

Cloud Testing Service External Power Supply Control

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Outline

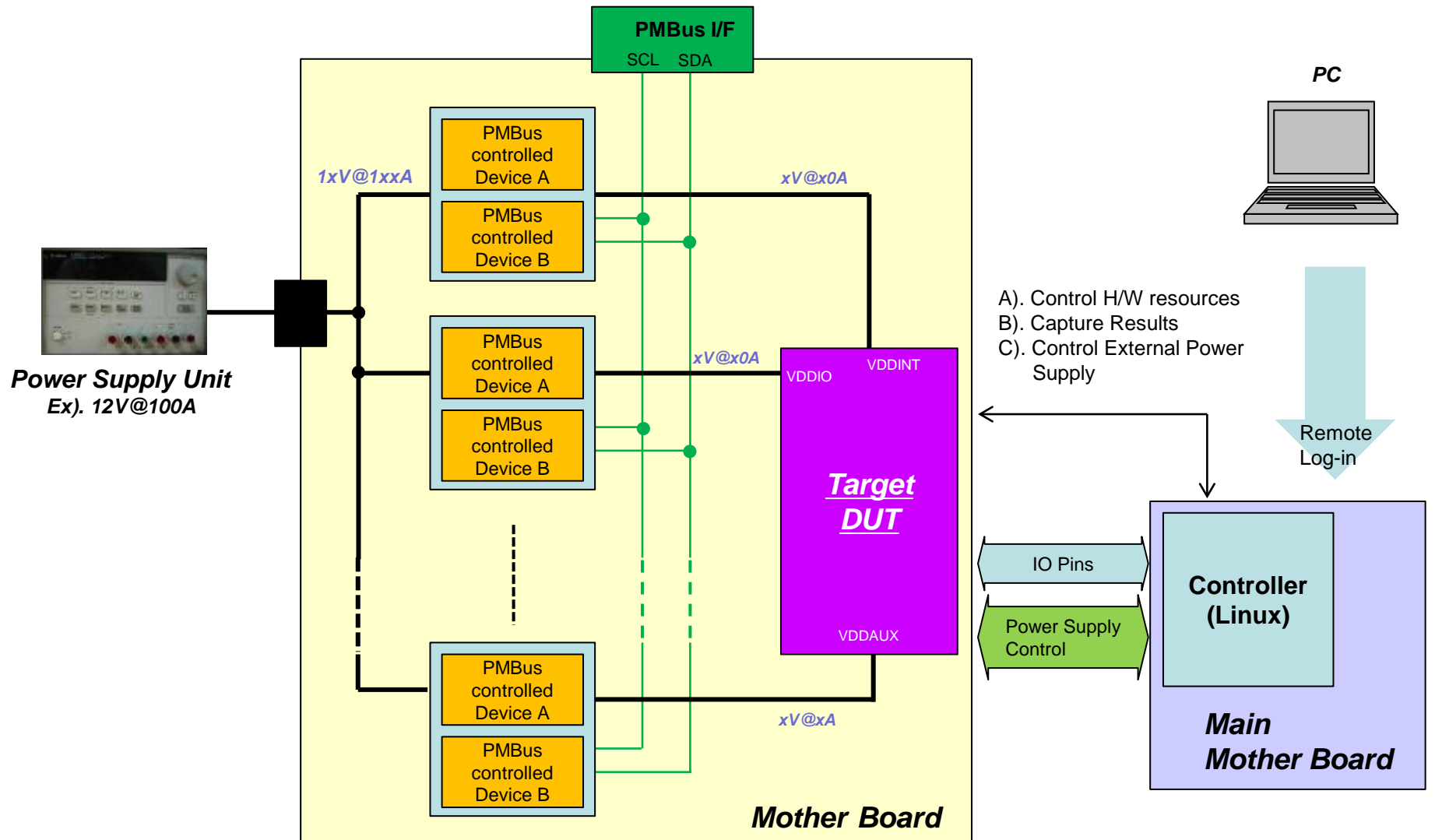
- Existing Verification Environment @Xilinx
- Cloud Testing Service Approach
- Power Control Requirements
- Power Supply Control Implementation
- Xilinx-CTS Collaboration
- How “The New Pattern Verification” Environment Works
- Next Steps, Q&A and Wrap-up

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Existing Evaluation Environment @Xilinx

- Remote Log-in to Mother Board Computer from User PC's.
- Operating System on Mother Board is Linux
- Mother Board issues Commands/Script for controlling Mother Board
 - HW Resources (Digital Pins, Pattern Execution)
 - Power Supply Units
 - Capture PASS/FAIL Result, Power Supply Current, etc.
- Does not use PMBus I/F connector on the Mother Board.
- There are two types of Power control device via PMBus on Mother Board
 - Device A → Voltage Regulator
 - Device B → Current Measurement

Existing Evaluation Environment



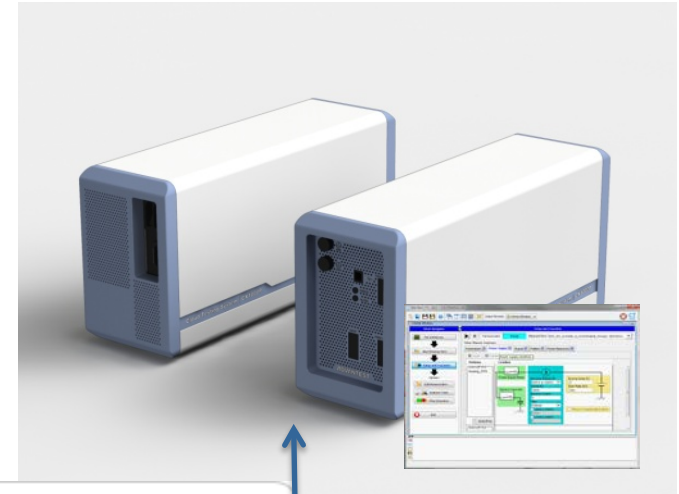
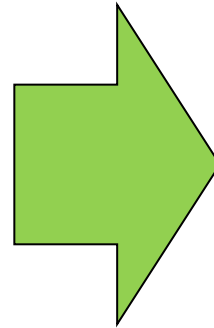
Next Gen Device Evaluation Needs

- Faster Pattern Execution
- Capability to Shmoo Power vs Frequency
- Easy Failure Analysis with LVP (Laser Voltage Prober)
- Modify Timing Levels & Pattern to Debug DUT
- Easy Maintenance of Hardware

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Cloud Testing Service - HW Concept

ATE + Bench + Test SW IP = CTS
All-in-one
CloudTesting™ Station CX1000P



Instrument



Device & Vector Generator



Power Supply



Digital Multi Meter



Signal Generator



External Instruments



External Modules

LabVIEW/GPIB/I2C/PMBus

Cloud Testing Service - Usage



CTS – Hardware Models To Choose From

CX1000P



I/O: 32ch
DPS: 2ch
PMU: 1ch
AWG: 1ch
DGT: 1ch
RVS: 2ch

CX1000D



I/O: 128ch
DPS: 8ch
PMU: 4ch
AWG: 4ch
DGT: 4ch
RVS: 8ch

1. **Small Footprint**
2. **Air Cooled**
3. **Office Power Outlet**
100V-240V
4. **Configurable Architecture**
 - **MCU**
 - **FLASH**
 -

CX1000D S2-LINK

I/O: 256ch AWG: 8ch
DPS: 16ch DGT: 8ch
PMU: 8ch RVS: 16ch



Flash Memory Test (Firmware Upgrade)

CX1000P



I/O: 32ch
 DPS: 2ch
 PMU: 1ch
 RVS: 2ch
 ALPG: 200/
 400
 Mbps

CX1000D



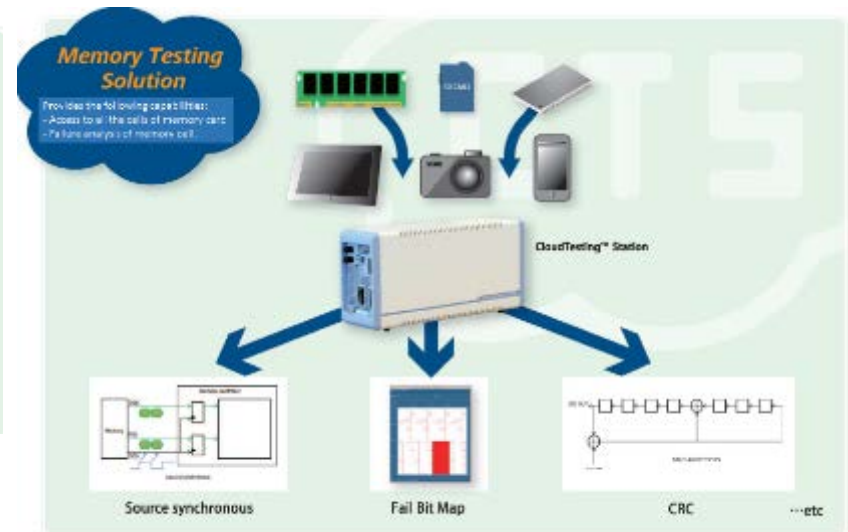
I/O: 128ch
 DPS: 8ch
 PMU: 4ch
 RVS: 8ch
 ALPG: 200/
 400
 Mbps

[To access entire address space of memory card]

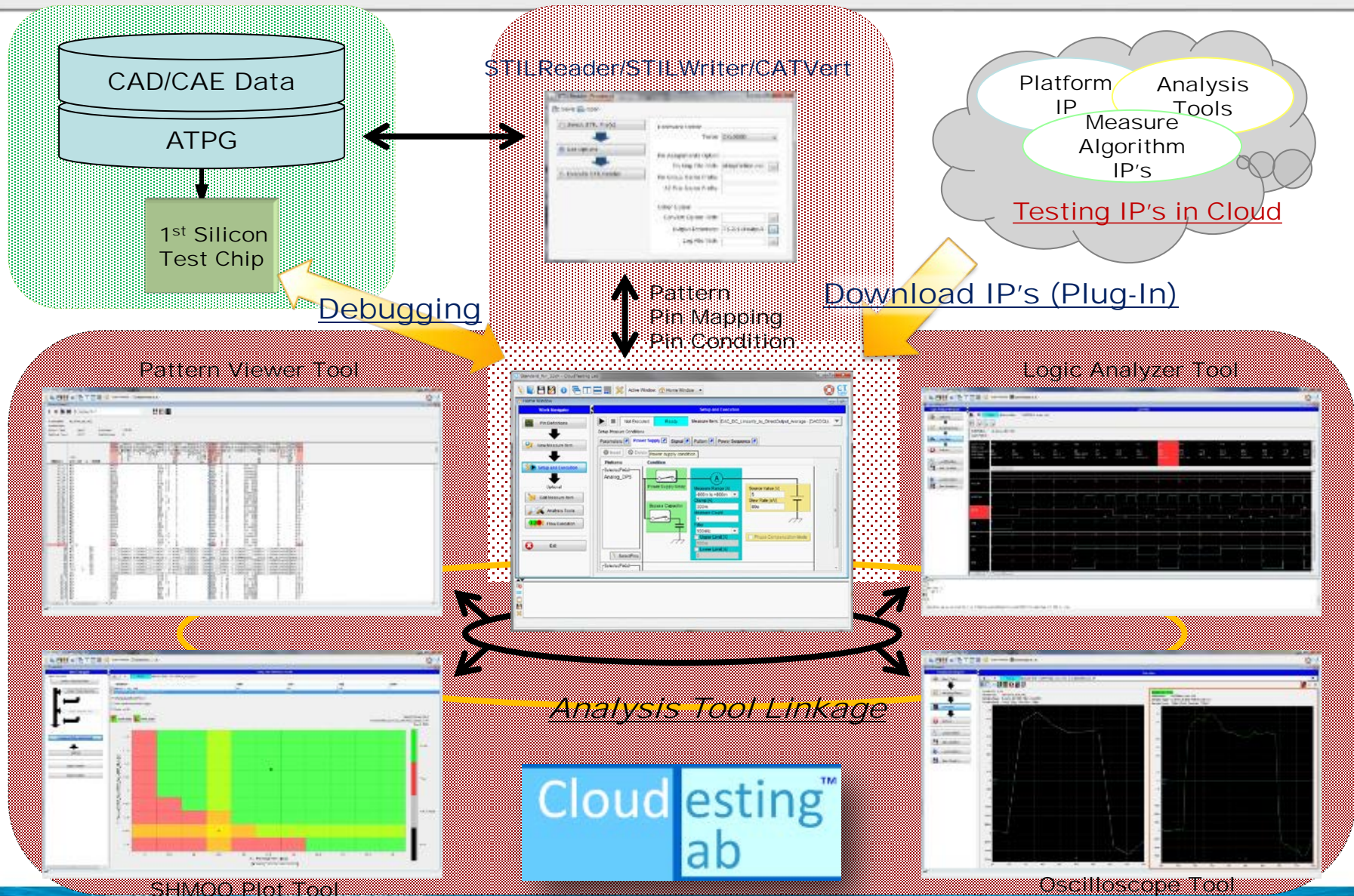
- Read/Write the memory at max rate of 400Mbps.
- The ALPG is compatible with Advantest memory tester T5xxx.
- Test any size memory by single data path.
- Built-in Source Synchronous Test capability.

[Failure analysis environment for memory has]

- 32 GB of failure analysis memory.
- Generates CRC for SD card and MMC.
- Drive/compare 1MB of random and deterministic data.
- Test/Skip failing blocks of Flash memory.



Interactive GUIs Connecting Everything



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Power Control Requirements

- Integrate PMBus I/F protocol in CX1000D system
 - Two new custom software for controlling the external power supply via I2C I/F
 - Define Voltage condition parameter via PMBus command
 - Check PMBus status via PMBus Command
- Implement PMBus alert signal to check using LED circuit on I/F Board.
- Implement voltage regulator power on/off via external relay unit.
- Support voltage regulator devices control via PMBus I/F.
- Provide Seamless GUI For Power vs Frequency Shmoo

What's PMBus?

PMBus

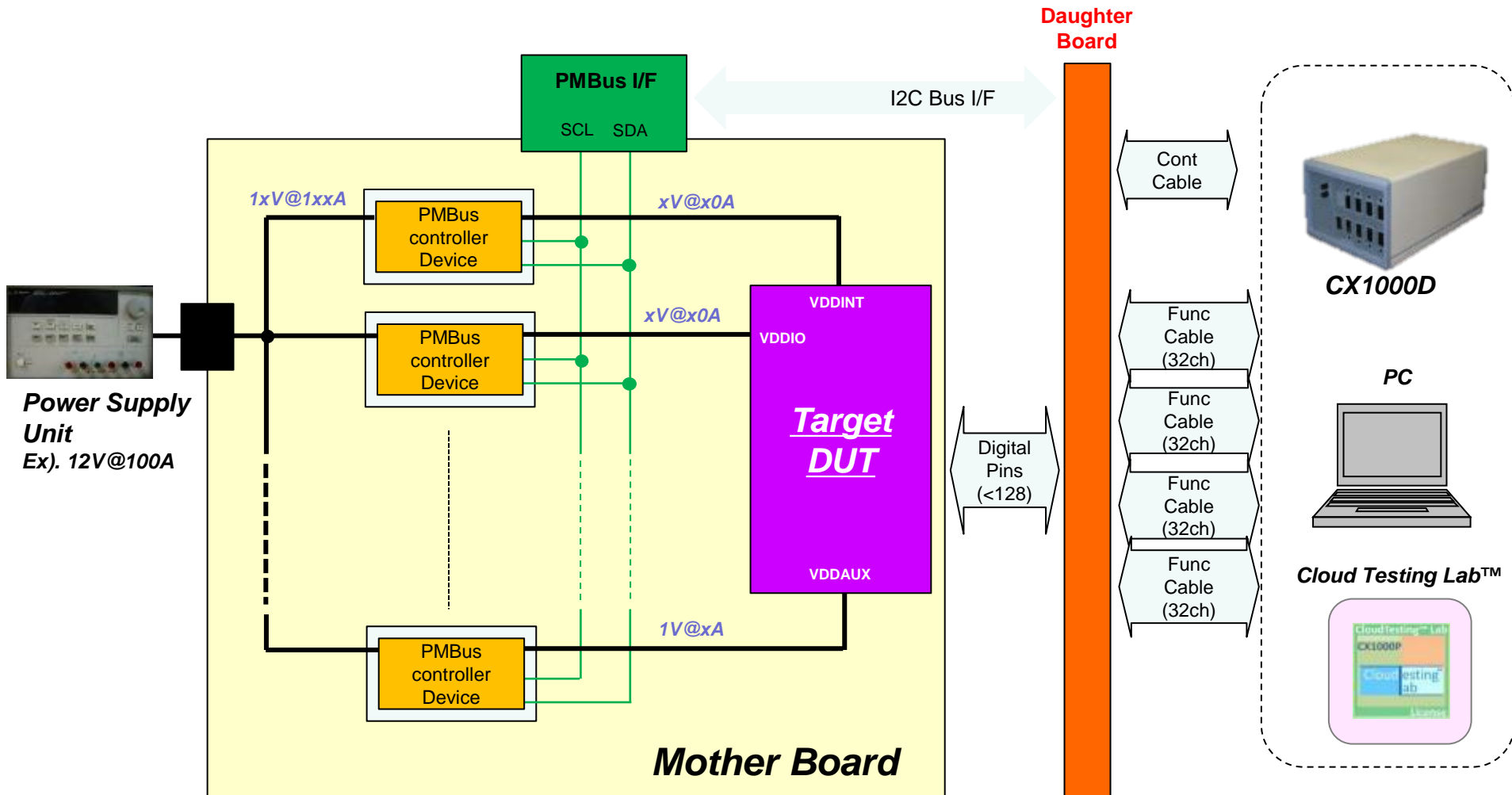
Items	Value	Comment
Revision	Rev 1.2	Based on PMBus 2.0
Clock Speed	100KHz	CX1000D has 100KHz I2C I/F
Pin Count	PMBCLK PMBDATA PMBALERT PMBCTRL	I2C SCL I2C SDA Control On/Off via Relay on Mother Board

Command Lists

CLEAR_FAULTS	IOUT_CAL_GAIN	POWER_GOOD_ON	READ_VOUT
VOUT_COMMAND	VOUT_OV_FAULT_LIMIT	POWER_GOOD_OFF	READ_IOUT
VOUT_TRIM	VOUT_UV_FAULT_LIMIT	STATUS_WORD	READ_TEMPERATURE_1
VOUT_MAX	IOUT_OC_FAULT_LIMIT	STATUS_VOUT	READ_TEMPERATURE_2
VOUT_MARGIN_HIGH	VIN_OV_FAULT_LIMIT	STATUS_IOUT	
VOUT_MARGIN_LOW	VIN_UV_FAULT_LIMIT	STATUS_INPUT	
FREQUENCY_SWITCH	TON_DELAY	STATUS_TEMPERATURE	
VIN_ON	TON_RISE	STATUS_CML	
VIN_OFF	TOFF_DELAY	STATUS_OTHER	
INTERLEAVE	TOFF_FALL	READ_VIN	

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CX1000D: Interface Block Diagram

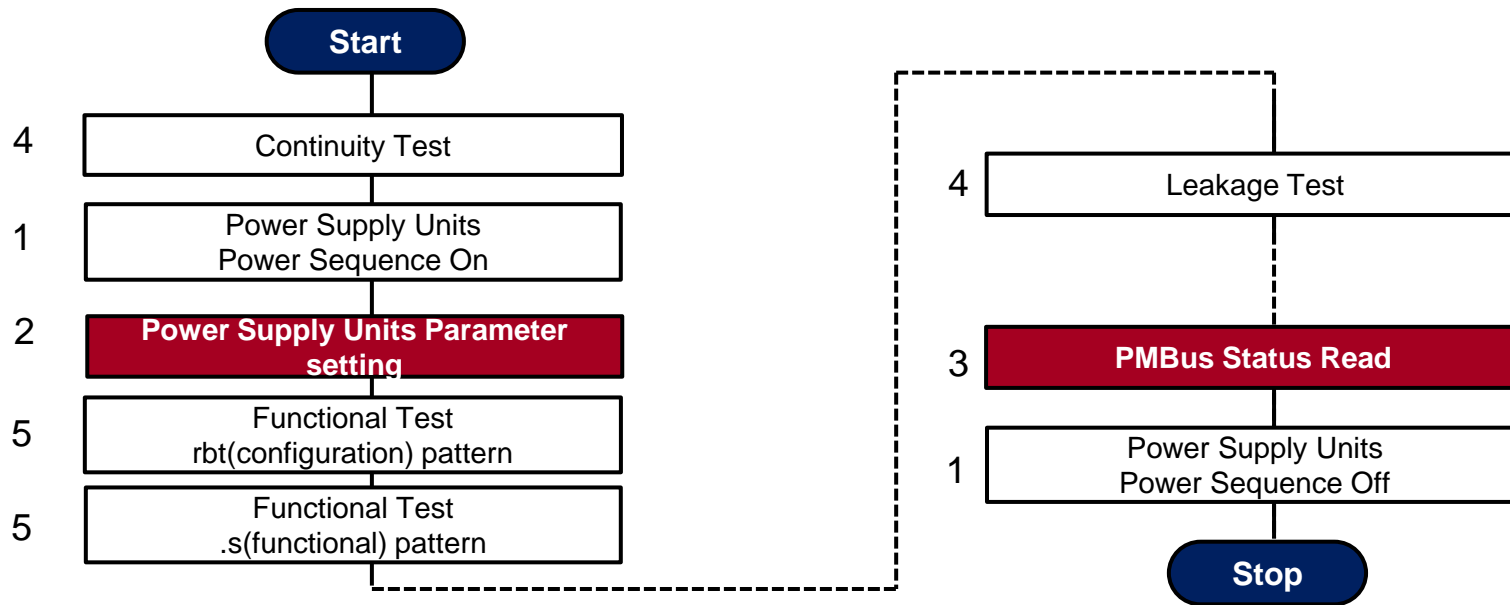


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CTS Xilinx Collaboration

- Software High Level Spec – Xilinx + CTS
- Interface Board Design & Fab - Xilinx.
- PMBus IP Design & Implementation – CTS.
- Bring up of Test Flow – Xilinx + CTS.

Software Specification

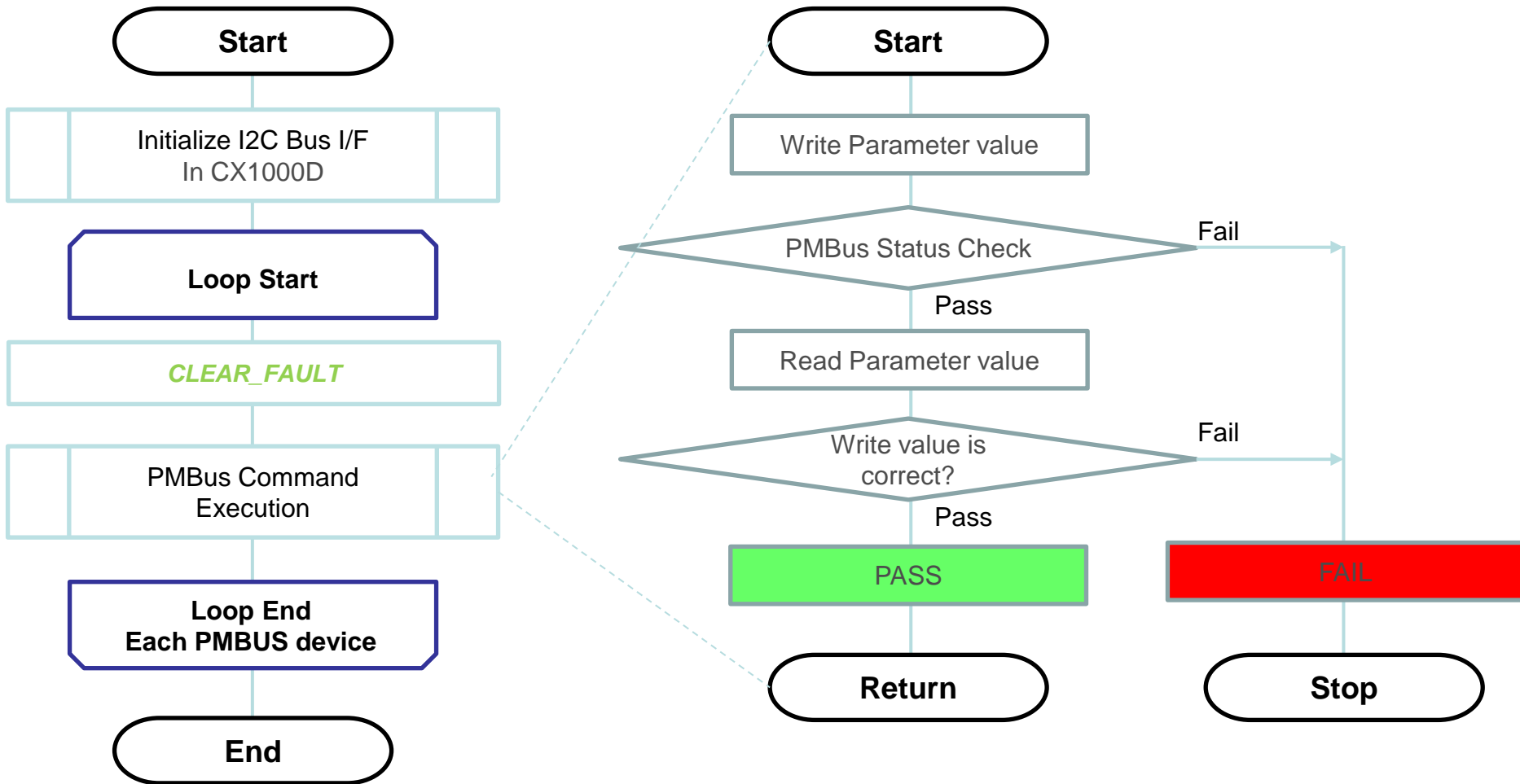


	Test Item	IP Name	Type
1	Power Sequence Control for Built-in Power Supply Units	“RelayControl_IP”	Standard IP
2	Power Supply Units Parameter Setting	“XLNX_conditionSetting_IP”	Custom IP
3	Power Supply Units Status Read	“XLNX_statusRead_IP”	Custom IP
4	Continuity Test Leakage Test	“XLNX_DCPParametricMeasure_IP”	Custom IP (*1)
5	Function Test	“XLNX_FunctionalMeasure_IP”	Custom IP (*2)

*1. Required all of Power Supply Unit pins are opened.

*2. Shmoo execution is available on this IP's

PMBus Command, the execution sequence



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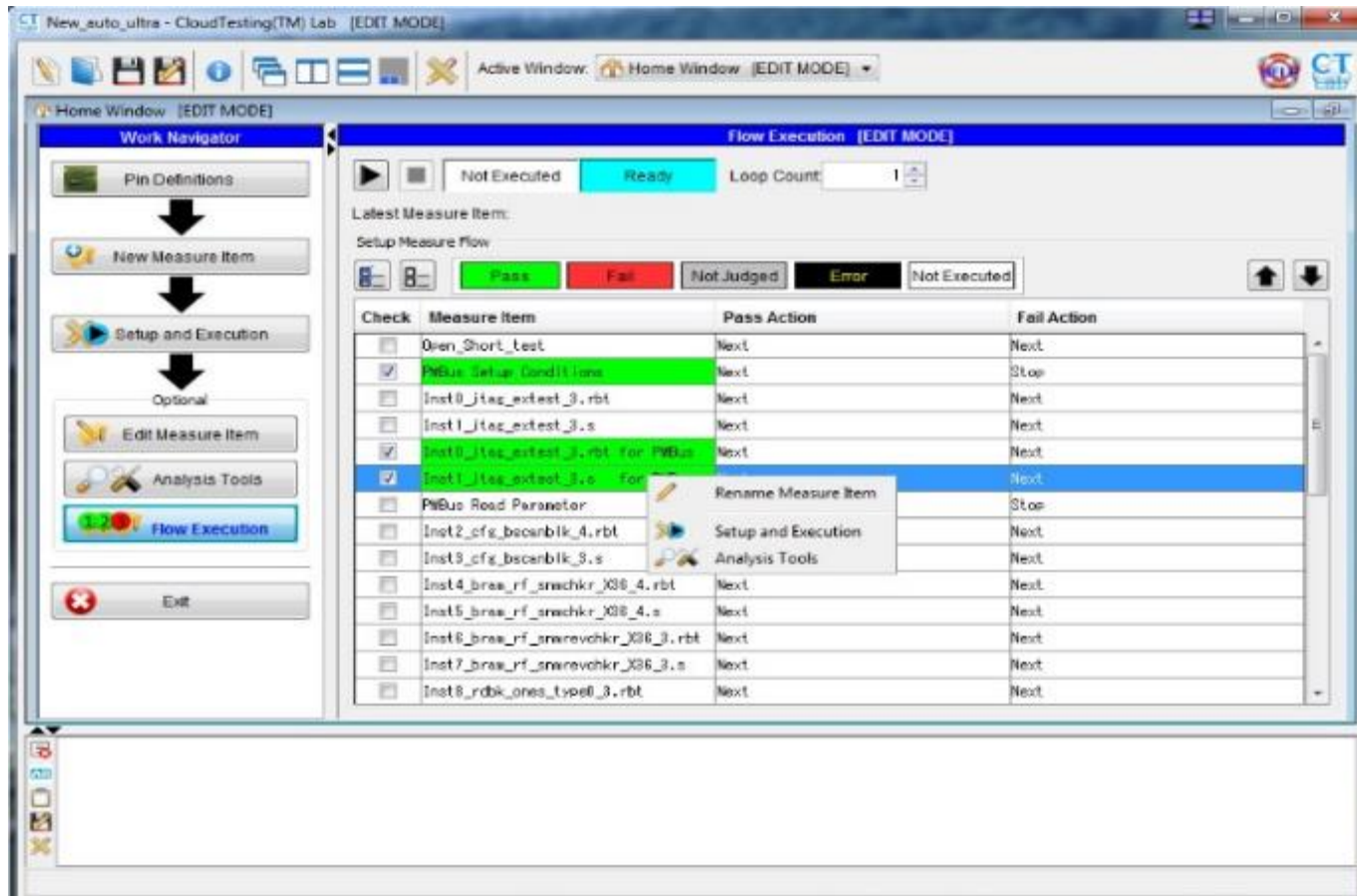
CX1000D Test Condition Image

The screenshot displays the 'Setup and Execution [EDIT MODE]' window in the CloudTesting(TM) Lab software. The 'Measure Item' is set to 'PMBus Setup Conditions - [XLNX_conditionSetting_IP]'. The 'Status' is 'Ready'. Below this, the 'Setup Measure Conditions' section shows a table of PMBus Test Parameters.

Index	Pin Name	Slave Address	Device Type	Condition	Status	Comment
1	VCCINT	0x70	VT7701M	0.95 0 1.52 1.52 0.25 60 0 600 0 4 2...	Ready	VCCINT @VT7701M
2	VCCAUX	0x0B	MAX15001	1.8 0 0 4 0.2 0 0 600 0 12 12 12 12	Ready	VCCAUX @MAX15001
3	VCCAUX_I0	0x0E	MAX15001	1.8 0 0 4 0.2 1 0 600 0 12 12 12 12	Ready	VCCAUX_I0 @MAX15001
4	VCCBRAM	0x0F	MAX15001	0.95 0 2.5 4 0.2 5 0 600 0 12 12 12 12	Ready	VCCBRAM @MAX15001
5	VCCD_HRA	0x11	MAX15001	1.8 0 0 4 0.2 0 0 600 0 12 12 12 12	Ready	VCCD_HRA @MAX15001
6	VCCD_HRB	0x12	MAX15001	0.3 0 5 5 0.2 0 0 600 0 12 12 12 12	Ready	VCCD_HRB @MAX15001
7	VCCD_HPA	0x13	MAX15001	1.0 0 0 4 0.2 0 0 600 0 12 12 12 12	Ready	VCCD_HPA @MAX15001
8	VCCD_HPB	0x14	MAX15001	1.5 0 0 4 0.2 0 0 600 0 12 12 12 12	Ready	VCCD_HPB @MAX15001
8	MGTAVCC	0x15	MAX15001	1 0 2.5 4 0.2 12 0 600 0 12 12 12 12	Ready	MGTAVCC @MAX15001
10	MGTAVTT	0x16	MAX15001	1.2 0 0 4 0.2 12 0 600 0 12 12 12 12	Ready	MGTAVTT @MAX15001
11	MGTVCCAUX	0x18	MAX15001	1.8 0 0 4 0.2 1 0 600 0 12 12 12 12	Ready	MGTVCCAUX @MAX15001
12	UTIL_1V8	0x19	MAX15001	1.8 0 0 4 0.2 1 0 600 0 12 12 12 12	Ready	UTIL_1V8 @MAX15001
13	UTIL_2V5	0x1A	MAX15001	2.5 0 5 5 0.2 2 0 600 0 12 12 12 12	Ready	UTIL_2V5 @MAX15001
14	UTIL_3V3	0x1B	MAX15001	0.3 0 5 5 0.2 5 0 600 0 12 12 12 12	Ready	UTIL_3V3 @MAX15001
15	UTIL_5V0	0x1C	MAX15001	5 0 5.5 5.5 0.2 5 0 600 0 12 12 12 12	Ready	UTIL_5V0 @MAX15001

At the bottom of the window, there are input fields for VIN value (12.00), VIN Range (11.60), VIN damp(+) (12.50), and VIN damp(-) (6.60).

CX1000 Flow Image



CX1000 Shmoo Image

Select another Power Supply Tracking

Setup Axis Value and Execute

Parameter	Start	Stop	Step	Count
X: Period(TS1) 8100ns	20n	160n	20n	8
Y: Source(VCCINT) 8950mV	4.5	800m	-100m	5

Relative tracking X: tracking
 Relative tracking Y: tracking

Timing values track Period:
 Level values track Power Supply:
 Output log file:

upper origin: lower origin:

Period(TS1) [ns]:
 Source(VCCINT) [V]:
 Result:

Y: Source(VCCINT) [V]
 X: Period(TS1) [ns]

Legend: PASS (Green), FAIL (Red), Not Judged (Grey), Error (Black)

[Result]
 Status(0:Pass,1:Fail,-1:Not Judged,-2:Error)
 *Source(VCCINT) [V]/Period(TS1) [ns], 2E-9, 4E-8, 6E-8, 8E-8, 1E-7, 1.2E-7, 1.4E-7, 1.6E-7
 1.2E0, 1, 1, 1, 1, 0, 0, 0, 0
 1.1E0, 1, 1, 1, 1, 0, 0, 0, 0
 1E0, 1, 1, 1, 1, 0, 0, 0, 0
 9E-1, 1, 1, 1, 1, 0, 0, 0, 0
 8E-1, 1, 1, 1, 1, 0, 0, 0, 0
 C:\Users\y.shibata\CloudTesting Lab\New_auto_ultra\Shmoo-Inst1_jtag_extest_3.s for PMBus-20150210_154402.csv

Y Axis Tracking

Shmoo Parameter(Base): Source(VCCINT)@950mV

Kinds of Parameter: ID: 1

Pin Name: VCCINT_33
 Magnitude: 1.8
 Offset: 0
 Base*A+B: 1.11

OK Cancel

Check condition from Built-in Power Supply

Log Format

```
$$$$$$$$$$$$$$$$$$$$
```

```
pin      : VCCINT
```

```
address  : 0x0a
```

```
device   : Device A
```

```
$$$$$$$$$$$$$$$$$$$$
```

```
#####
```

```
READ_VIN,12.03125[V]
```

```
READ_VOUT,0.949951171875[V]
```

```
READ_IOUT,0.0[A]
```

```
READ_TEMPERATURE_1,41.375[degree C]
```

```
READ_TEMPERATURE_2,-273.0[degree C]
```

```
#####
```

```
$$$$$$$$$$$$$$$$$$$$
```

```
pin      : VCCAUX
```

```
address  : 0x0b
```

```
device   : Device A
```

```
$$$$$$$$$$$$$$$$$$$$
```

```
#####
```

```
READ_VIN,12.046875[V]
```

```
READ_VOUT,1.7998046875[V]
```

```
READ_IOUT,0.0[A]
```

```
READ_TEMPERATURE_1,38.1875[degree C]
```

```
READ_TEMPERATURE_2,-273.0[degree C]
```

```
#####
```

Power Supply Name

Slave Address

Device Type (Device C or Device A)

Input Reference Voltage (READ_VIN)

Power Supply Voltage (READ_VOUT)

Power Supply Current (READ_IOUT)

Temperature(Inside)
(READ_TEMPERATURE_1)

Temperature(Outside)
(READ_TEMPERATURE_2)

CTS VS Xilinx Board Testing Environment

- Portable – Small Foot Print, Powered from wall outlet.
 - ✓ Easy Failure Analysis with LVP (Laser Voltage Prober).
- Expandable – Easy to add many capabilities.
- No Maintenance Charges – Replacement unit shipped free.
 - ✓ Easy Maintenance of Hardware.
- Quick Bring up Test Program – CTLab (GUI + CSV).
 - ✓ Modify Timing Levels & Pattern to Debug DUT.
- Power vs Frequency Shmoo
 - ✓ Capability to Shmoo Power vs Frequency.
- Faster Test Rates (100MHz vs 100KHz)
 - ✓ Faster Pattern Execution.
- Floating Licenses - Everyone can use CTS.

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Next Steps

- Release Generic PMBus IPs
- GPIB Control For Power Supplies
- LabVIEW Control For Power Supplies