

# ***CUSTOMIZE PICOCLOCK CHECKERS (Software Program)***

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## Background

Picoclock is a simple low jitter clock frequency generator with multiplier function in Mixed Signal Tester.



$$\text{Reference channel frequency} \times \text{Frequency multiplier} \\ = \text{Output frequency of the Pico-Clock}$$

## Problem Statement

### Original Problem

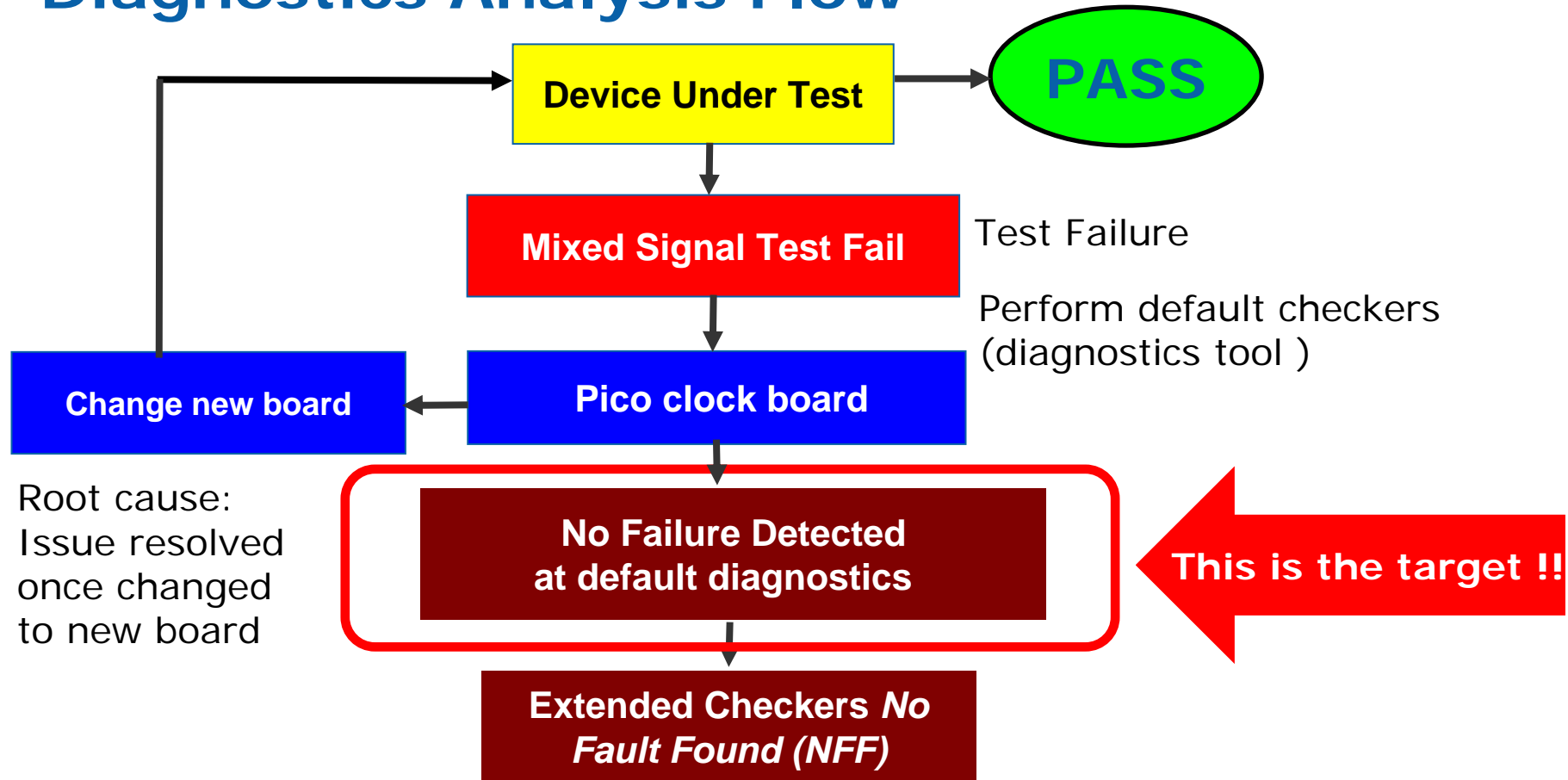
“Signal to Noise Ratio” signal to noise ratio test failure on mixed signal devices.

### Actual Problem

If default picoclock diagnostics is passing , then it is qualified but devices are failing for mixed signal test during manufacturing.

**Engineering Contradiction**

# Diagnostics Analysis Flow



Root cause:  
Issue resolved  
once changed  
to new board

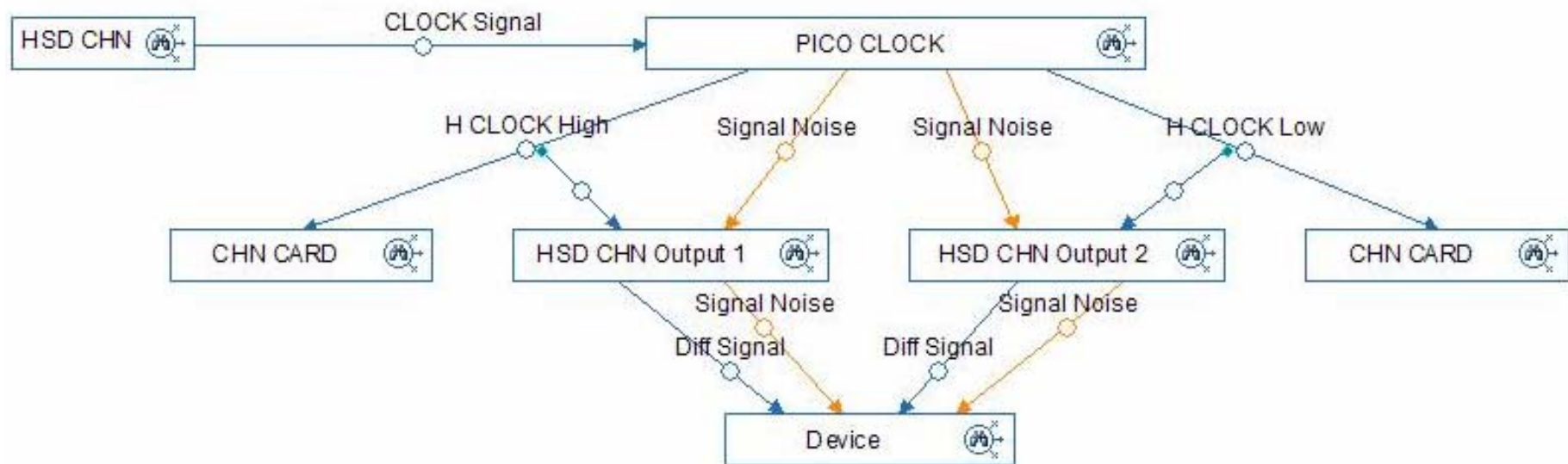
### The Problem statement:

“Mixed Signal” signal to noise ratio test failure. Default checkers and extended checkers (wider range) passes 100% while in actual test environment it fails.

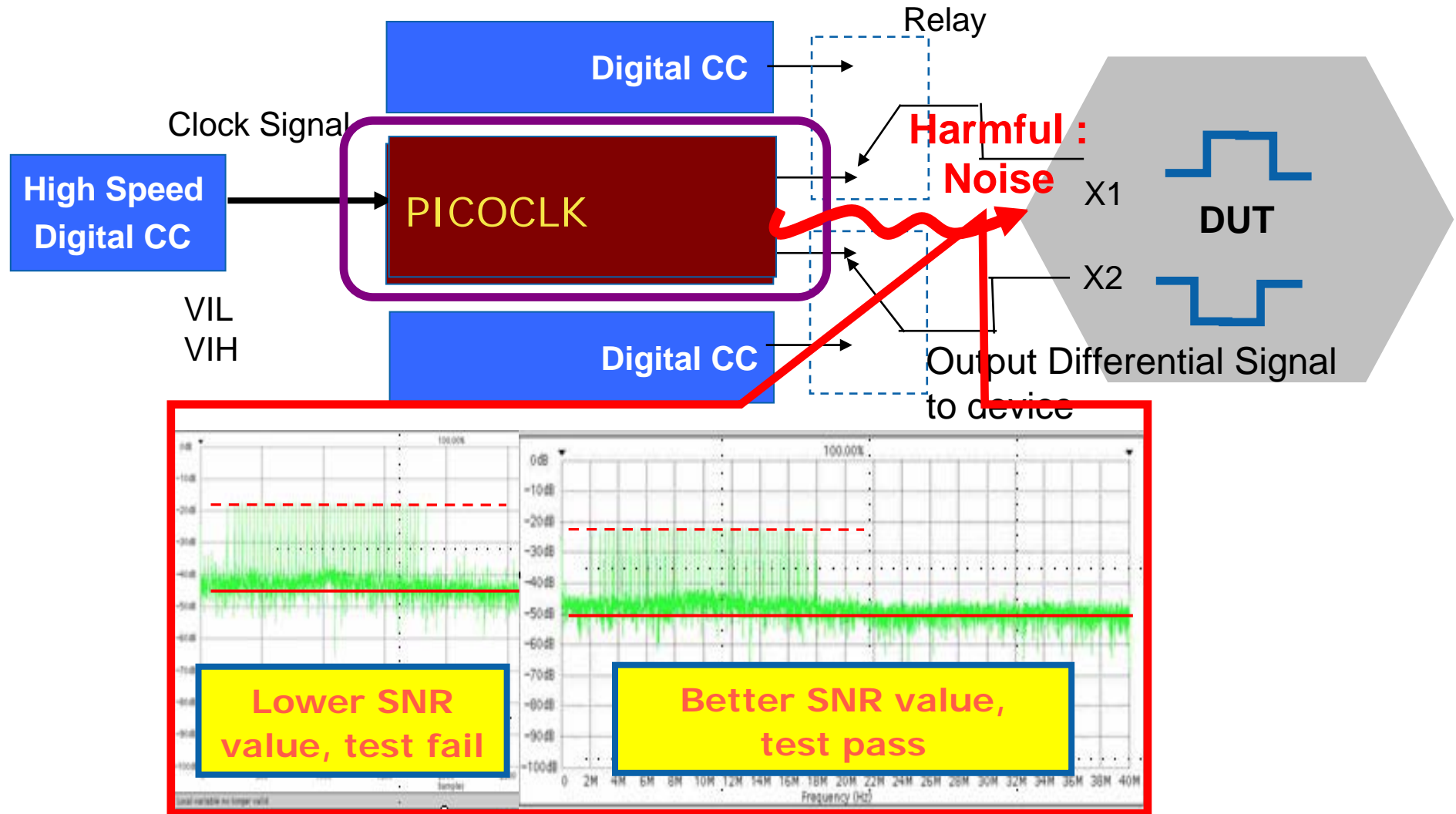
### Engineering Contradiction:

If system (instruments) checkout is not *complex*, then the time checkout can be reduced; but *reliability* of entire system (tester+instrumentation) worsens.

# Picoclock- Its Function Model



# Picoclock- Its Function Model



# Existing checkers limitation & what TRIZ says....

Contradiction matrix				
	Worsening Feature →	Reliability	Object-affected harmful factors	Difficulty of detecting and measuring
	Improving Feature ↓			
		27	30	37
36	Device complexity	13, 35, 1	22, 19, 29, 40	15, 10, 37, 28

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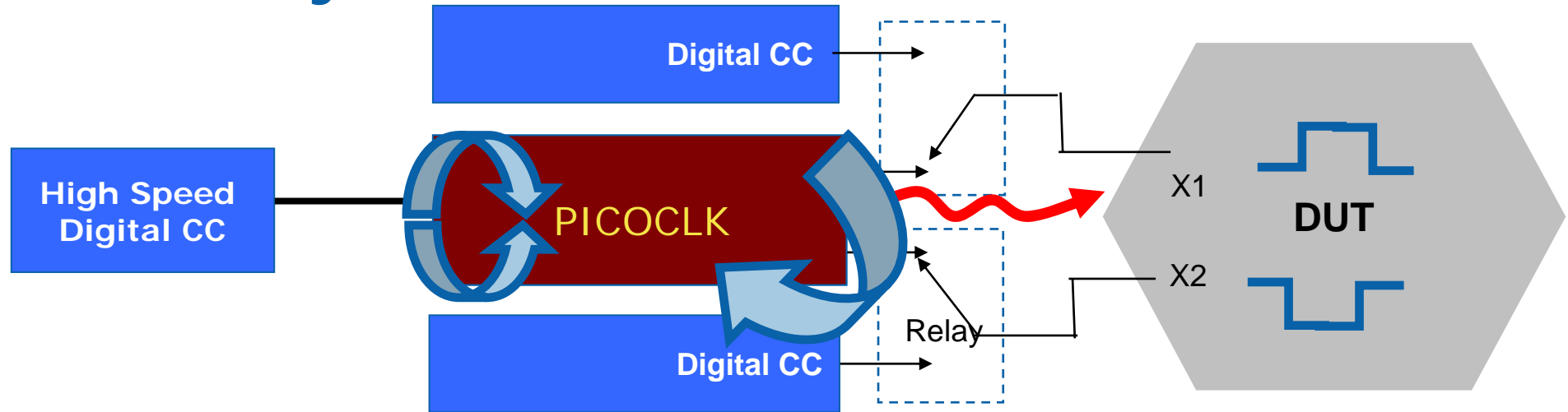
### List of the 40 Principles

- Principle 1. Segmentation
- Principle 2. Taking out
- Principle 3. Local quality
- Principle 4. Asymmetry
- Principle 5. Merging
- Principle 6. Universality
- Principle 7. "Nested doll"
- Principle 8. Anti-weight
- Principle 9. Preliminary anti-action
- Principle 10. Preliminary action
- Principle 11. Beforehand cushioning
- Principle 12. Equipotentiality

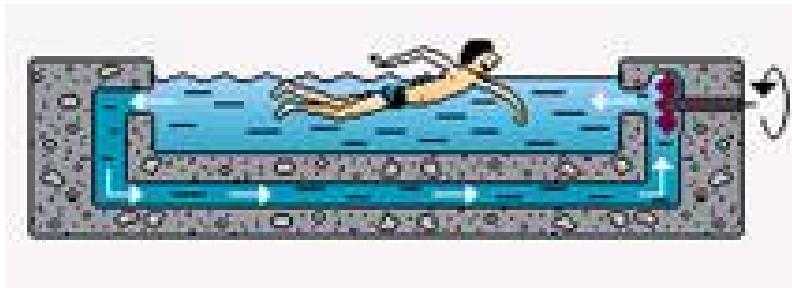
### Principle 13. 'The other way round'

- Principle 14. Spheroidality - Curvature
- Principle 15. Dynamics
- Principle 16. Partial or excessive actions
- Principle 17. Another dimension
- Principle 18. Mechanical vibration
- Principle 19. Periodic action
- Principle 20. Continuity of useful action
- Principle 21. Skipping
- Principle 22. "Blessing in disguise" or "Turn Lemons into Lemonade"
- Principle 23. Feedback
- Principle 24. 'Intermediary'
- Principle 25. Self-service
- Principle 26. Copying
- Principle 27. Cheap short living objects
- Principle 28. Mechanics substitution
- Principle 29. Pneumatics and hydraulics
- Principle 30. Flexible shells and thin films
- Principle 31. Porous materials
- Principle 32. Color changes
- Principle 33. Homogeneity
- Principle 34. Discarding and recovering
- Principle 35. Parameter changes
- Principle 36. Phase transitions
- Principle 37. Thermal expansion
- Principle 38. Strong oxidants
- Principle 39. Inert atmosphere
- Principle 40. Composite materials

# Existing checkers limitation & what TRIZ says....



TRIZ Principle: "THE OTHER WAY ROUND"



Instead of checking inside out which is the current architecture of the checkers...

Why can't we check outside in?

# TRIZ Principle: "Multifunctionality"

Contradiction matrix				
	Worsening Feature → ↓ Improving Feature	Loss of Time	Reliability	Ease of repair
		25	27	34
36	Device complexity	6, 29	13, 35, 1	1, 13

## Engineering Contradiction:

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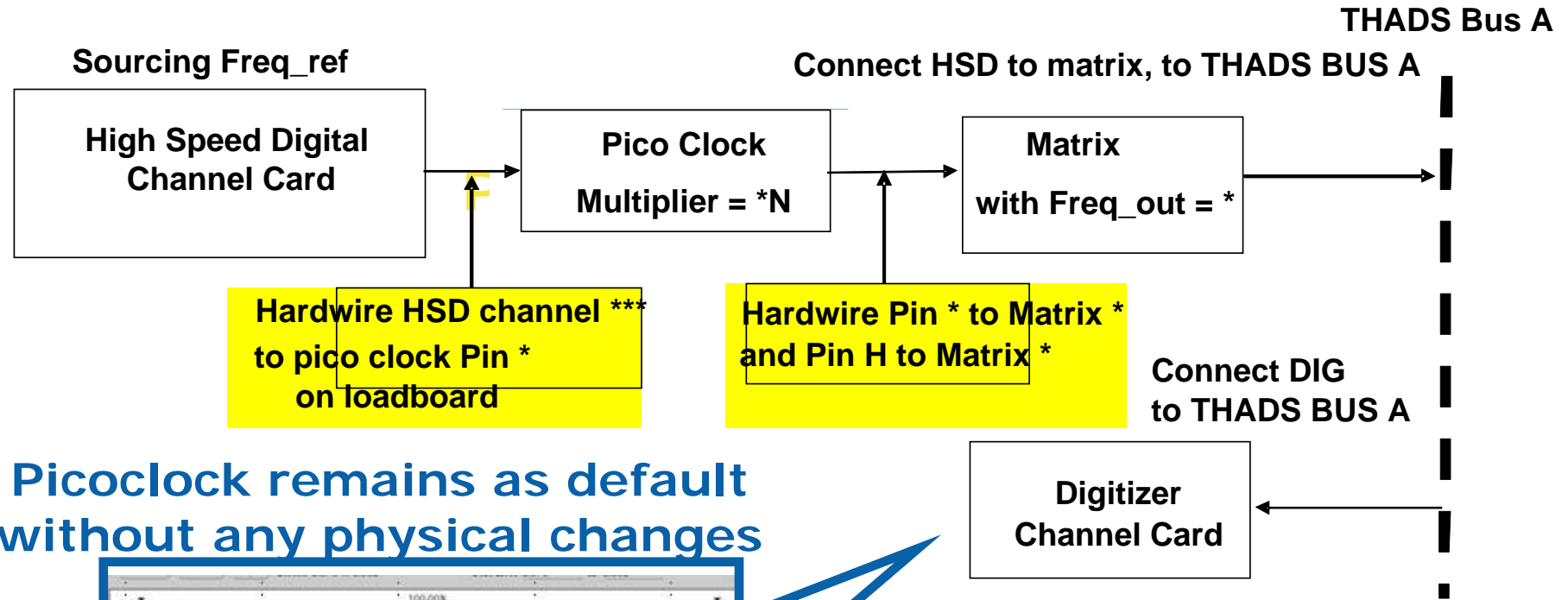
### Principle 6. Multifunctionality

- Principle 7. "Nested doll"
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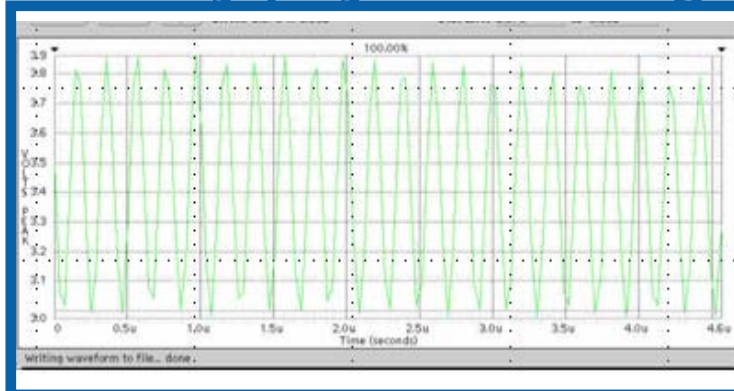


# TRIZ – Breakthrough Solution

## “Customize Picoclock Checkers Program”



**Picoclock remains as default without any physical changes**



**Capture whole waveform**

# Solution – “Customize Picoclock Checkers Program” How it works!!

## STEP 1: *The Other Way Round*

- Customize checkers program (software algorithm) was developed to measure Signal to Ratio from output of picoclock board.
- Output from this board is plotted in statistical distribution. This shows the real failure signature.

## STEP 2: *Multifunctionality*

- Configure this board to measure Signal to Noise Ratio instead of its nature to produce low jitter clock frequency. This eliminates the need for changes on picoclock boards itself.
- No reliability impact to picoclock board as verified with difference output produced with new solution.

# Key Learning on TRIZ

- TRIZ method works in software & electrical issues!! – Innovative principals, used of 39 parameters and contradiction matrix had helped us to solve issue that we faced with structured problem solving.
- Troubleshooting time improved with detail root causing.
- Non genuine Signal to Noise Ratio test failure reduced and within goal.
- Picoclock board repair rate reduce by 80%.
- Innovative principles applied in this project are:
  - ✓ *The Other Way round*
  - ✓ *Multifuntionality*
- This team has drive for implementation customize checkers program as a new process flow at their repair centre for detail debugging prior to shipment of picoclock boards to Intel.



# Acknowledgement

- Team members for their support and flawless delivery to achieve this project and for their guidance applying TRIZ methodology and innovative principles.
- ✓ Cheng, Chiew Shan – Module
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- ✓ Darin Moreira - Coach

*Thank You*