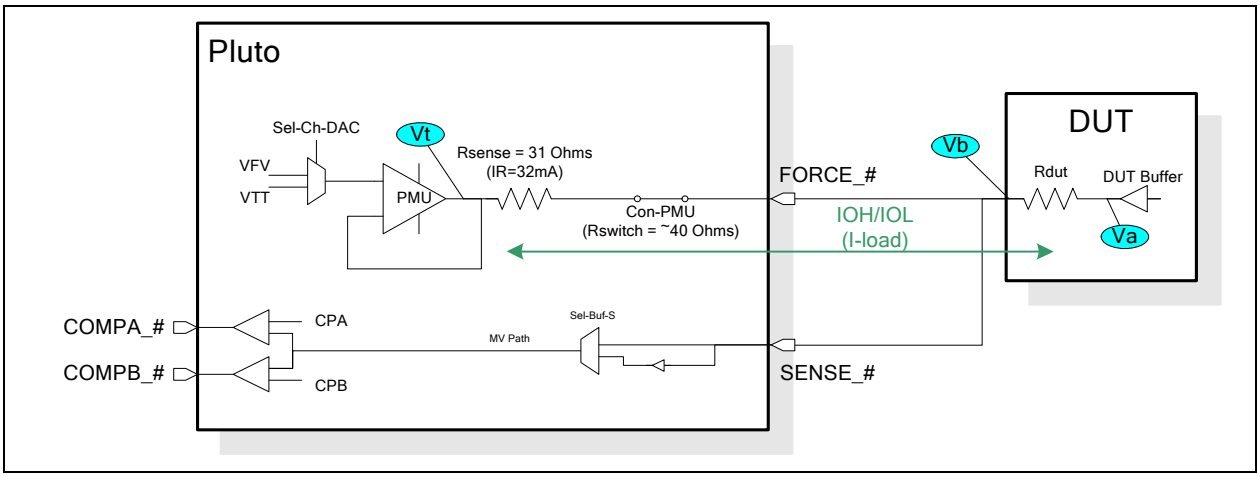
1 Introduction

This document describes how to configure the Pluto device for DUT VOH/VOL/IOH/IOL tests. The Pluto device uses the PMU in Resistive Load mode to set the desired current load. The comparators are set to provide a Go No-Go result.

- Device in PMU Mode Tight Loop, IR=32mA
- VFV is used as the drive high voltage. VTT is used as the drive low voltage.
- Use the 'Sel-Ch#-DAC' mux to select between drive high/low.
- Close Con-PMU switch (can optionally control using EN_# pin)
- Sel-Buf-S = 0 (from SENSE pin). Don't use buffered path
- CPA/B set the VOH/VOL limits

Figure 1: Pluto VOH/VOL Configuration



Node	Description
Iload	IOH/IOL. Current Load relative to DUT
Va	Programmed DUT output level
Vb	DUT output level under current load.
Vt	Termination voltage.
VFV	VOH Termination voltage reference
VTT	VOL Termination voltage reference
CPA	VOH Limit. PMU Comparator A (CPA) Threshold
CPA	VOL Limit. PMU Comparator B (CPB) Threshold

To calculate the Termination Voltage Level:

$$Vt = Vb - \left[Iload * \left(Rswitch + Rsense \right) \right]$$

where Vb is typically set to the VOH/VOL limit. Therefore the equation does not take into consideration the Rdut. This will guarantee the current load regardless of the DUT's output impedance. See Section 1.2 for details on measuring the actual VOH/VOL at the desired current load.

1.1 Example

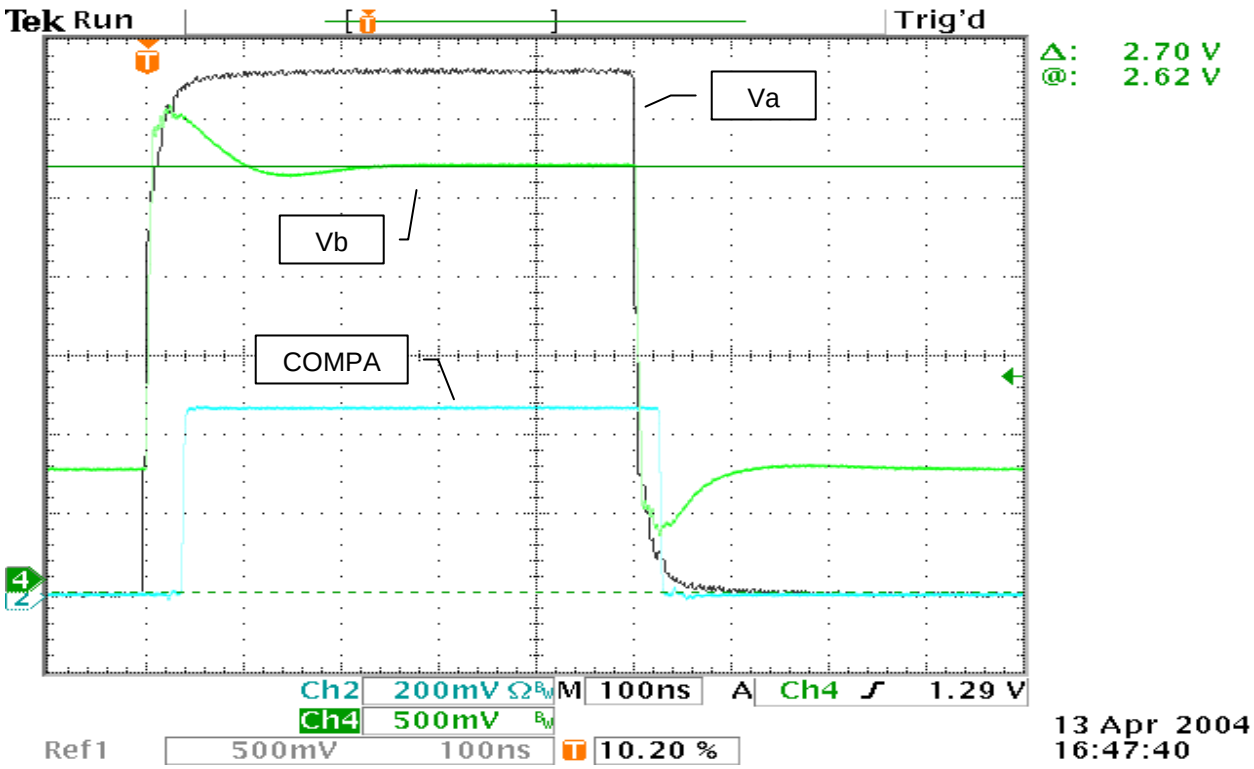
- Iload = +8mA (VOH) / -8mA (VOL) [relative to DUT]
- VOH Limit = 2.4
- VOL Limit = 0.8
- Va = 3.3 (VOH) / 0.0 (VOL)
- Rdut = 50 Ohms

1.1.1 VOH Settings

$$VFV = 2.4 - [0.008 * (31 + 40)]$$

$$VFV = 1.832$$

$$CPA = 2.4$$

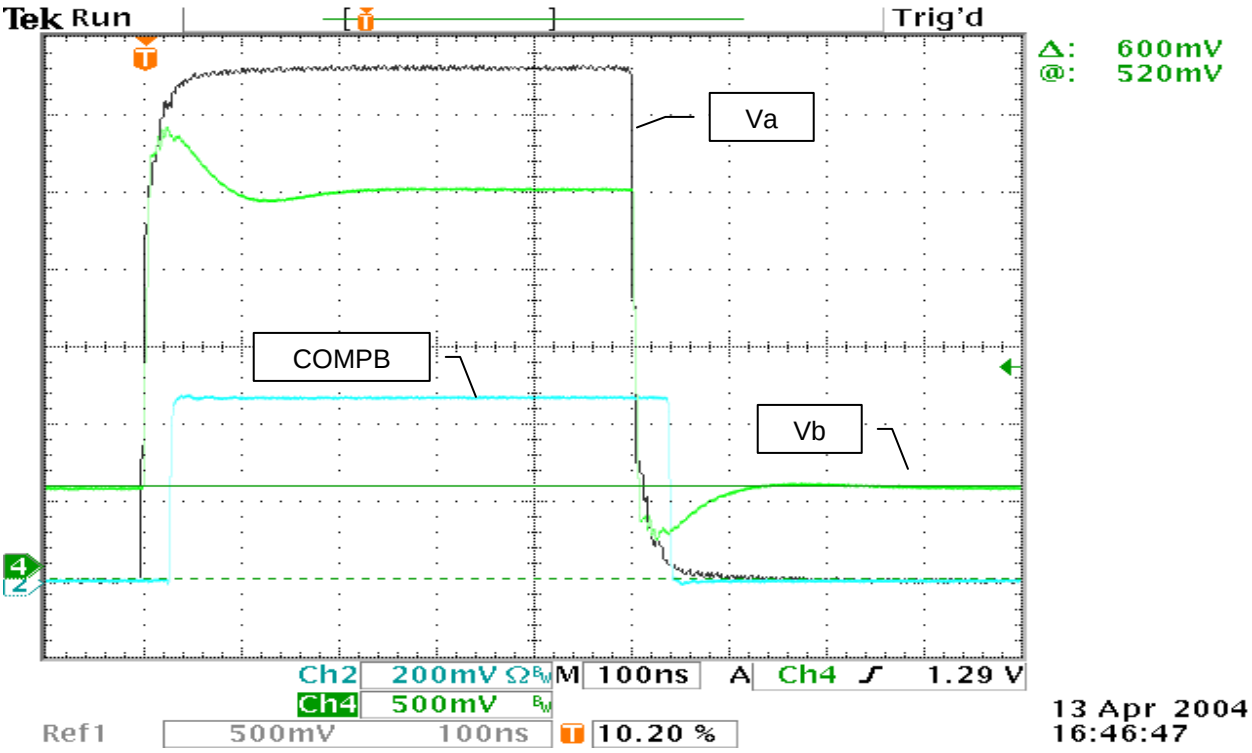


1.1.2 VOL Settings

$$VTT = 0.8 - \left[-0.008 * (31 + 40)\right]$$

$$VTT = 1.368$$

$$CPB = 0.8$$



1.2 Measuring the Actual VOH/VOL at the Desired IOH/IOL

A Comparator Sweep can be used to measure the actual VOH/VOL at the desired IOH/IOL. The CPA/B threshold and VFV/VTT level are proportionally adjusted until the comparator outputs reach the metastability state. The metastability state defines when the DUT is outputting the desired IOH/IOL; the CPA level is the measured VOH/VOL value.

The following table illustrates the input and output levels as the comparator (CPA) level is changed. The setup is the same as described in the example above (section 1.1).

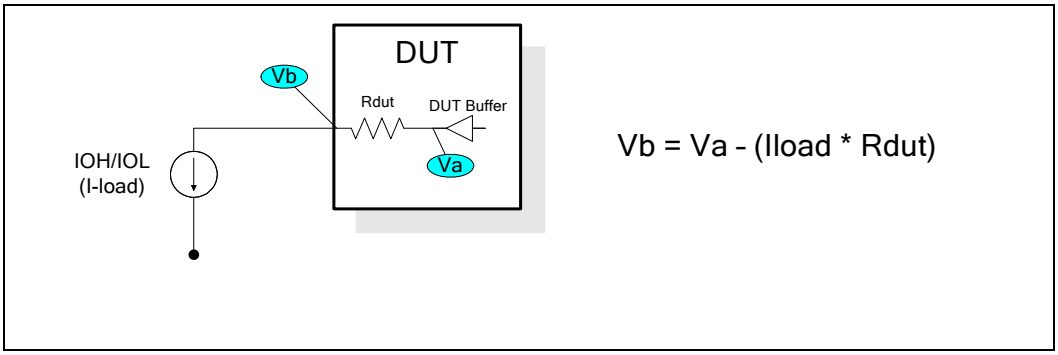
CPA (V)	VFV (V)	Iload (mA)	Vb (V)	COMPA State
2.4	1.832	12.1	2.69	HIGH
2.6	2.032	10.4	2.77	HIGH
2.8	2.232	8.8	2.86	HIGH
2.9	2.332	8.0	2.9	Metastable

The following table shows the input and output levels assuming Rdut = 40 Ohms.

CPA (V)	VFV (V)	Iload (mA)	Vb (V)	COMPA State
2.4	1.832	13.2	2.77	HIGH
2.8	2.232	9.6	2.915	HIGH
3.0	2.432	7.8	2.987	LOW
2.95	2.382	8.3	2.969	HIGH
2.980	2.412	8.0	2.98	Metastable

The following figure and equation illustrate the VOH (Vb) voltage assuming an ideal current load.

Figure 2: Ideal Current Load Model



The following table illustrates that the Comparator Sweep measurement technique yields the same result as the Ideal Current Load model.

Va (V)	Rdut (Ohms)	Vb (Comparator Sweep)	Vb (Ideal Current Model)
3.3	50	2.90	2.90
3.3	40	2.98	2.98