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**Test Plan,
Suite
for
OKAD-G144**

Steven Hsu
GreenArrayChips

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CPU Description

- **Opcodes: 32.**
- **ROM: 64 words BIOS.**
- **Registers: A,B,IOCS,Data,Addr,PC,IW,**
- **Comm ports: Right, Down, Left, Up.**
- **RAM cells: 64 18 bits words.**
- **Stacks: Data, 10 cells, Return, 9 cells.**
- **I/O: Analog/Digital and Serial Pins.**

G144 Description

- CPU(Node): 144. (8 X 18 Array)
- ROM: BIOS, Boot and Math functions.
- I/O: Async serial, Sync serial, SPI.
1wire, Data and Addr with Control, A/D
and Serdes.
- Port: Total 262 ports.

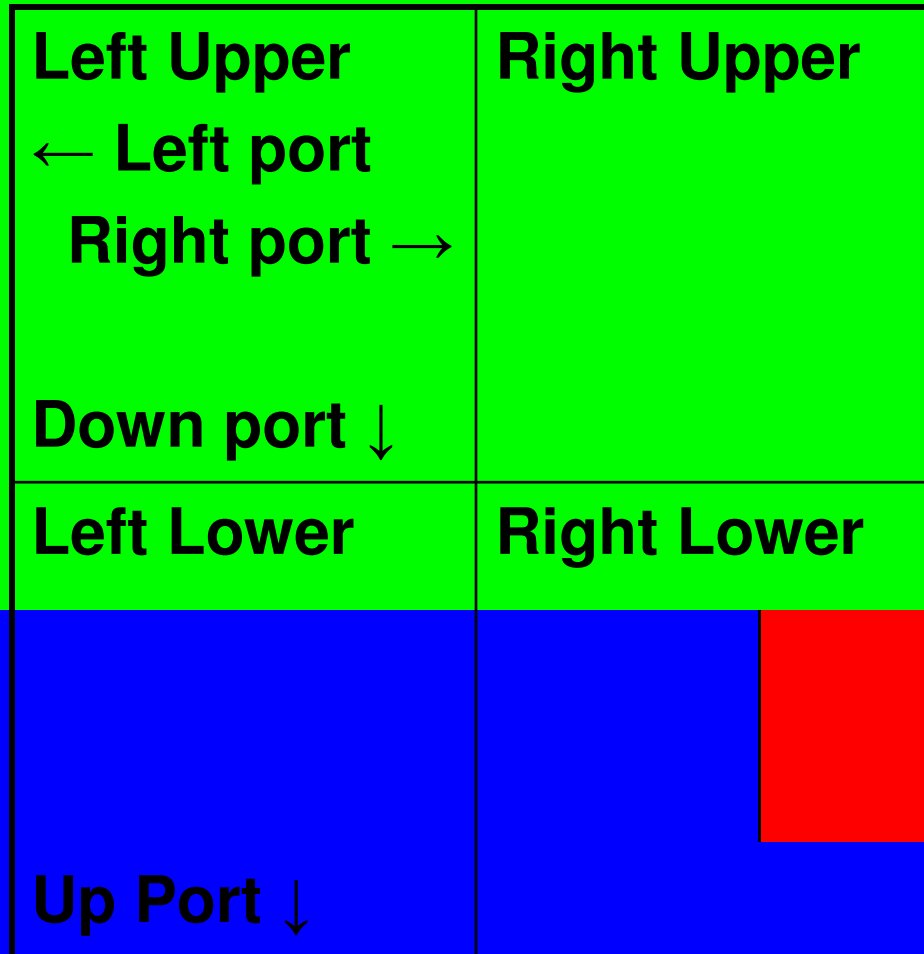
Coverage

- I/O: IOCS Pins.
- Registers: A, B, Addr, Data.
- Stacks: Data, Return.
- RAM cells: 64 Words/node.
- Comm port: All 262 ports.
- Node: All 144 nodes.

Strategies

- Functional test only.
I/O Boot, ROM-BIOS, A/D, Serdes,
NOT included.
- Single node. (4 Node/Core Orientations)
- Neighbor Parallel communication.
- Multiple node chain-SMTM.
- Special tests- opcodes, functions.
- Special requirement- 4 corner tests.

4 Node/Core Orientation



Single Node Test-IOCS

- Goal: Communication through I/O.
- Test nodes : SPI, Serial, 18 bit Bus/control. (Most I/O nodes)
- Method: Write bits to Bi-directional pads and read them back to compare.
- SPI:(bit 17- 3, 2. low bits- 2a, 2b, 2e, 2f, 3a, 3b, 3e, 3f.) ex. 3002b, 2003a...etc.
- Serial, and others. (20002,20003, 20002, 30003.)

Single Node Test-Registers

- Goal: Validate data in registers.
- Method:
 1. Write bits to registers read them back to be compared with expected data. (4-8 patterns, 3ffff, 0, 15555, 2aaaa, 19999, 26666, 33333, cccc)
 2. All the test use registers.

Single Node Tests-Stack

- **Goal:** Validate data in stacks.
- **Method:**
Fill up patterns to stacks, read them back to be compared with expected data. (8 patterns, 3fff, 0, 15555, 2aaaa, 19999, 26666, 33333, cccc)

Single Node Test-RAM

- Goal: Validate data in RAM.
- Method: (Tested on 4 orientations)
 1. Fill the Ram with jump code and jump through all 64 cells.
 2. Fill up patterns to all cells read them back to be compared with expected data. (8 patterns, 3ffff, 0, 15555, 2aaaa, 19999, 26666, 33333, cccc)

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Single Node Tests-Special

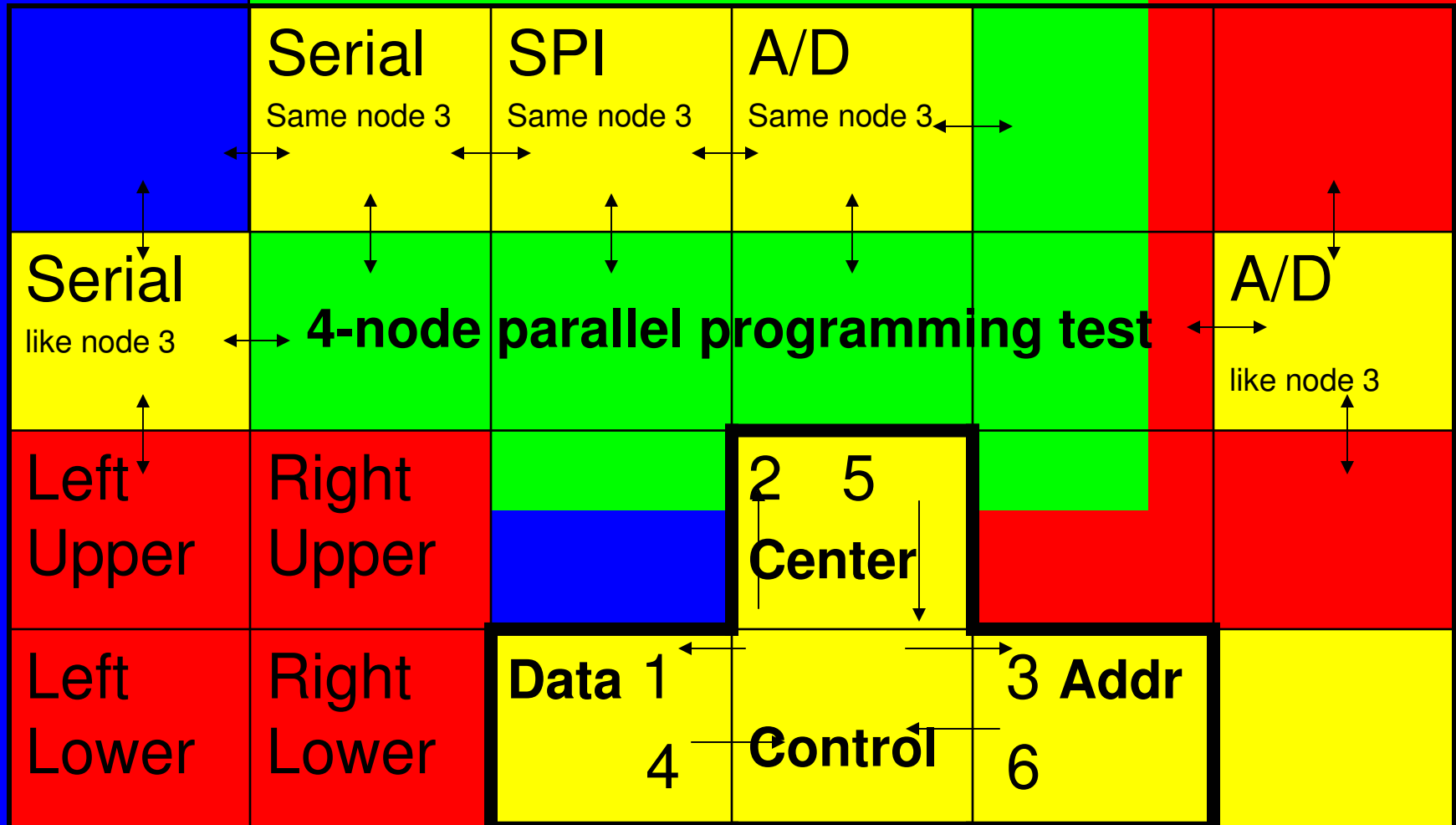
- Special opcodes tests: ;:, !p+.
- Special loop tests, if ..then drop, for next loop, unnext loop.
- Special function, Math test.
- 4 corners test: RAM-patterns test.
- Ram-patterns and ram-execution tests also test at 4 different orientations of the core design.

Multi-Nodes Test-Ports

- **Goal: Neighbor Parallel Programming and test the ports.**
- **Test nodes : Most of the I/O nodes.**
- **Method: I/O node send request to neighbors and get back the data in sequence .**
- **All SMTM use/test ports.**

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Multi-Nodes Tests-Ports.



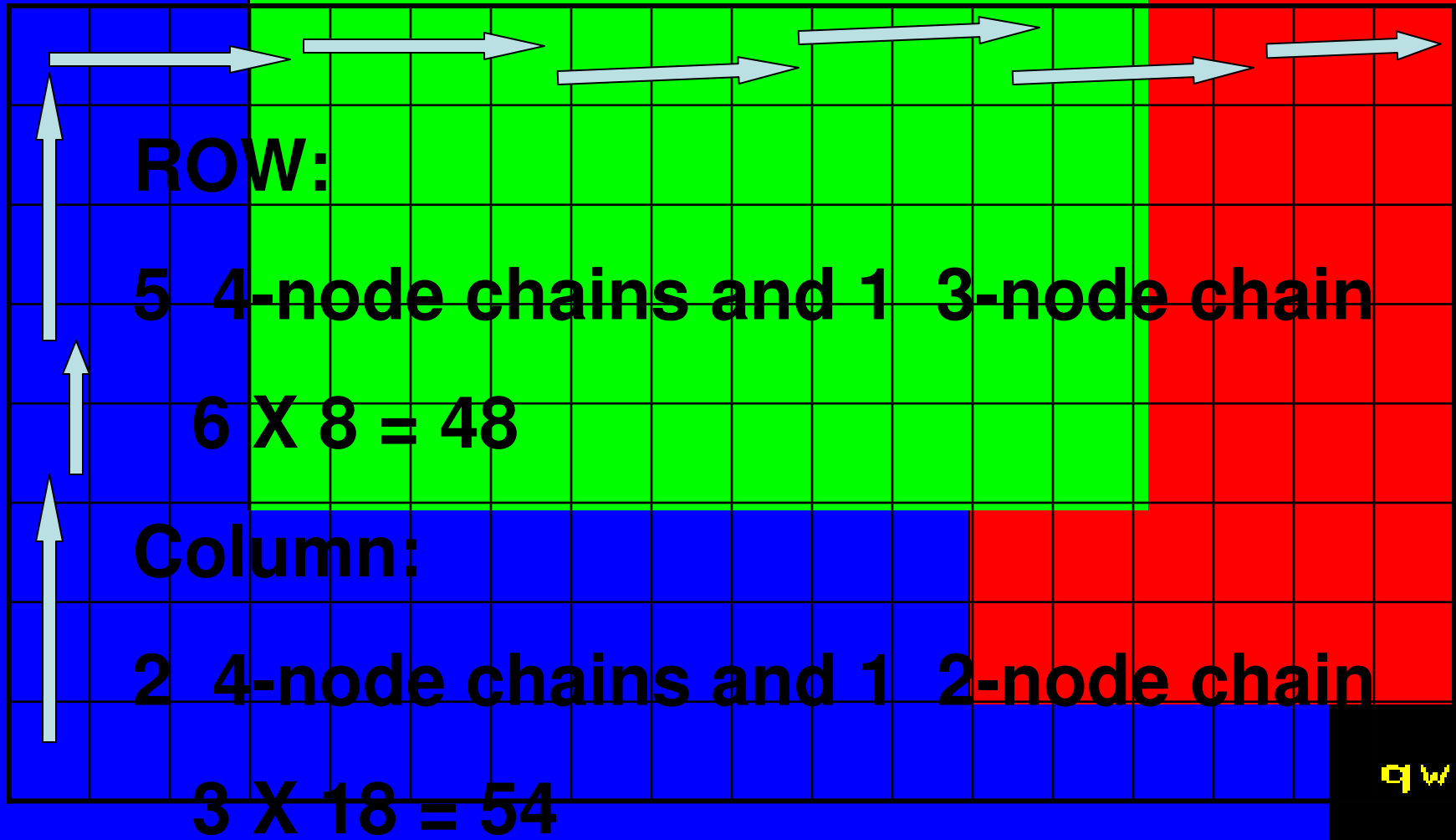
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Self Migration Test Module

- Goal: Combined application tests.
Connectivity/port tests.
- (SMTM can carry test program to target for chip test)
- Test nodes : 144 nodes.
- Method: SMTM move around the chip to cover all 144 nodes in many 2, 3, or 4 node chains.
- SMTM use ports and all 64 ram cells

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The 7E Crawler tests



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Tests Preparation

- Design/Update tests,
- Compare/Prepare needed blocks, **-cfutility**
- Create/Edit templates,. **Xxxx.af files -cfutility**
- Set up logging system, **work on OkadWork.cf**
- Set up auto exit function, **work on OkadWork.cf**
- Generate test suite. **Xxxx.cf files -cfutility**
- Create DOS Batch files to start the tests and do the filing management automatically.
- Run tests and check log file to validate the intermediate results and end results.

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OkadWork-RAM-04-FF-corner.af

User define test environments

Set Running Nodes

```
652 88 12 652 code{ ( cfchip definition { 4F } active ) [ d# 10 ps/ ! d# 1
  sim ! d# 8 cuco ! ]
| 7row 700n 701n 702n 703n 704n 705n 706n 707n 708n 709n
  710n 711n 712n 713n 714n 715n 716n 717n ;
| 0row 000n 001n 002n 003n 004n 005n 006n 007n 008n 009n 010n 011n
012n
  013n 014n 015n 016n 017n ;
| logo poly cpr m1 cpr m2 cpr m3 cpr m4 cpr ;
| chip0 power octagon dummy global pcps ( 0row 1row 2row 3row 4row
5row
  6row 7row ) 008n ;
| chip seal origin v chip0 d# 120 [ gy d# -169 + ] v logo ; }block
```

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OkadWork-RAM-04-FF-corner.af

User define test environments

Set Corner parameters

```
922 93 11 922 code{ ( extract.0 ) [ empty ]
| up ; [ d# 202 load { 9080000E } ] ( silterra tsmc 194 )
  [ d# 906 load ] ( 196 ) [ d# 204 d# 2 loads { 9080000E } ] ( corner... )
  [ ff ] ( sf fs ss ff )
| fast d# 2 [ sim ] ! d# 85 d# 92 uanp! ; ( fast { 9080000E } ) [ d# 300
  d# 2 loads d# 500 load d# 318 load d# 322 d# 8 loads d# 210 load d# 212
  load d# 224 load d# 226 load d# 502 d# 3 loads d# 508 load ] ( probes )
  [ d# 954 d# 14 loads cfprobe load ] ( 982 )
| ?short [ testb ] @ d# 31 or drop if ; then short ; ( load ) [ d# 510 load
  scan probe register ] ( xx ?short short ) [ hardsim start ] }block
```

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OkadWork-RAM-04-FF-corner.af

Test Program

```
1248 4 1 1248 code{ ( 04 left ram serdes ) [ h# aa reset ] [ h# BF org ]
| done ; [ h# 80 org ]
| test h# 3FFFF dup push h# 0 push h# 15555 push h# 2aaaa push
  h# 19999 push h# 26666 push h# ccc push h# 33333 push push pop .
  pop pop pop . pop pop pop . pop pop h# 3F h# 0 a! for h# 7 . for dup
  ! . @ or . . if h# DEAD ; then drop next @+ . drop next h# BEEF done ; [
h# AA org ]
| cold h# 1 h# 10000 h# 3E h# 3F a! for dup . !+ over + . next h# 10080
  !+ . push ; }block
```

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OkadWork-RAM-04-FF-corner.af

Load Test Program

```
1300 97 12 1300 code{ ( test code for chip { C620000E } custom code )
  [ d# 1302 load ] ( exit { C620000E } ide serial ) [ d# 708 node d# 1372
  load { 76C08C4E } ] ( sync ) [ d# 300 node d# 1374 load { 76C08C4E } ]
  ( wire ) [ d# 17 node d# 1376 load { 76C08C4E } ] ( end ) [ d# 16 node
  d# 1378 load { 9080000E } ] ( allnodes ) [ d# 15 node d# 1350 load {
C620000E } ]
  ( smtm test ) [ d# 8 node d# 1248 load exit { C620000E } ] ( */ exerciser )
  [ d# 402 node d# 1354 load { 76C08C4E } d# 401 node d# 1356 load d#
400
  node d# 1358 load { 9080000E } ] ( serdes ) [ d# 1 node d# 1360 load
  d# 701 node d# 1362 load { 9080000E } ] ( spi flash write ) [ d# 702
  node d# 1364 load { 9080000E } ] ( ana ) [ d# 715 node d# 1366 load d#
717
  node d# 1368 load { 9080000E } ] }block
```

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Log File Sample

- completed-OkadWork-DATA-ram-007.log

```
r7, 00015555
r6, 00015555
r5, 00015555
r4, 00015555
r3, 00015555
r2, 00015555
r1, 00015555
r0, 00015555
r, 00015555
a, 00015555
b, 0000015d
p, 000002ab
i, 000316c7
op, 00000018
t, 00015555
s, 00015555
d0, 00015555
```

```
d1, 00015555
d2, 00015555
d3, 00015555
d4, 00015555
d5, 00015555
d6, 00015555
d7, 00015555
op, 00000016
op, 00000018
t, 00000000
op, 0000001c
s, 00000000
p, 000002ac
i, 00027def
op, 00000013
op, 0000001d
t, 0003ffff
```

```
op, 00000005
r, 00015555
p, 000002a3
i, 000102ea
op, 00000008
p, 000002a4
op, 00000002
t, 0000bead
s, 0003ffff
0000077519
```

over

Special Test/Conditions

1. Are Math test results compatible with previous version when compared the log files.
2. The SMTM unext port pump tested between nodes 003 and 004, back and forth, in sender and receiver.

9 Combinations of

- 1, "@p+ !+ . unext". (Slot 3 w/ nop)
- 2, "@p+ !+ unext". (Slot 2)
- 3, "@p+ . !+ unext". (Slot 3 w/o nop)

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G144 Test Report

G144 3.5C Test Report -v1.1

(Completion time stamps, p/s = 10, SIM 1)

1. Register and stacks, write and read back.	G144 3.5C		S40 3.0E	Comment
OkadWork-ADDR-ram-009	77545		77180	
OkadWork-DATA-ram-007	77519		77154	
2. IOCS, write and read back, pin values				
OkadWork-IOCS-ram-008	114674		114168	
OkadWork-IOCS-1wire-200	24381		22857	
OkadWork-IOCS-Async-708	23118		22974	
OkadWork-IOCS-sync-300	23015		22864	
OkadWork-IOCS-spi-705	114625		114109	
3. RAM and stacks, write and read back.	8 patterns		4 patterns	
OkadWork-RAM-01 (Lower Right 001 Serdes)	2301308		1227096	
OkadWork-RAM-04 (Lower Left 008)	2292845		1222082	
OkadWork-RAM-31 (Upper Right 701 Serdes)	2302463		1227770	
OkadWork-RAM-34 (Upper Left 708)	2291892		1221634	
OkadWork-RAM-04-FF-corner (008)	2090275		1113989	
OkadWork-RAM-04-FS-corner (008)	2329060		1241511	
OkadWork-RAM-04-SF-corner (008)	2309114		1230443	
OkadWork-RAM-04-SS-corner (008)	2557478		1363316	
4. PORT.				

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G144 Test Report

OkadWork-KAWI-04-SS-corner (006)		257476			136316		
4. PORT.							
OkadWork-PORT-D-L-R-008 (Control)		10611			10435		
OkadWork-PORT-D-L-R-709 (A/D)		14144			10406		
OkadWork-PORT-D-L-R-713 (A/D)		10794			10413		
OkadWork-PORT-D-R-L-705 (SPI)		10562			10402		
OkadWork-PORT-D-R-L-708 (Async)		10607			10586		
OkadWork-PORT-D-U-R-200 (1wire)		10528			10440		
OkadWork-PORT-D-U-R-300 (Sync)		10525			10513		
OkadWork-PORT-L-D-R-009 (ADDR)		10616			10414		
OkadWork-PORT-L-R-D-001 (Serdes)		13099			12970		
OkadWork-PORT-R-D-717 (A/D)		8184			7966		
OkadWork-PORT-R-D-L-007 (DATA)		10590			10404		
OkadWork-PORT-R-L-D-701 (Serdes)		13104			12966		
OkadWork-PORT-U-D-R-117 (A/D)		10873			10593		
OkadWork-PORT-U-D-R-617 (A/D)		10872			10517		S40 3.0E*4
5. Special.						11	210742
OkadWork-IF--IF-04		19531			19338	12	210542
OkadWork-IF--IF-then-drop-04		17997			17812	13	210558
OkadWork-MATH-49-04		855472*3			852740*3	21	208278
OkadWork-MATH-rotate-04		45470*3			45250*3	22	193399
OkadWork-SEMICOLON-COLON-04-05-14		14427			14236	23	206422
OkadWork-STORE-P-PLUS-04-05		31485			31221	31	209517
OkadWork-NEXT-05		56830			56513	32	208576
OkadWork-UNEXT-05		47334			47029	33	208789

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G144 Test Report

6. SMTMs, 144 Nodes, 262 ports.	Total 120	SMTM tests					unext 3.5B*4	
Rows-x. 6 chains/row, 48 tests	x00-x03	x03-x06	x06-x09	x09-x12	x12-X15	x15x17	11	211661
SMTM 000 row	293551	291542	293014	291712	292865	195544	12	211435
SMTM 100 row	292985	291975	293187	292053	293264	196691	13	211462
SMTM 200 row	292975	291960	293177	292038	293255	195851	21	209097
SMTM 300 row	292990	291975	293287	292053	293264	195861	22	194333
SMTM 400 row	292969	291960	293177	292038	293255	195851	23	207270
SMTM 500 row	292985	291975	293187	292053	293264	195861	31	210426
SMTM 600 row	292975	291960	293177	292038	293255	196630	32	209484
SMTM 700 row	293581	291611*1	297210	293365	296638	196349	33	209723
Columns-xx. 3 chains/col, 54 tests	0xx-3xx	3xx-4xx	4xx-7xx	0xx-3xx	3xx-4xx	4xx-7xx	3.5C*4	
SMTM 000 & 001 col	297745	99398	294328	297467	99615	297423*2	11	211661
SMTM 002 & 003 col	294918	99694	294962	294704	99641	294743	12	211435
SMTM 004 & 005 col	294944	99720	294988	294730	99667	294807*1	13	211462
SMTM 006 & 007 col	294969	99746	295014	294835	99693	294795	21	209097
SMTM 008 & 009 col	294996	99772	298539	294857	99719	295666	22	194333
SMTM 010 & 011 col	295022	99798	295066	294808	99745	294847	23	207270
SMTM 012 & 013 col	295048	99824	295091	294834	99771	295718	31	210426
SMTM 014 & 015 col	295074	99850	295118	294860	99797	294936	32	209484
SMTM 016 & 017 col	295100	99876	295144	296913	99583	297105	33	209723

*1. 705 Forced await. (705 SPI).

*2. Reverse 701 > 401. (701 Serdes)

*3. Math test results were compatible with previous version when compared the log files.

*4. The SMTM unext port pump tested between nodes 003 and 004, back and forth, in sender and receiver on both versions.

9 Combinations of 1, "@p+ !+ . unext", 2, "@p+ !+ unext" and 3, "@p+ . !+ unext"

Examples: 11. Both "@p+ !+ . unext". 12. Sender "@p+ !+ . unext" and receiver "@p+ !+ unext".

31 Sender "@p+ . !+ unext" and receiver "@p+ !+ . unext". (S40 3.0E test data for comparison)

NOTE: Completed 3.5B SMTM test results were not listed here.

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Thank You!

Steven Hsu
GreenArrayChips

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