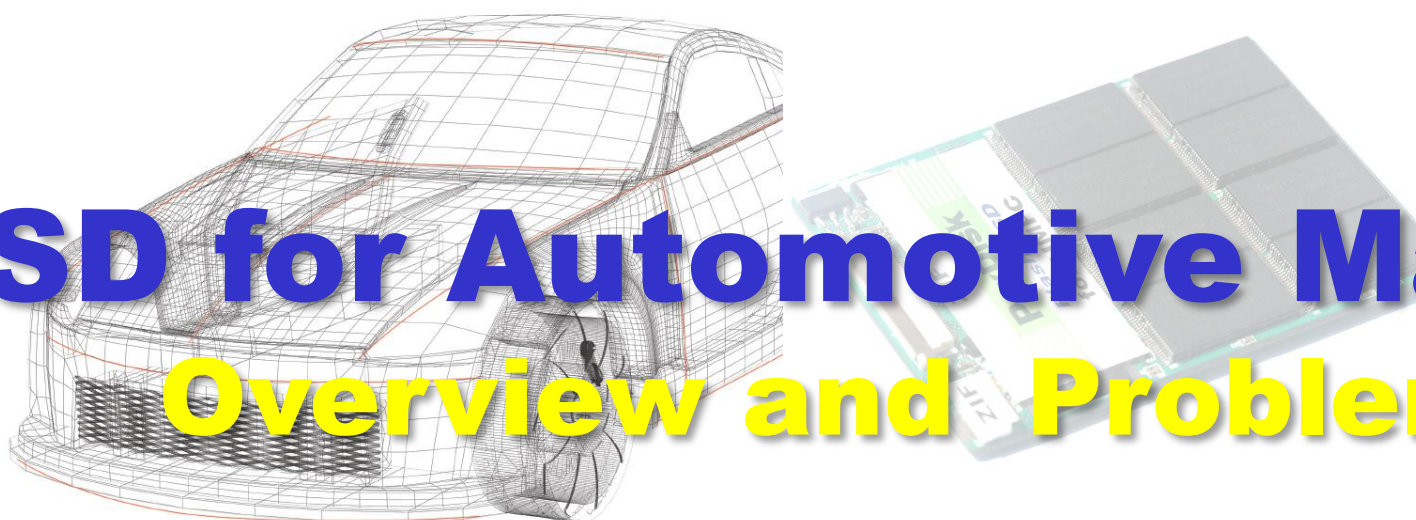


**Flash SSD**

**NVRAMOS 2009 Fall**

A wireframe illustration of a car is positioned on the left side of the slide. To its right, there is a detailed image of an SSD component, showing its green printed circuit board (PCB) with various electronic components and a black heat spreader.

# **SSD for Automotive Market**

## **Overview and Problem**

OCT 19<sup>th</sup> ,2009  
PaxDisk Co., Ltd.  
Yi, DaeHee

# Moving From AV Room to Infor-tainment Car

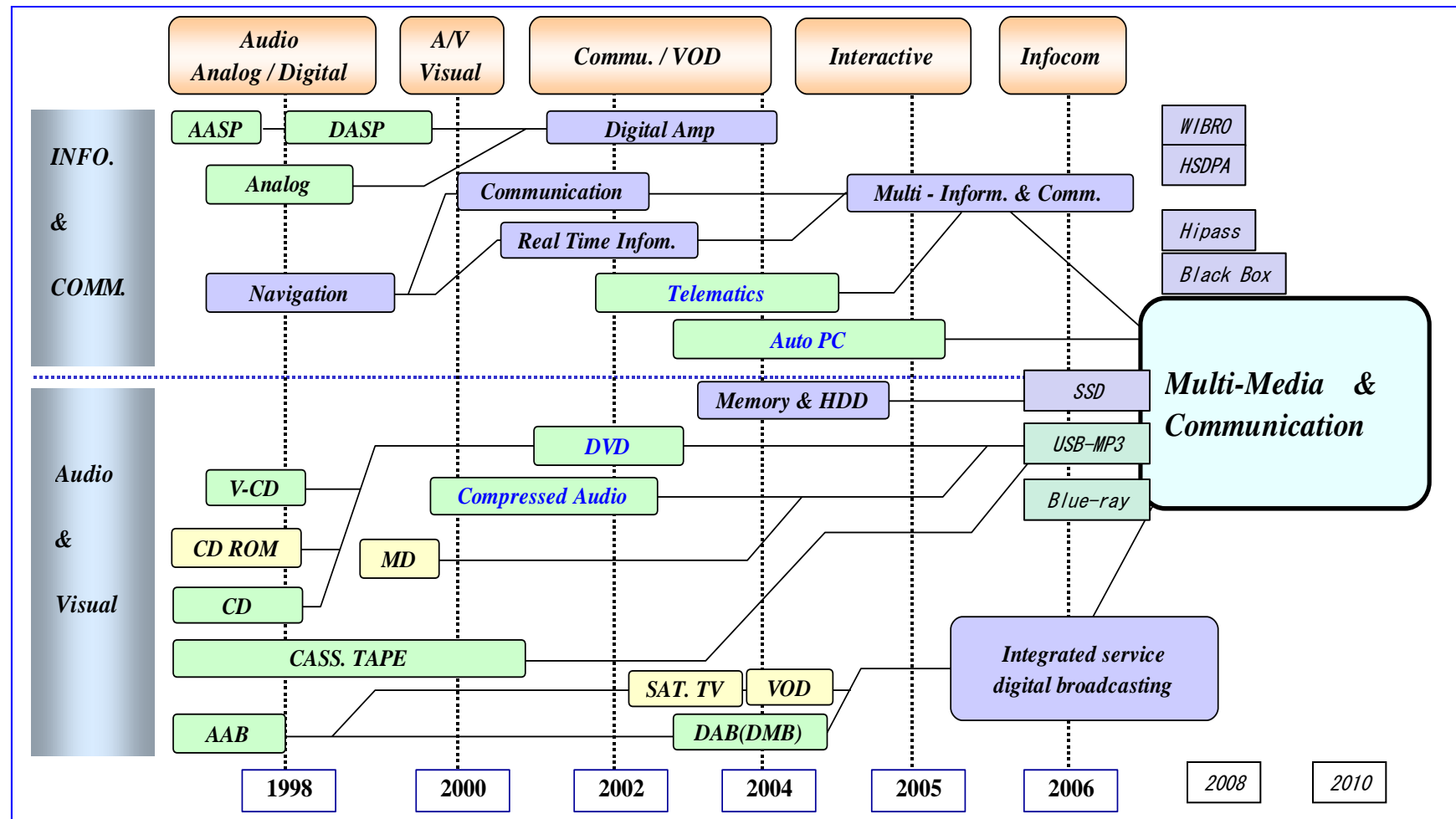
PaxDisk

- ☑ Car PC for Navigation , Karaoke and Game
- ☑ Black Box for taking precautions against the acc ident



# Car infor-tainment Technical Trend

- ☑ Hi-Pass for passing Tollgate charge, DMB, BlackBox...
- ☑ Multi-Media need storage device => HDD or SSD ?



# Car Infor-tainment Market Segmentation

- ✓ Aftermarket is Consumer concept => Life Cycle is about 6months~1year and Market size is big
- ✓ Built-in Market is Industrial concept => Life cycle is over 5 years

## Aftermarket

### Mobile Navigation



- Navigation
- MP3
- Hi-Pass

### Black Box



### Automotive – Ready UMPC's



- Navigation
- MP3
- Internet
- Video

### Car PC – Fixed installed Solutions



## Built-in Market

### Headunits/ OEM Navigation





# Japan Market 1, After Market SSD Navigation

PaxDisk

- ☑ Fujitsu-ten Memory Type Navigation, HDD Type Navigation (Fujitsu-ten is one of Toyota OEM Brand)
- ☑ Sanyo, Clarion also announce the SSD Navigation for making market difference

メモリーナビゲーション FUJITSU TEN ECLIPSE

使いやすいそのまま！  
満足感いっぱいのニューモデル登場！

カンタン操作  
わかりやすい音声案内  
楽しいAV機能  
すっきりスマート  
しっかりナビゲート

ベーシックタイプ AVN119M  
エンタテインメントタイプ AVN339M

HDDナビゲーション FUJITSU TEN ECLIPSE

きれがいいナビ、イワハズ。

映像のきれがいい。  
音のきれがいい。

HDDナビゲーション製品ラインナップ

オーディオ、ビジュアル、ナビゲーション、  
すべての高機能を美しくジャストフィット。

ワンセグチューナー内蔵 SSDポータブルナビゲーション NV-SD730DT SANYO Gorilla

Gorilla NV-SD730DT

車  
でナビ  
後ろ  
を見る  
エコ  
ドライブ  
テレビ  
を見る  
テレビを  
録画再生  
音楽  
を聴く  
静止画  
を見る

大容量8GB SSD搭載。7V型の大きな画面で、  
全国1,157エリアの詳細市街地図をフル活用！



16GB  
SSD  
Navigation

# Japan Market 2, Built-in SSD Navigation

PaxDisk

- ✓ Honda's New Solid State Drive(SSD) Navigation
- ✓ Toyota has plan to use SSD for their Solaris OS Car PC

14.08.2009

## Honda's new Solid State Drive (SSD) Navigation

**HONDA**  
The Power of Dreams

### Honda's new Solid State Drive (SSD) Navigation

#### NEW UNIT FROM HACE COMPLETES NAVIGATION RANGE

Honda Access Europe (HACE) has announced the addition of its **SSD (Solid State Drive) Navigation System** to its Audio & Electronics range of accessories. The unit completes the Honda Genuine Accessories navigation line-up, sitting between the Compact and HDD Navigation units.

In addition to optimal coverage, rapid route calculation and superb audio connectivity, the **8GB SSD** Navigation System offers great value for Honda customers and additional business opportunities for dealers.

The unit sits unobtrusively within the car's dashboard and is linked to controls on the steering wheel. It is available with an optional rear view camera to assist parking and has been extensively tested to meet **Honda's exacting quality standards**.

With no soldering or wire-cutting required, dealers will appreciate the **fast and easy-fitting** characteristics of Honda's SSD Navigation System. Customers, meanwhile, will enjoy the wide variety of functions and its great blend of versatility and value.



# Auto-PC infotainment

- ☑ Popular Car Navigator use Localization Map. So, Global business is limited.
- ☑ Windows XP Based Auto-PC overcome the “Localization Limit”. H/W maker can survival unit only.

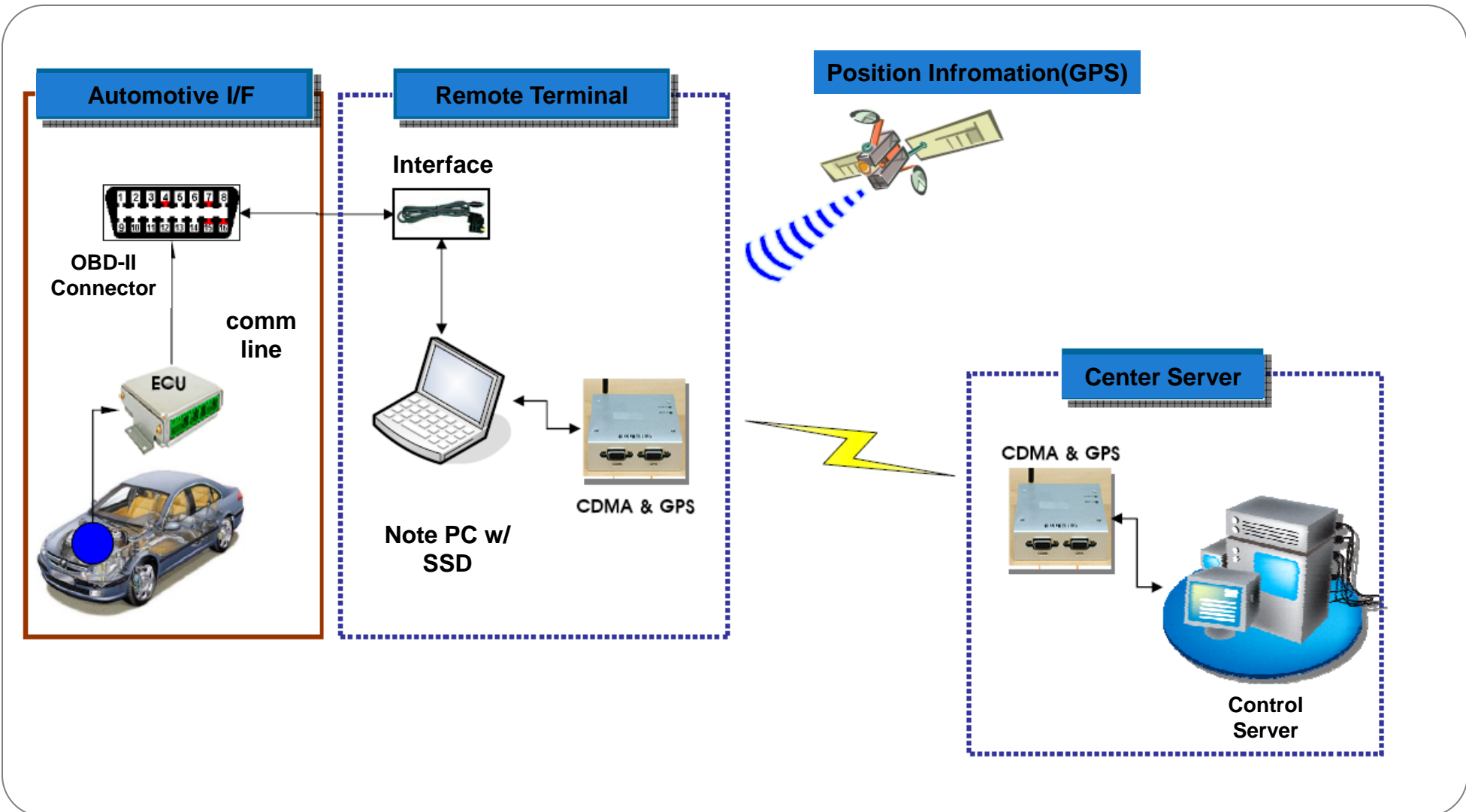




# Vehicle Remote Diagnosis System

PaxDisk

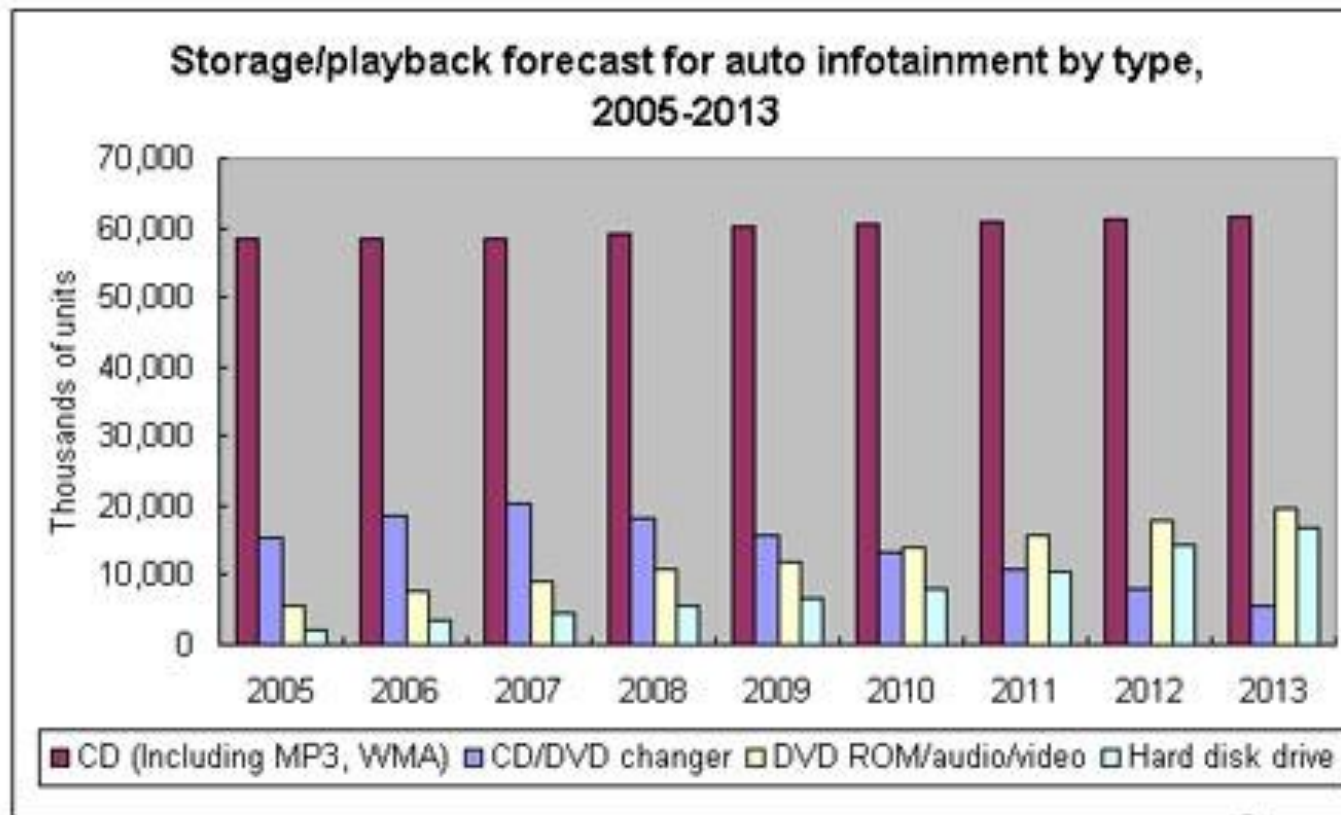
- ✓ Recently Automotive Maker use PC based vehicle remote diagnosis before launching
- ✓ It can be used to Car Telematics Service





# Automotive HDD/SSD Market

- ☑ Still HDD has good reliability.
- ☑ But, SSD has more advantage. So, HDD will be replaced to SSD.



Source: iSuppli, compiled by Digitimes, July 2007

BojNara

- ☑ Intel Supper from ROI(Return of Investment) in the consumer area
- ☑ Intel support Automotive Solutions ; the first is "ATOM Processor"

## Consumer

### Short Lifecycle

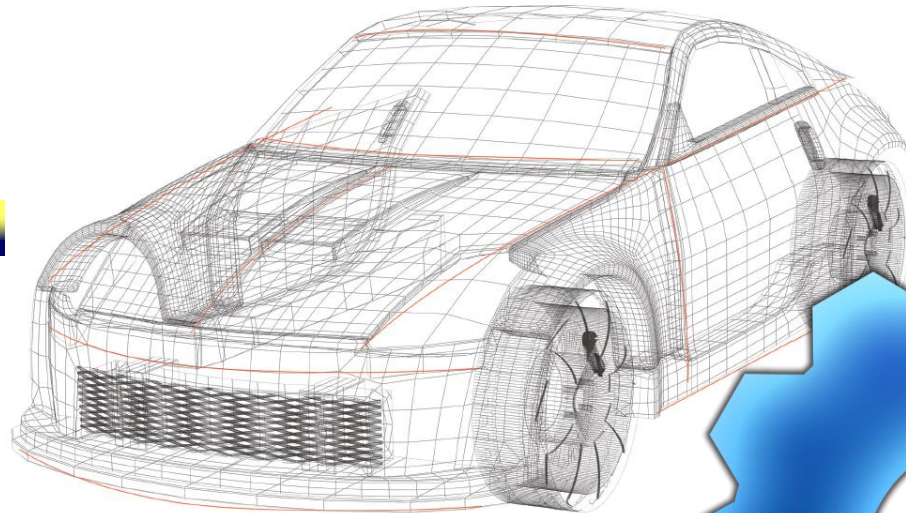
Consumer Electronics +  
Handsfree Control  
Eyesfree Info



## Automotive

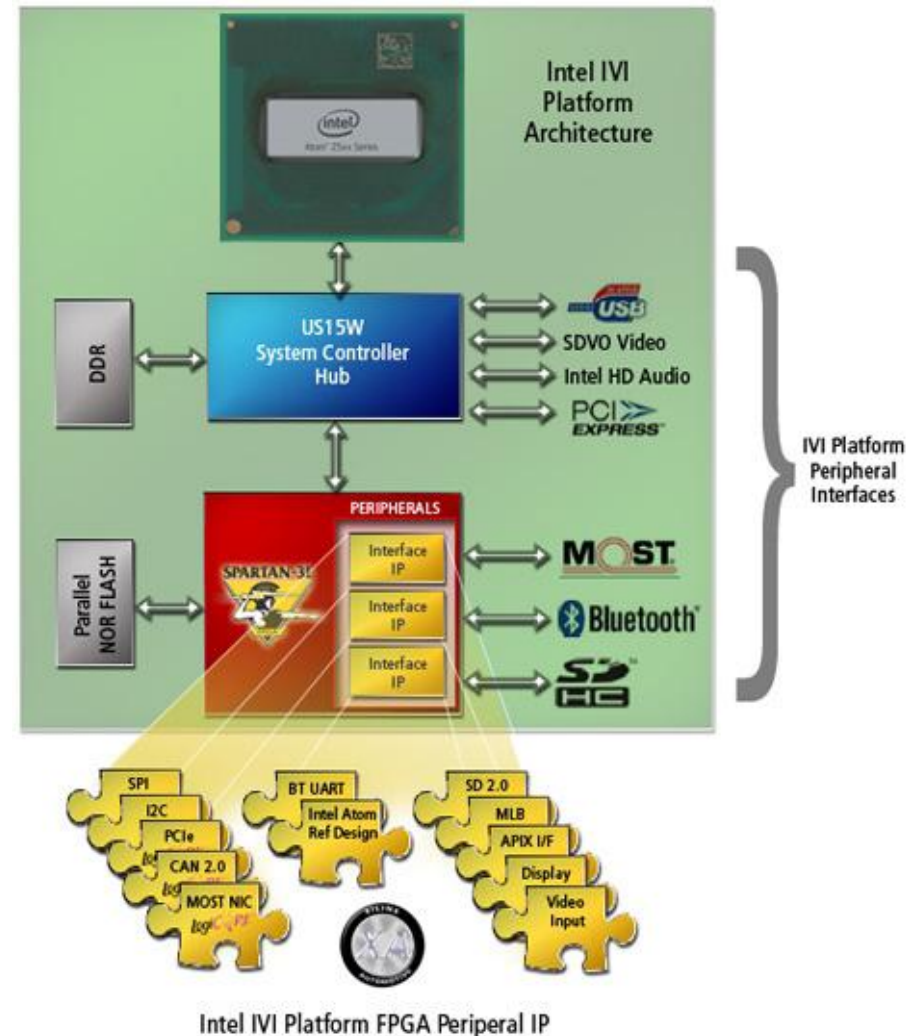
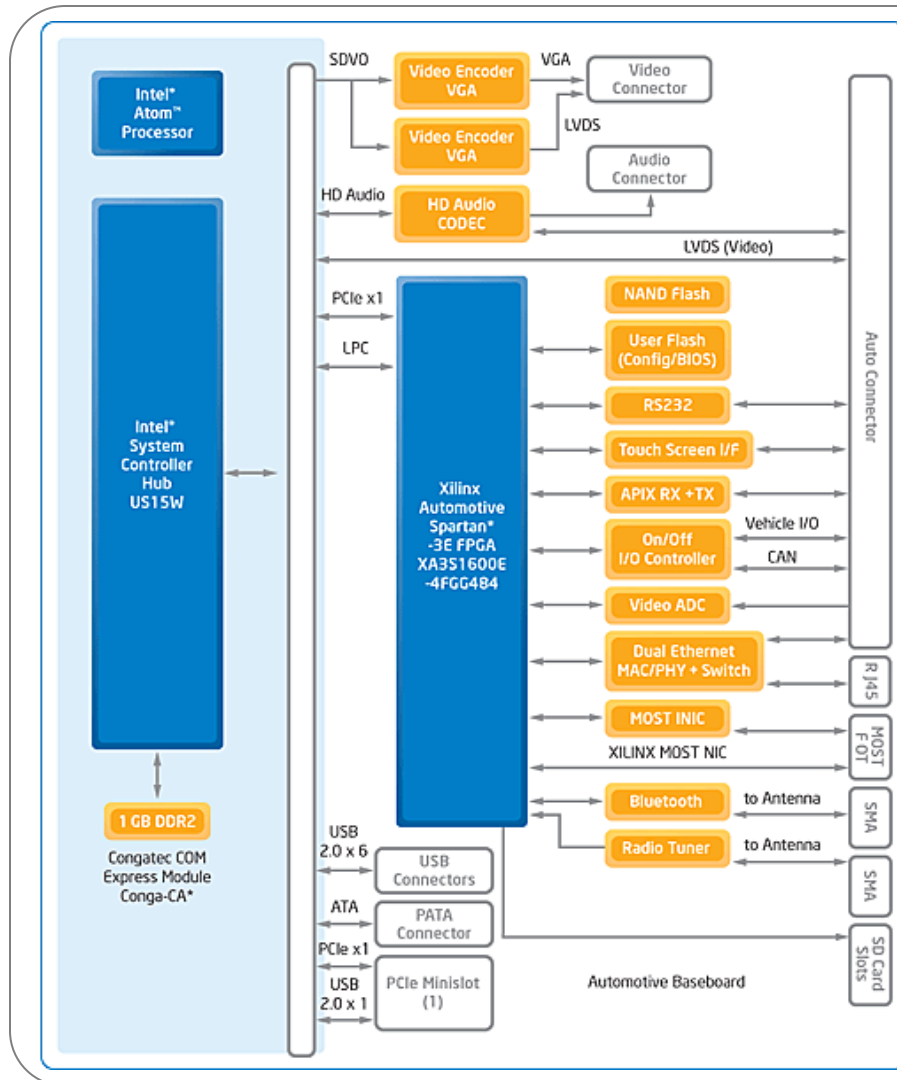
### Long Lifecycle

Extended Temp  
Low DPM  
Airbag, Brake system control,  
Tire pressure, cabin control, door monitors  
engine monitoring, feedback, etc



# intel Automotive Base Board / Platform Diagram PaxDisk

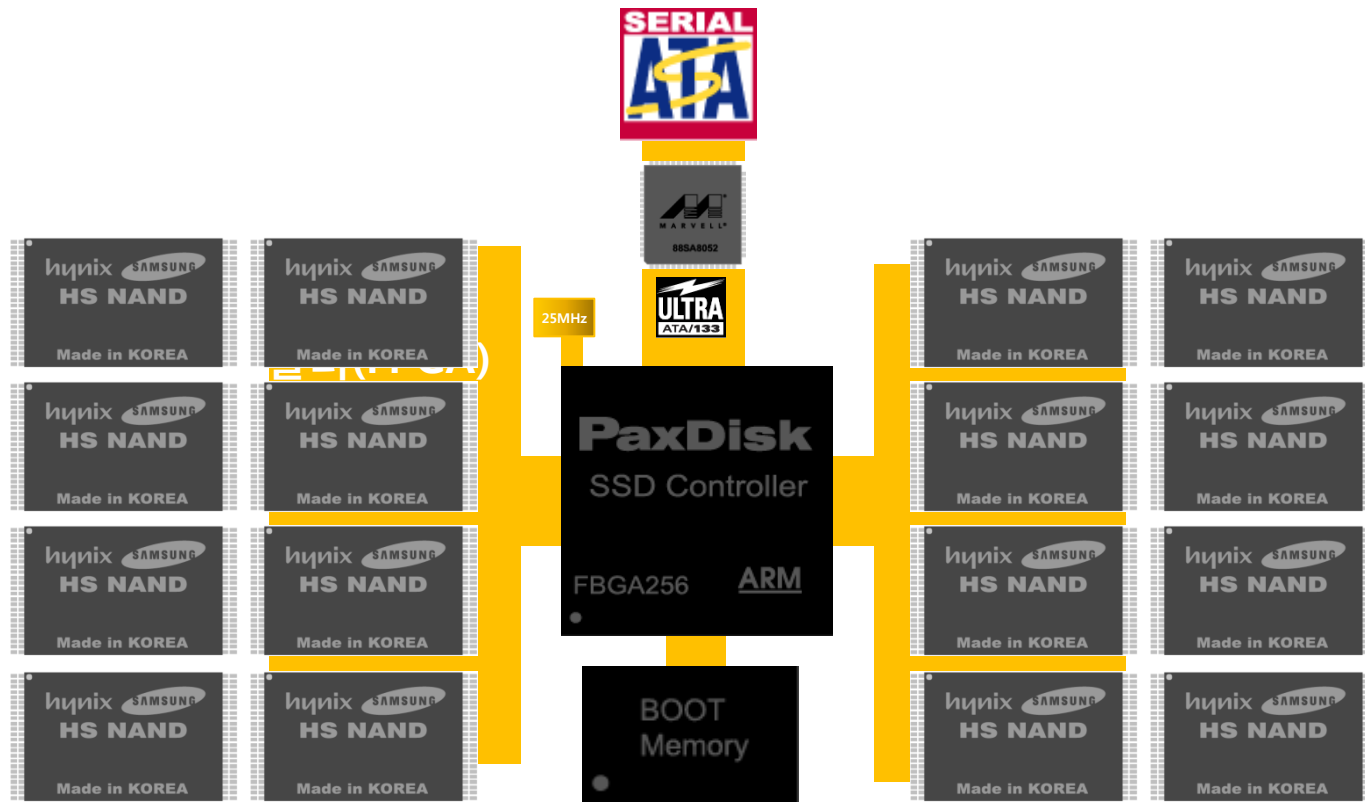
- ✓ Intel use ATOM processor for Built-in & After Market and ATOM support Industrial Grade
- ✓ Intel use Xilinx FPGA for South Bridge. It has various flexibility.



\* intel Automotive information

# General SSD Block Diagram

- ☑ SSD Controller has CPU and ROM, RAM and buffer
- ☑ NAND Interface need to correct ECC logic.

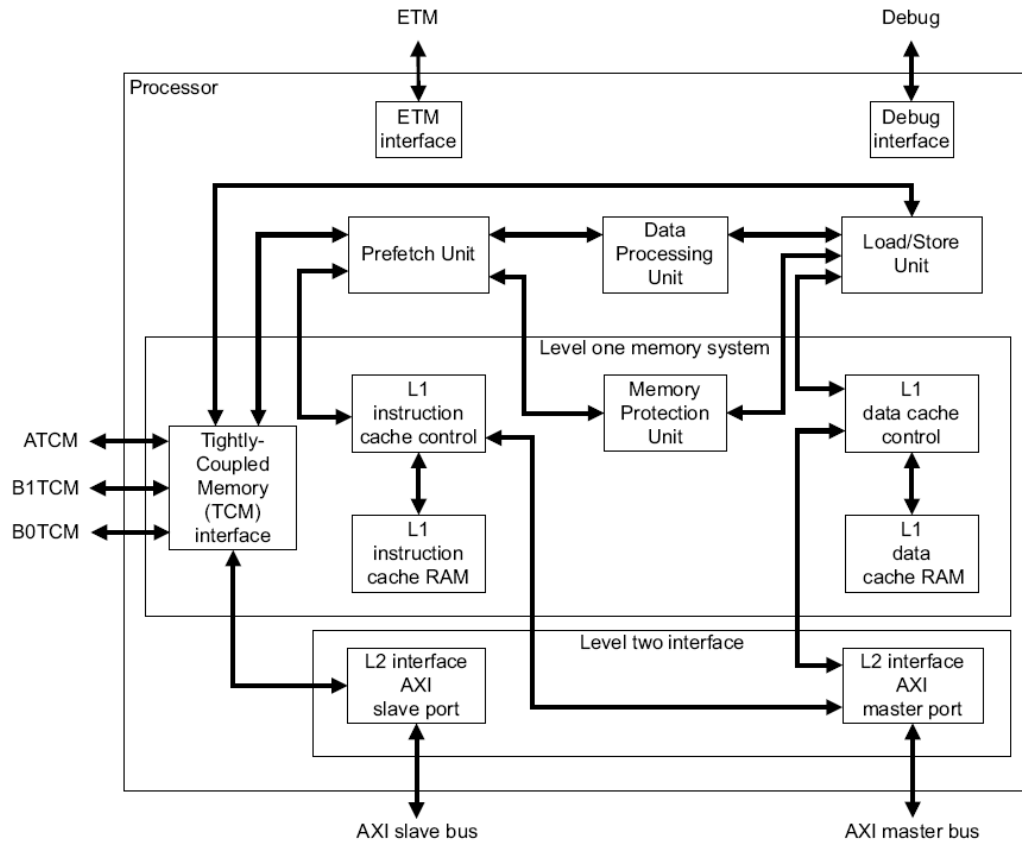




- ☑ In the silicon devices, stray radiation and other effects can cause system's corruption.
- ☑ Fault Tolerant technology is necessary.

to be corrupted.

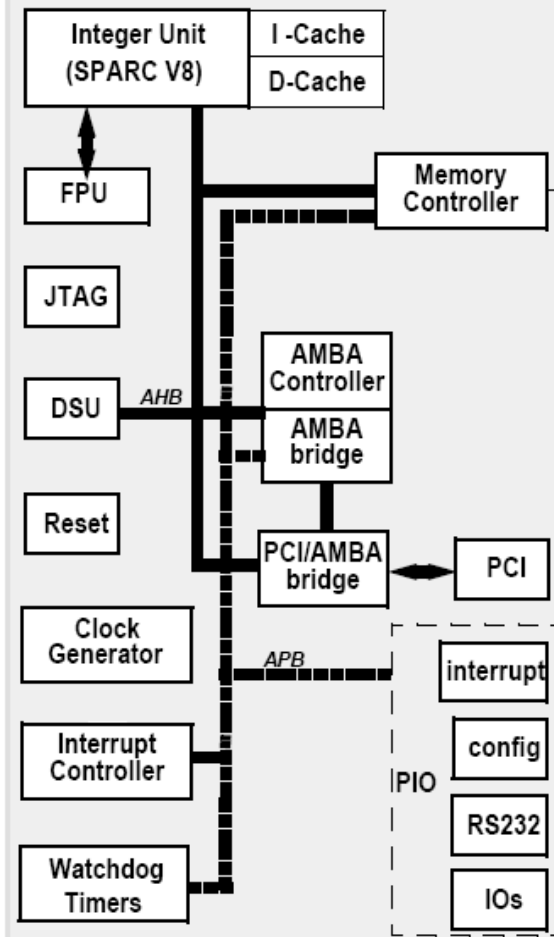
ARM CORTEX-R4



ARM CORTEX-R4 has Fault Tolerant Scheme.

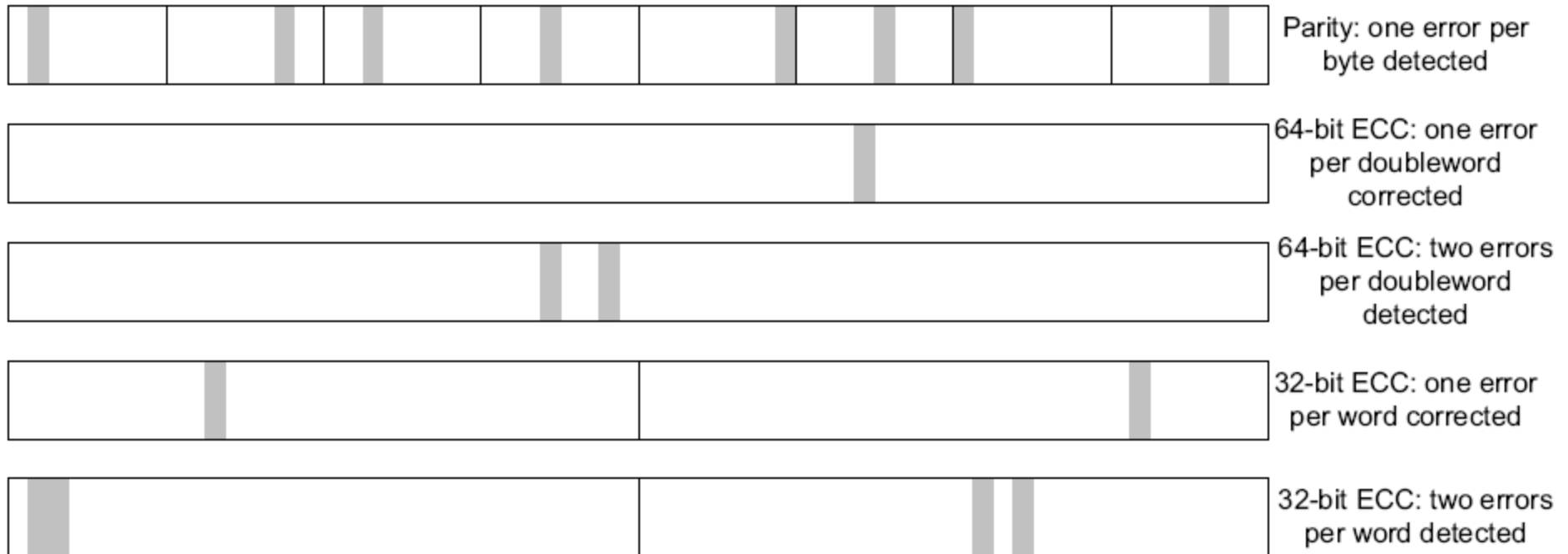
LEON2 Project

AT697



# CPU System's ECC & Parity Consideration

- ☑ ARM Cortex-R4's internal core ECC architecture



MISRA ; Motor Industry Software Reliability Association (British Trust)  
TS; Toyota Standard is Based on the MISRA-C

## MISRA-C Rule 19

### Do Not Use Octa Number System

```
code [1] = 109;  
code [2] = 100;  
code [3] = 052;  
code [4] = 071;
```

## MISRA-C Rule 21

### Do Not Use Same variable in a same scope

```
typedef signed short SI_16;  
SI_16 I;  
{  
    SI_16 i;  
    i = 3;  
}
```

## MISRA-C Rule 50

### Do Not Use Floating Point in a range of Fraction Error

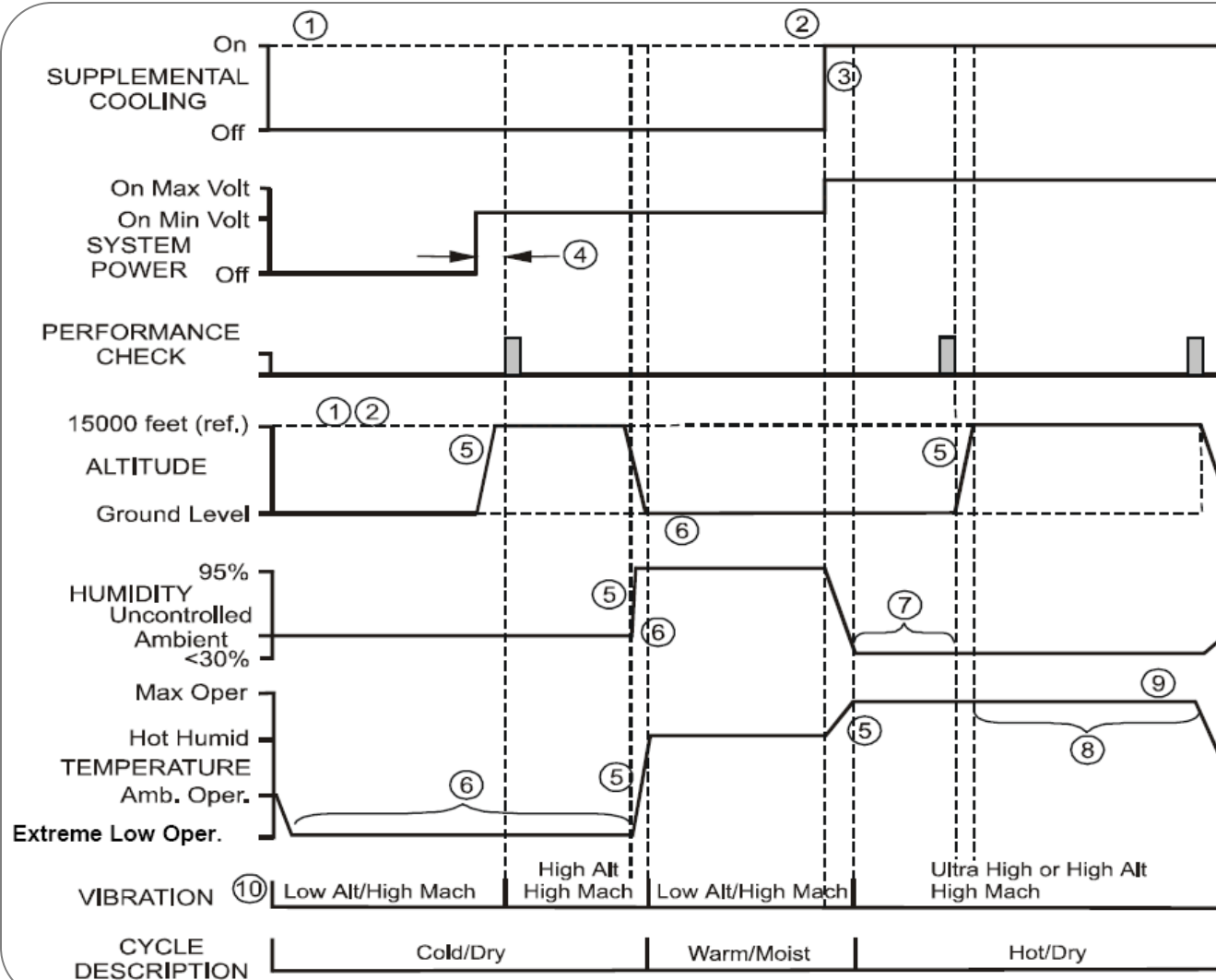
```
typedef double F_32;  
F_32 x,y;  
if (x == y)  
{ ****/ }
```

## MISRA-C Rule 52

### Do Not Use not reached code

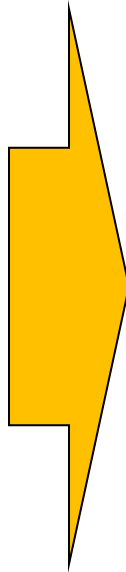
```
switch (x)  
{  
    case 0:  
        a=b;  
        break;  
    case 1:  
        a=c;  
    default:  
        errorflag=1;  
        break;  
}
```

# Automotive Qualification Test Process(MIL810F) PaxDisk



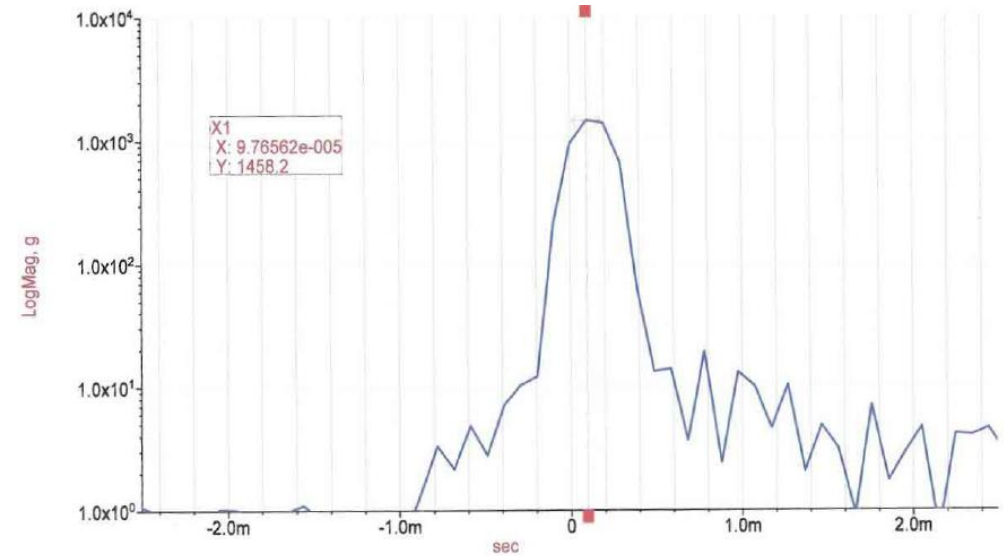
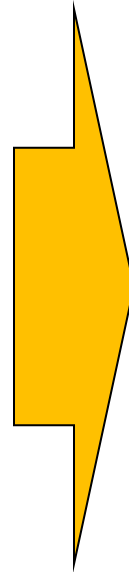
- ① Tailor temperature and flow of supplemental cooling to provide worst case heat dissipation.
- ② Carefully tailor the platform/product specific factors.
- ③ Minimum of 20°C per minute.
- ④ Equipment warm-up time.
- ⑤ Perform transition at maximum facility capability.
- ⑥ Ideally, bleed hot/humid air into chamber (see paragraph 2.3.5b) so minimum soak follows achievement of all temperature, altitude and humidity conditions.
- ⑦ System thermal stability or 2 hours, whichever is greater.
- ⑧ System thermal stability or 4 hours, whichever is greater.
- ⑨ Carefully tailor high altitude operating temperatures.
- ⑩ Vibration may be performed separately with temperature.

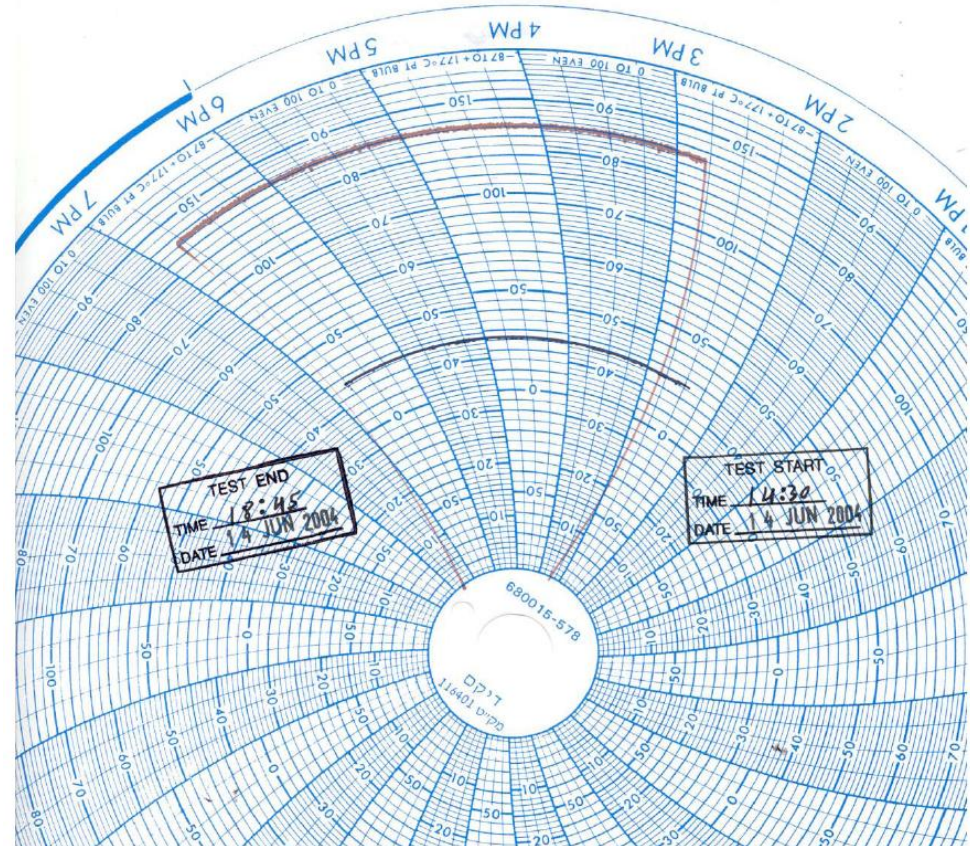
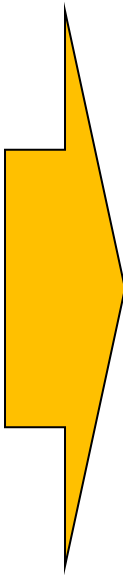




# Mechanical Shock Test – Non Operation(1500g)

**PaxDisk**







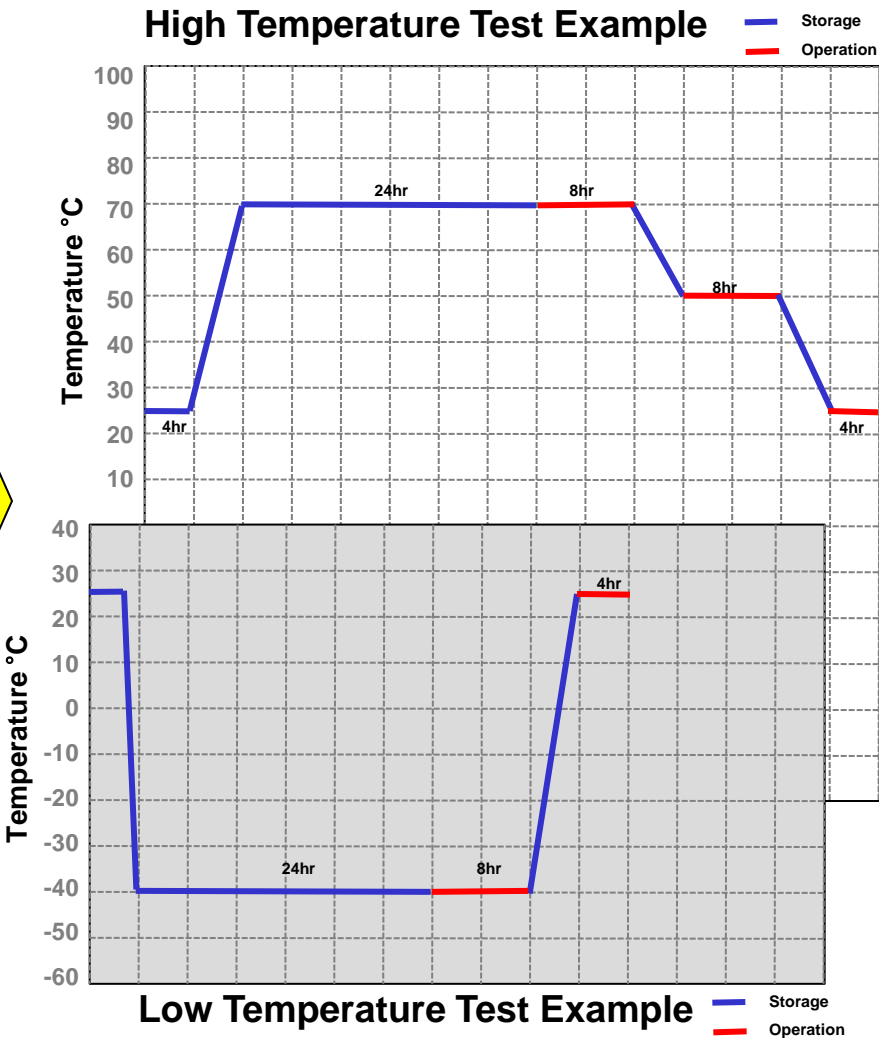
# Temperature Test Procedure

☑ Temperature Test is more important for the Industrial Grade

PaxDisk Temperature-Humidity Test Chamber



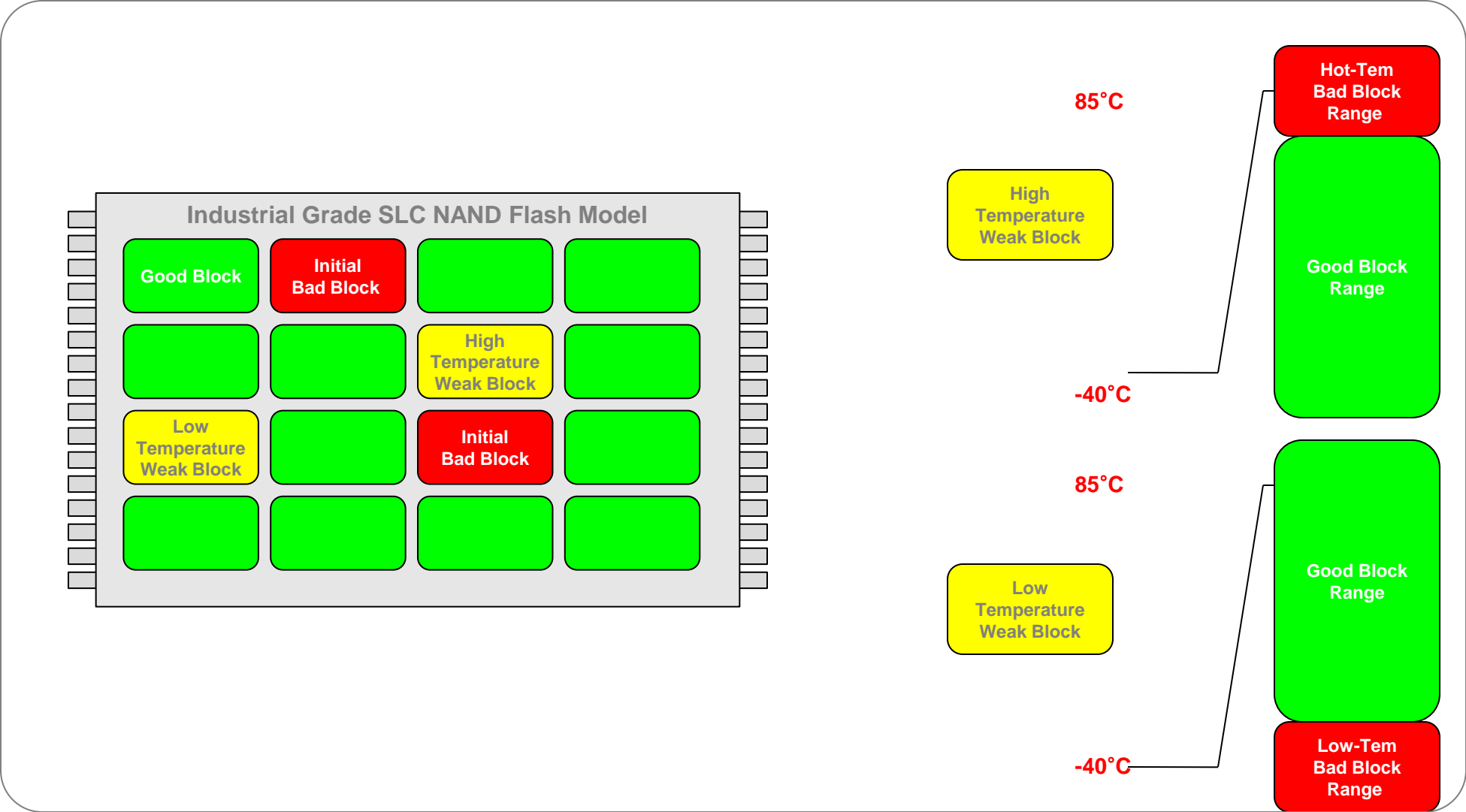
High Temperature Test Example





# NAND Flash Operating Temperature Issue

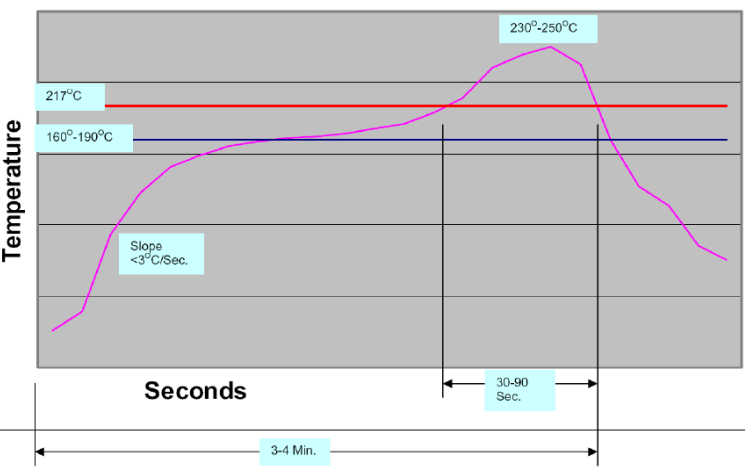
☑ Weak block is depend on each temperature range



# SMT Reflow Defect Issue

- ☑ Reflow Defect block is also depend on temperature range
- ☑ We need more detailed study for the temperature.

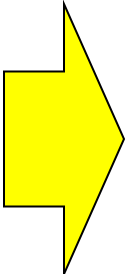
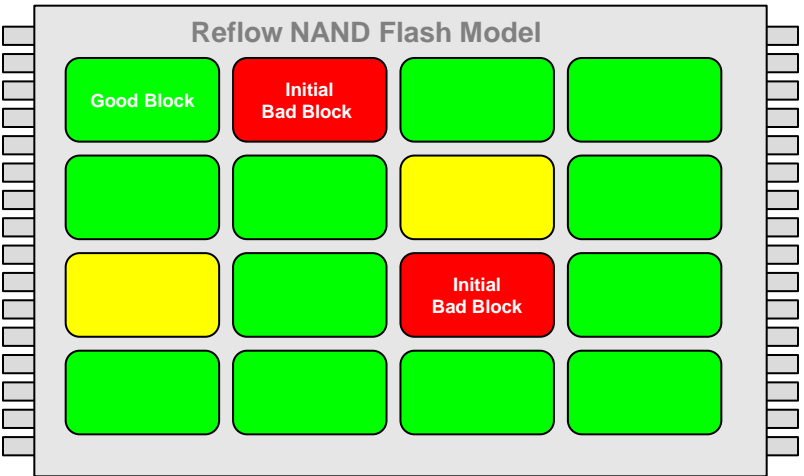
Temperature Profile for Lead Free solder



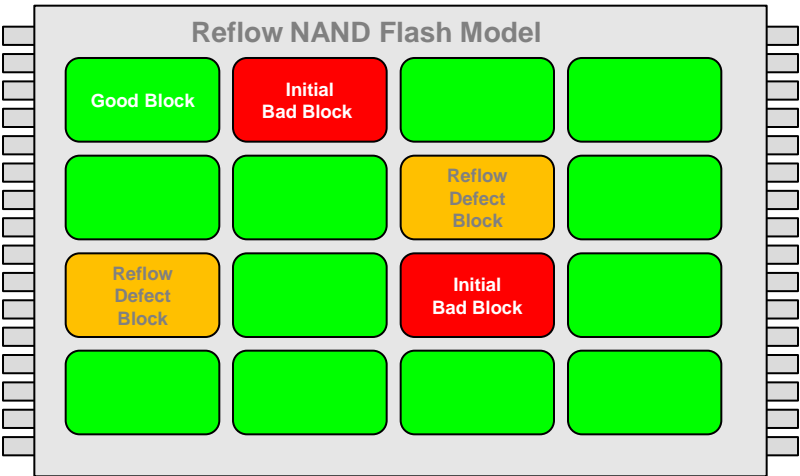
PaxDisk SMT Production Line with Reflow



Reflow NAND Flash Model



Reflow NAND Flash Model



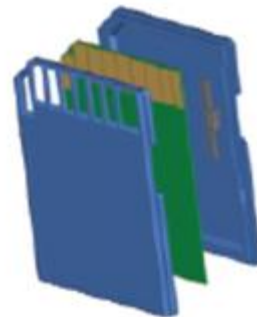
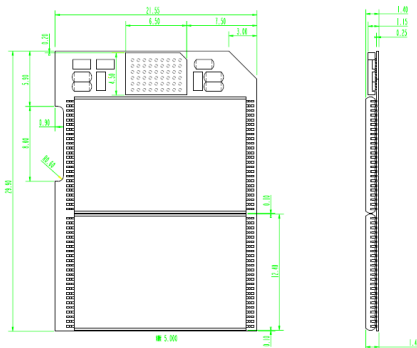
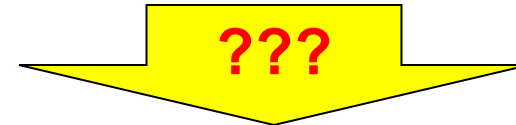
# A valuable lesson can be learned from it.

타산지석(他山之石)

- ☑ SD Card is industry Standard. But, What is SD Association's Role ?
- ☑ Many Customer suffer from broken SD Card in the Navigation. Is SSD different ?



1. Navigation & Black Box Recall Problem
2. Weak Controller issue
3. B-grade NAND Flash issue
4. Weak Test Methodology
5. Piracy SD Card



1. No Price Room for the Good SD Card
2. Increasing Accident Ratio while driving a car
3. End-user's wrong awareness for NAND flash media

# PaxDisk Military & AeroSpace SSD

PaxDisk

- ☑ PaxDisk Support the Military & AeroSpace Applications.
- ☑ PaxDisk is now focused to Radiation-Tolerance Space SSD Technology.





# PaxDisk Line Up for the Industrial Grade SSD



1.0 inch	1.8 inch	2.5 inch	3.5 inch	Special	Embedded SSD
 40IDE2CF	 ULTRA ATA	 ULTRA ATA	 ULTRA ATA	 PMC	 ESSED40
 44IDE2CF	 ULTRA ATA D50 mATA		 SERIAL ATA 3Gb/s	 PCI CONVERSIONAL	 ESSED44
 SATA2CF	 ULTRA ATA ZIF	 SERIAL ATA 3Gb/s	 Ultra 160 SCSI	 P2 256GB	 ESSDSATA
 mATA2CF	 SERIAL ATA 3Gb/s	 SSD25KB 32GB MADE IN KOREA		 PLAN	 ESSDZIF
 SCSI2CF	 SERIAL ATA 3Gb/s			 PLAN	