SSD for Automotive Market
Overview and Problem

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Moving From AV Room to infor-tainment Car

- Car PC for Navigation, Karaoke and Game
- Black Box for taking precautions against the accident
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 6 months~1 year 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

*Microsoft 2006 Presentation + PaxDisk*
Japan Market 1, After Market SSD Navigation

- 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
Honda’s New Solid State Drive (SSD) Navigation

Honda’s new Solid State Drive (SSD) Navigation

NEW UNIT FROM HACE COMPLETES NAVIGATION RANGE

Honda Access Europe (HACE) has announced the addition of a Solid State Drive (SSD) 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 3GB 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 infortainment

- 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

- 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.

![Storage/playback forecast for auto infotainment by type, 2005-2013](Image)

Source: iSuppli, compiled by Digitimes, July 2007

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Intel’s the Automotive Market

- 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 2006 Presentation + PaxDisk Opinion
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.
SSD Controller has CPU and ROM, RAM and buffer
NAND Interface need to correct ECC logic.
MCU for Automotive SSD

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

ARM CORTEX-R4

In the silicon devices, stray radiation and other effects can cause system’s corruption.

Fault Tolerant technology is necessary.

ARM CORTEX-R4 has Fault Tolerant Scheme.
CPU System's ECC & Parity Consideration

- ARM Cortex-R4’s internal core ECC architecture

- Parity: one error per byte detected

- 64-bit ECC: one error per doubleword corrected

- 64-bit ECC: two errors per doubleword detected

- 32-bit ECC: one error per word corrected

- 32-bit ECC: two errors per word detected
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)

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.

*MIL810F Standard*
Electro-dynamic vibration Tester
Mechanical Shock Test – Non Operation(1500g)
Altitude Test Chamber
Temperature Test Procedure

- Temperature Test is more important for the Industrial Grade

PaxDisk Temperature-Humidity Test Chamber

High Temperature Test Example

Low Temperature Test Example
NAND Flash Operating Temperature Issue

- Weak block is depend on each temperature range.

Industrial Grade SLC NAND Flash Model

- Good Block
- Initial Bad Block
- Low Temperature Weak Block
- High Temperature Weak Block

-40°C to 85°C

- Hot-Tem Bad Block Range
- Good Block Range
- Low-Tem Bad Block Range
SMT Reflow Defect Issue

- Reflow Defect block is also depend on temperature range
- We need more detailed study for the temperature.
A valuable lesson can be learned from it.

✔ SD Card is industry Standard. But, What is SD Association’s Role ?
✔ Many Customer supper 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 Raito while driving a car
3. End-user’s wrong awareness for NAND flash media
PaxDisk Military & AeroSpace SSD

- 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
- 40IDE2CF
- 44IDE2CF

1.8 inch
- ULTRA D50
- SAT2CF
- mATA2CF

2.5 inch
- ULTRA ZIF
- SATA2CF

3.5 inch
- SERIAL ATA

Special
- PMC
- PMC Embedded

Embedded SSD
- ESSD40
- ESSD44
- ESSDSATA
- ESSDZIF

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