Automotive Electronics

Trend in Automotive Industry

Sithiporn Scientific & Technology Conference
At Chulabhorn Research Institute

by: Kenji Suzuki

July 18, 2013

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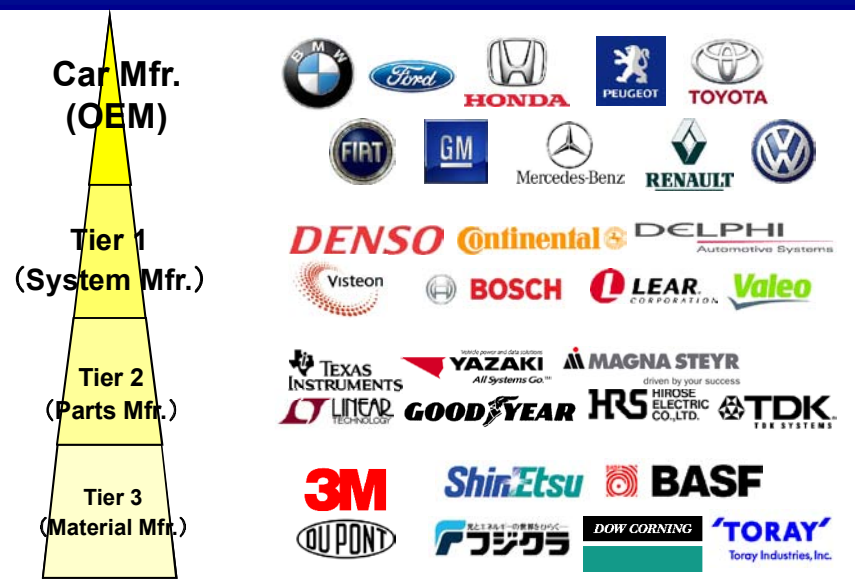
a. Trend in Industry Structure

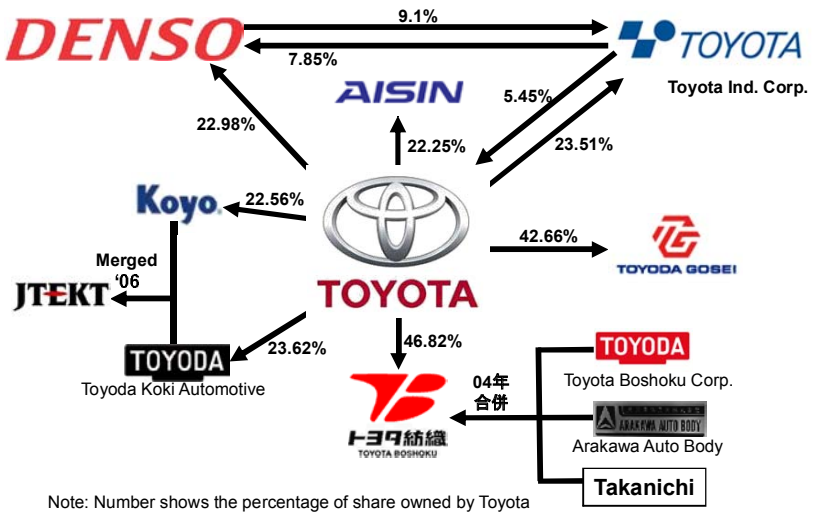
Examples		Examples
Global	**Strategy**	Multi-Domestic
Globally	**Competition**	Per country/region
Standardized product	**Marketing**	Localized product
Placed in a country/region per function in the VC	**Positioning of Value Chain**	The entire VC placed in a country/region
Stringent management by parent company	**Organization Management**	Localized authority

Globalization

b. Industry Structure (1)



c. Industry Structure (Keiretsu)

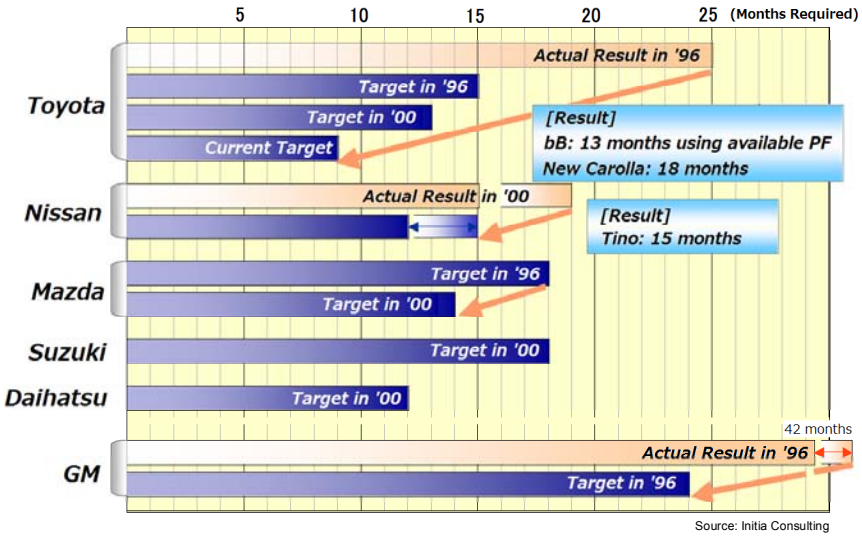


Note: Number shows the percentage of share owned by Toyota

d. Industry Structure Type

1. *Closed: Owning parts mfr. as a division or a group within a company.*
2. *Semi-Closed: Parts supply to be outsourced to limited number of companies (Owning a percentage of their share).*
   ⇒ *KEIRETSU*
3. *Open: Having parts supply to be outsourced as an open bid as required.*

e. Development Lead Time



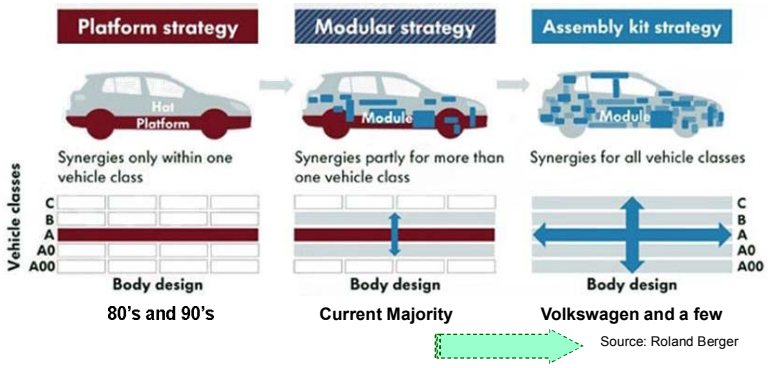
Source: Initia Consulting

f. Vehicle Development – The Difference

Region	Development Time		Cost		Quality	
	Rating	Reason	Rating	Reason	Rating	Reason
EU/ NA	Short	•By **modularization** - Specifying modules in pre-development stage - Less newly developed parts	Low	•Scale merit by utilizing modules to multiple vehicles •Clear development time frame •RFQ to multiple suppliers	High	•Improvement per module or architecture •Efficiency in production
JPN	Short	•Good understanding by parts suppliers - Instant understanding of OEM's request - Acucmulation of daily meetings	Low	•Cost reduction by working together •Becoming difficult to meet price requirements in global competition environment.	Very High	•Broad approach to safety, quality, and reliability •Approach done at every stage of suppliers •Possibilities of **over quality**
CHN	Short	•Using conventional parts and modules •Least amount of evaluation and testing •Less demanding market	Very Low	•Volume purchase of conventional parts •Stringent request of cost reduction •Self-production as an option	Low	•Many copies and counterfeit by reverse engineering •Unbalanced vehicle dynamics •Low interest in NVH

Source: Roland Berger

g. Vehicle Architecture



This is not matter of right or wrong, but manufacturers are always looking for better ways to make profit. The European manufacturers failed to pursuit the Japanese way of building cars. They found their style in modularization, pioneered by Volkswagen.

h. OEM and Suppliers (VW)

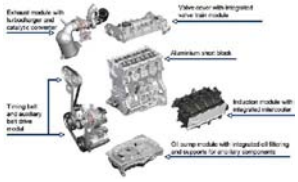
Volkswagen Modular Transverse Matrix (MQB)

Drive systems in MQB

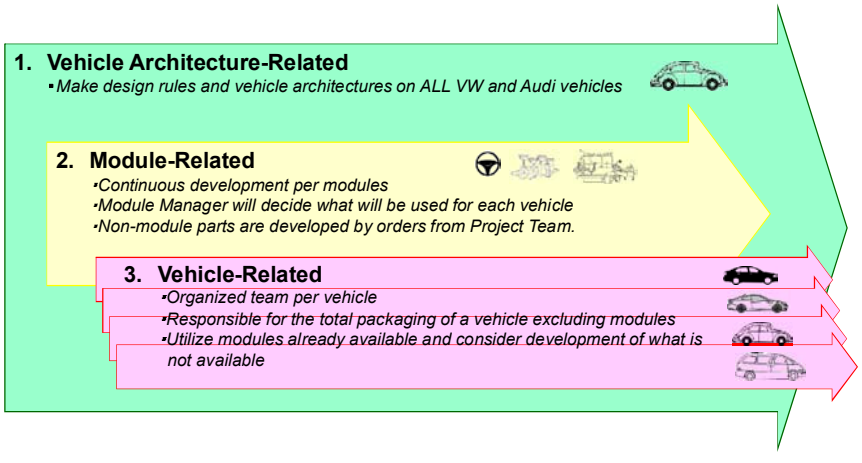
The idea of "module" has been implemented in all levels from Components to vehicle.
The base is to utilize what's already available.


Modular layout of EA211 TSI (MQB)

One of the prominent characteristics of the Modular Transverse Matrix is the uniform mounting position of ALL engines.



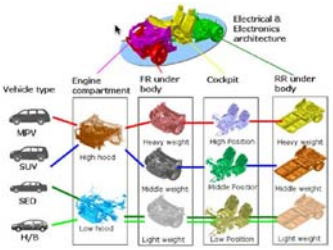
i. OEM and Suppliers (VW)



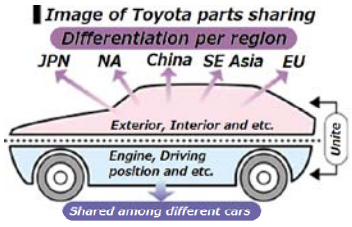
Unlike many of their Japanese rivals, the vehicle project manager is NOT in charge of that vehicle.

j. Modularization

Mazda Common Architecture



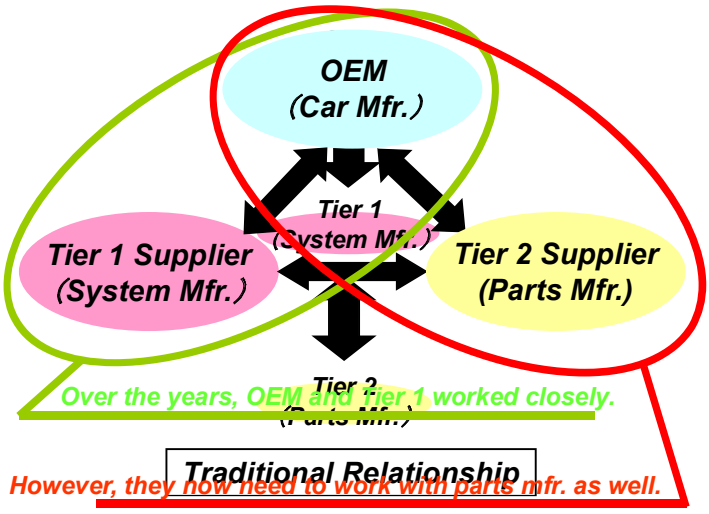
Nissan Common Module Family



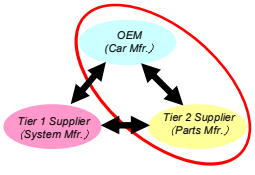
Toyota New Global Architecture

PSA Peugeot Citroen EMP2 Efficient Modular Platform

k. OEM and Suppliers



l. OEM and Suppliers



Cooperation of Parts Mfr. And OEM

A must-have relationship to adapt the latest electronic technologies.

Adaptation possibilities and cultivation of "Newborn Tech" to car applications.

Key: Adaptation to Car Applications

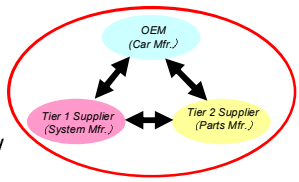
＜Examples＞

1. *Automotive Microcomputer*
2. *ACC* Radar (Milliwave, Laser)*

＜Progress＞

1. *OEM＋Parts Mfr.「Fundamental Development」*
2. *＋System Mfr.「Product Development」*

**ACC: Automatic Cruise Control*



Courtesy : Nissan Motors Corp.

m. Thailand Master Plan

		Short 2012-2014	Middle 2015-2018	Long 2019-2021
Targets	Industry Structure	Strengthen & Maintain as ASEAN production leader and localized R&D	Expand to be R&D hub in Asia	Actively participate in world D&D
	Automotive/Engine System	ICE	Hybrid & Plug-in hybrid	Fuel cell
	Components: Exterior / Interior / Brake&Suspension	Light weight	Auto electronics	Modified Personalized atmosphere
	Components: Electronic	Integrated software	EMC	Motor Driven
	Production	QCDEE	Part design	System design
Actions	R&D	Focus (Safety, energy, environment /Localize	User comfort Reverse engineering Battery, Motor	Bio material
	Knowledge/Infra/Interconnection	R&D Centers	Centers of Excellence	Knowledge/info sharing center
	Policy & Standard	HRD-Infrastructure-Incentive		

Source: MTEC, NSTDA and Thailand Automotive Institute

n. Suppliers in Thailand

Top 100 Global Suppliers Active in Thailand

Japanese Global Suppliers		Other Global Suppliers	
2. Denso	46.Bridgestone	1. Robert Bosch	44. Federal-Mogul
4. Aisin Seiki	49.Tokai Rika	3. Continental	47. Michelin
13.Yazaki	57.Showa	6. Faurecia	50. GKN Driveline
15.Sumitomo	61.Mitsuba	7. Johnson Control	51. Hella
16.Toyota Boshoku	66.Asahi Glass	8. ZF	52. Goodyear
18.CalsonicKansei	72.Stanley	11. TRW	56. Grupo Antolin
19.JTEKT	74. Akebono Brake	12. Delphi	58. Bayer
20.Hitachi	82.Sanden	14. Lear	59. TI Automotive
28.Toyoda Gosei	84. F-Tech	17. BASF	65. Draexlmaier
33.NTN	92.Alpine	21. Valeo	67. American Axle
34.NSK	94.Pioneer	22. Visteon	73. Rieter Auto.
35.Mitsubishi	98. Omron	23. Autoliv	84. F-Tech
39.NHK Spring		25. Mahle	86. Hayes Lammerz
40.Koito		27. Dana	93. 3M
41 TS Tech		31. BorgWarner	
43.Takata		36.Teneco	
	28/29 Companies		30/71 companies

Source: Thailand Automotive Institute

Contents

a. Pursuit of Better Efficiency and Safety

GREEN : *Low (Zero) emission*
Multiple powertrain (Hybrid)
CVT, DCT and other transmission

Safety : *Advanced Emergency Brake System (AEBS)*
Lane Departure Warning System (LDWS)
Pedestrian Airbag
Alcohol Ignition Interlock

Comfort: *Cabin Air quality management*
Linear Motor Suspension

Wellness : *Health monitor of occupants*

Courtesy: Nikkei BP(Hitachi)、Dräger Safety AG & Co. KGaA、TEAC Corp.

b. Priority…Greener and Safer

Protection of pedestrians and occupants, and earth's environment is a MUST, regardless of geographical area. These are GLOBAL ISSUES!!

SE Asia Traffic Death Statistics

Country	Rate per 100,000 population	Absolute Deaths
China	16.5	96,611
Indonesia	16.2	16,548
Vietnam	16.1	12,800
Thailand	19.6	12,492
Japan	5	6,639
Malaysia	23.6	6,282
Bangladesh	12.6	4,108
Afghanistan	39	1,779
Cambodia	12.1	1,668
Myanmar	23.4	1,638
Philippines	20	1,185
Singapore	4.8	214
Bhutan	14.4	111

Courtesy: WHO survey 2009

Global Emission Standard Timeline

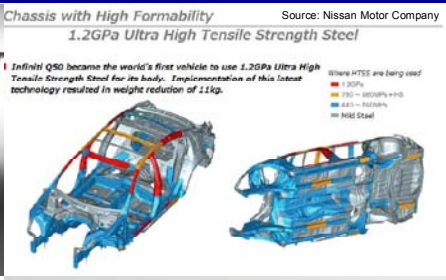
Courtesy: AltEnergyStocks.com

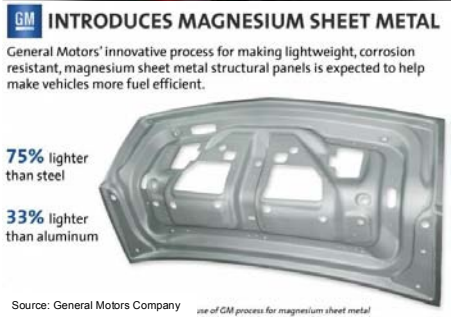
In the past, it was common to see so-called "Trickle down effect" in car features. The latest and best technologies were only available to those sold in developed countries. But Not anymore! They have to provide as much hi-tech and new technologies to ALL of their customers.

c. Cars on a Diet

Source: Automobili Lamborghini S.p.A.

Source: Nissan Motor Company





Source: General Motors Company

Source: BMW AG

d. Higher Voltage

1920s	1955	2015?	20XX
7V (6V Battery)	**14V (12V Battery)**	**42V (36V Battery)**	**Multiple-Voltage**
Load: Accessories - Lamp - Ignition	Load: Body electronics - Lamp - Engine management system - Audio - Navigation System	Load: PWR electronics - HEV, ISG - X-by-wire - High fuel-efficiency - Low emission	HEV, FCEV 150 – 300V - Power: 42V - ECU: 7V

Source: Tatsuo Teratani
Edited by author

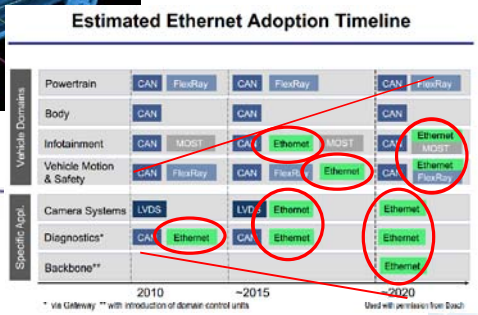
Merit:

- **Higher voltage = lower amps (1/3 less) = thinner cables, smaller connectors, and smaller motors = Weigh less = better fuel efficiency**
- **Be able to use high-wattage system (E-air compressor, motor generator, integrated starter generator, E-heated windshield, and etc.)**
- **Less use of converters = less power loss = better overall efficiency**

e. Connected

Expanding use of ethernet

TOMORROW: Critical, Signal and Power Supply applications



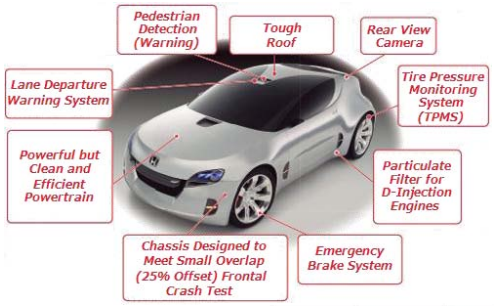
OPEN ALLIANCE

AVNU

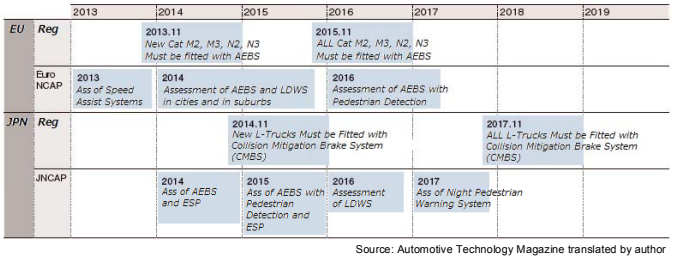
TODAY: Non-critical, Signal-Only applications

Source: NXP Semiconductors

f. Regulations or …



Assessment of technology and disclosure of test results by institutions may encourage manufacturers to implement and improve the technology earlier than their plan.



Source: Automotive Technology Magazine translated by author

g. Systems in Sync

Courtesy: BBC News

Today

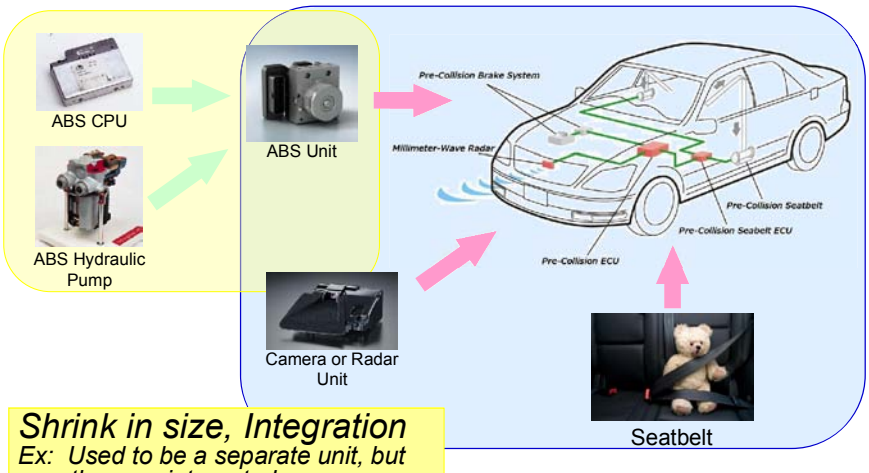
- *Navigation*
- *AT Control*
- *Power Windows*
- *Headlights*
- *Windshield Wipers*
- *Car Radio*

Near Future

Telecom System

Body Control ↔ *Engine Control*

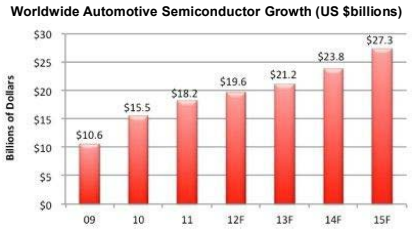
h. Evolution in Brakes



Shrink in size, Integration
Ex: Used to be a separate unit, but now they are integrated as one.

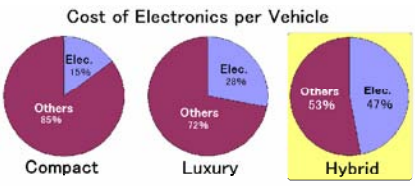
Synchronization
Ex: A group of parts work in-sync to execute a function, as a system.

i. Increase of Electronics (1)



- *In semiconductor industry, sales to automotive industry was US$11 billion in 2000. However, that number reached US$18 billion in 2011, and by 2015, it is expected to reach US$27 billion. (Annual growth of 11%)*

Courtesy: IC Insight

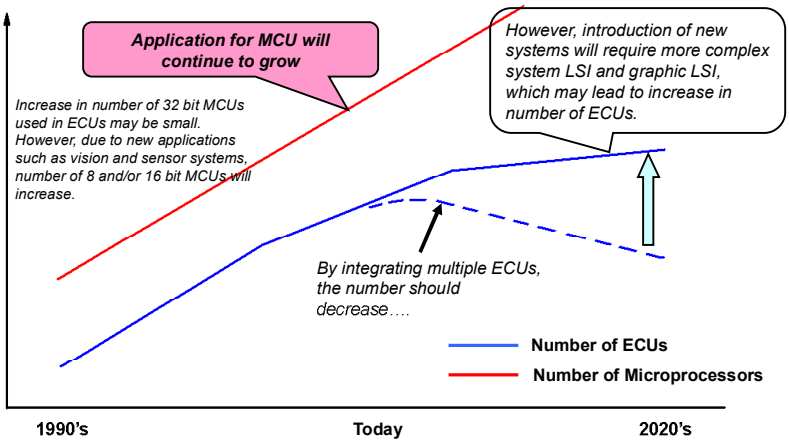


Toyota Corollla | Lexus LS460 | Toyota Prius

- *Cost of Electronics in a Vehicle*
  2005 Avg. 20%
  2015 >Avg. 40% (expected)

Courtesy: Nikkei BP

j. Increase of Electronics (2)



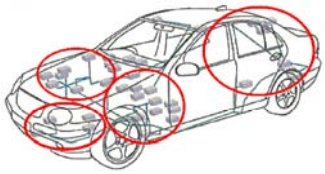
Number of ECUs stabilizes, while number of MCUs continue to grow.

Integration of multiple ECUs has begun. However, there are new systems that requires MCUs to control, are waiting to be adapted. As a whole, number of ECUs may stabilizes while the number of MCUs expected to continue to grow.

Courtesy: Nikkei Automotive Technology

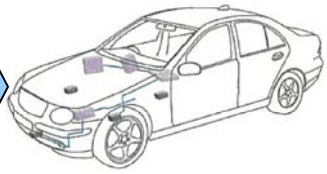
k. ECU Groupings

Approx. 60 to 100 ECUs



Integration by Function

Integrated into 4 function groups



- **Powertrain**
- **Multimedia**
- **Body Control**
- **Safety**

Integration of approx. 60 to 100 ECUs to 4F groups.

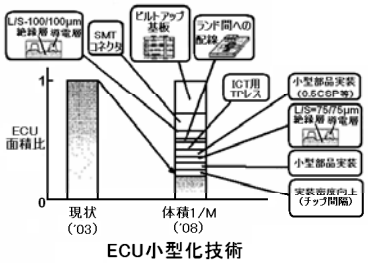
Toyota Motors has announced that they will integrate ECUs to 4 function groups. 4 function groups are:

1. Powertrain 2. Body Control 3. Multimedia 4. Safety

Courtesy: Toyota Motor Company

l. Leader not Follower

Miniaturization



ECU小型化技術

<Today>

ECU Placement=Dead Space

<Future>

No more dead space=
Miniaturization

Mounting Technique
(Semicon、MLPC、Material)

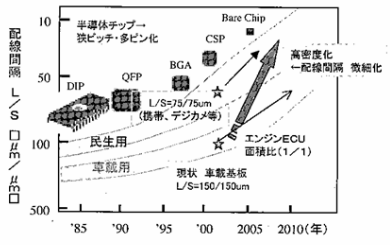


図１５．実装基板ロードマップ

<Today>

Following consumer electronics

<Future>

Leading miniaturization technique and technology

Hattori, (Toyota Motors) MES2005

m. Change in Environment

Direct-Mount ECU

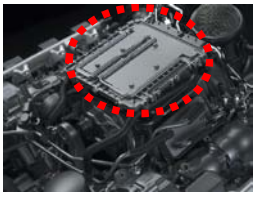
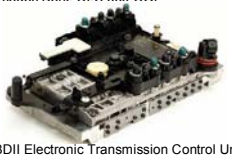


Photo: Mercedes Benz CLS 350 CGI



OBDII Electronic Transmission Control Unit

ECU directly mounted on engine to cut the use of wire harness and production cost. Some vehicle even submerge ACU in transmission oil.

Miniaturization and High Temp. Operation

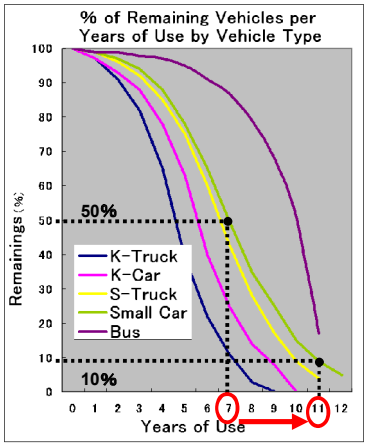
Porsche Cayenne Hybrid ECU

BMW M5 ECU

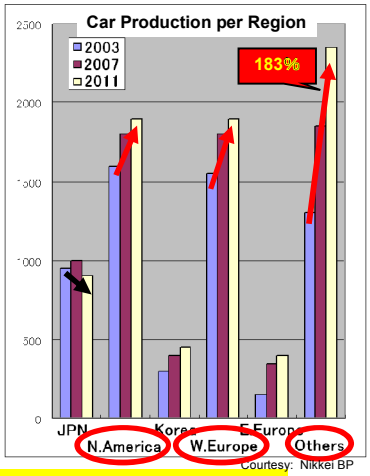
<New Technology>
- *Aluminum Oxide Substrate*
- *High-Temp. Application IC*
- *Bare-chip mounting technique*
- *Power semiconductor devices*

n. Change in Expectations in a Car

～Key: Manufacturing Quality～



Courtesy: Denso



Courtesy: Nikkei BP

For globalization of the business, the expansion of mfg. capability while maintaining the quality will be the key.

o. Something You Want to Avoid

The New York Times

May 12, 2015

AP IMPACT: Cars Made in Brazil Are Deadly

By THE ASSOCIATED PRESS

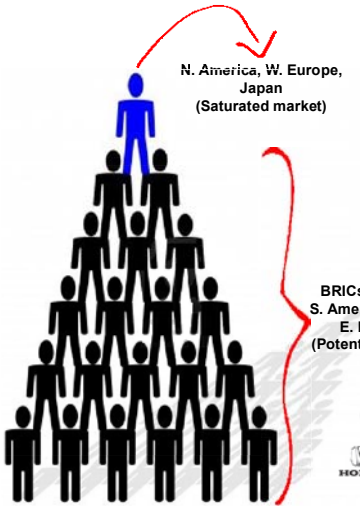
SAO PAULO (AP) — The cars roll endlessly off the local assembly lines of the industry's biggest automakers, more than 10,000 a day, into the eager hands of Brazil's new middle class. The shiny new Fords, Fiats, and Chevrolets tell the tale of an economy in full bloom that now boasts the fourth largest auto market in the world.

What happens once those vehicles hit the streets, however, is shaping up as a national tragedy, experts say, with thousands of Brazilians dying every year in auto accidents that in many cases shouldn't have proven fatal.

The culprits are the cars themselves, produced with weaker welds, scant safety features and inferior materials compared to similar models manufactured for U.S. and European consumers, say experts and engineers inside the industry. Four of Brazil's five best-selling

This is the last thing you want to see!!

p. The Challenge – Volume Zone



The volume zone is shifting to low-end cars. No bells and whistles but with low, low price tag. These cars are to be sold mainly in BRICs, ASEAN, S. America, Africa and E. Europe, where mobility itself is becoming a part of their life.

HONDA CIVIC

JPY 1.9M
US$ 18,000

DACIA LOGAN

EU 7,600
US$ 9,800

TATA NANO

Rs. 2.5 lakh
US$ 3,000

q. The Challenge – Stay in Business

Large market	Small market
Low-Priced Vehicles	Mid-High Priced Vehicles
Low Profitability	High Profitability
Earn by VOLUME	**Earn by PROFITABILITY**

Contents

a. Problem Caused by Electronization

All began in a small indep dent system.

Began in power window and po steering but now
AT, fuel injection, navigat tems and

Indep
Mult

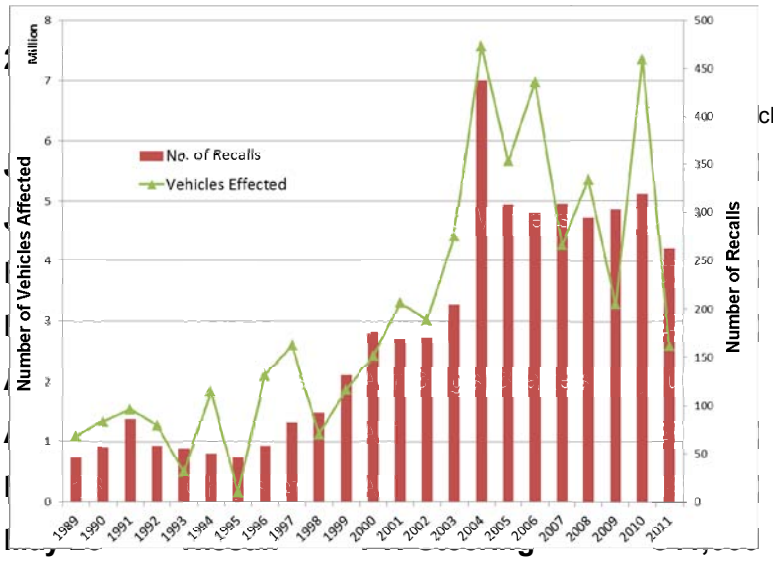
these
ed ically.

Caused increase in:

Harness, # of parts and Cost

Increase in both Environmental Stress and Recalls!!

b. Recall Problems



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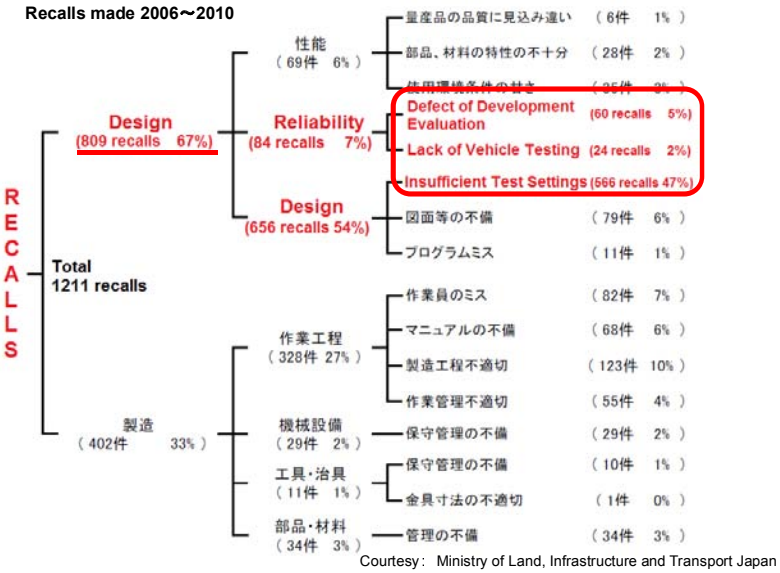
c. Recall Analysis



Courtesy: Ministry of Land, Infrastructure and Transport Japan

d. Recall Counter Measures

1. If there is to be a recall
    1. Retrace of trouble
        1. Cause-Analysis, Importance (Criticality) Measure
        2. Influence-Analysis
        3. Assessment of Counter Measures
    2. Recall Announcement
        1. Redesign & Test (Design of repair need to be done to meet the original spec. and evaluation test)
        2. Procurement and/or Manufacturing of Parts Required
        3. Recovery, Service and Maintenance
2. Recall Prevention
    1. Modularization of Platform
    2. Standardization of Parts without increasing a risk
    3. Standardization of Design

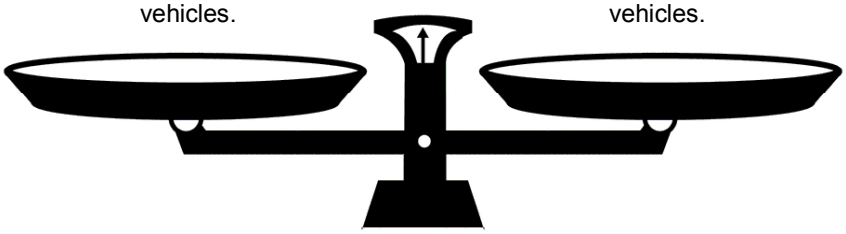
e. Recall Prevention and Cost Balance

Volume (Scale) Merit

Limit number of suppliers and getting as much volume discount as possible would result in lower market price among competitors. Reliable parts can be used in ALL vehicles.

Quality (Recall) Risk

One defect in a part can affect ALL vehicles produced. Recalls not only cost them physically, but also in brand's reputation. OEMS cannot be aware of all new technologies used in their vehicles.



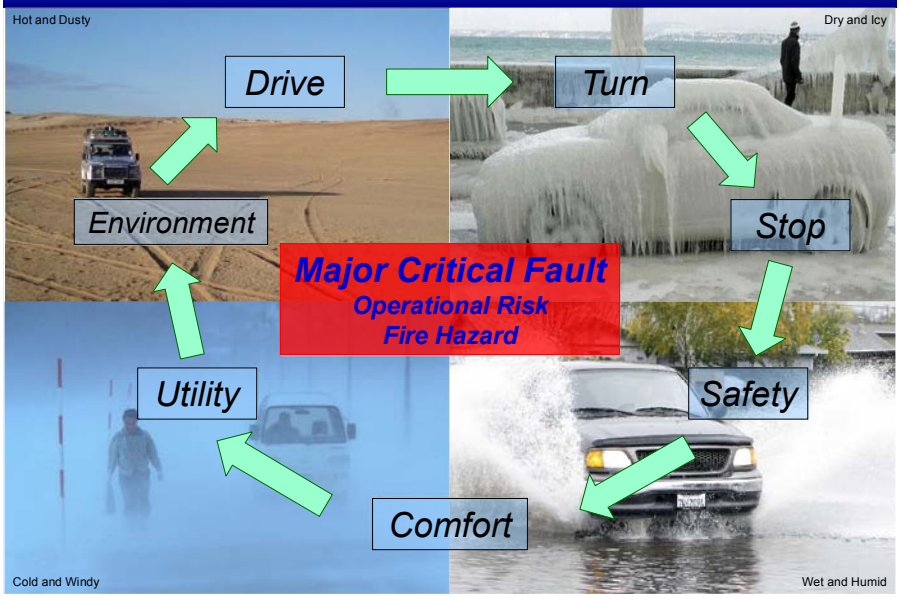
They need to find a way to balance it out!

f. Automotive Requirements

～Entry of Electronics Mfrs.～

	Autmotive	Electronics
BASIC	Afraid of **RECALL**s. Stringent quality management and reliability evaluations expected.	Need to meet demand the industry's **short product life-cycle**. Quick implementation of the latest technology is the key.
Requirements	・Reliability (>10yrs.) ・Quality (No dispersion) ・Anti-Heat (-40℃～+150℃) ・Spec. (Relatively Low-Spec.)	・Reliability (3yrs.) ・Quality (Dispersion accepted) ・Temp. Range (-30℃～+85℃) ・Spec. (High-Spec.)
Test Spec.	・Temp. Range: -40℃～+150(180)℃ ・Test Time: 1,000～3,000hrs. ・Stress: Temp./RH/Cycle/Vib./ Cond./Salt Spray	・Temp. Range: -35(55)℃～+85(125)℃ ・Test Time: 300～1,000hrs. ・Stress: Temp./RH/Cycle
Obstacles	・**Establishment of legitimate reliability evaluation procedures** ・Shortening of development lead time ・Cost reduction of testing ・Quality management of int'l procurement	・Shortening of development lead time ・Cost reduction of testing ・**Expanding business into automotive industry**

g. Why So Harsh?



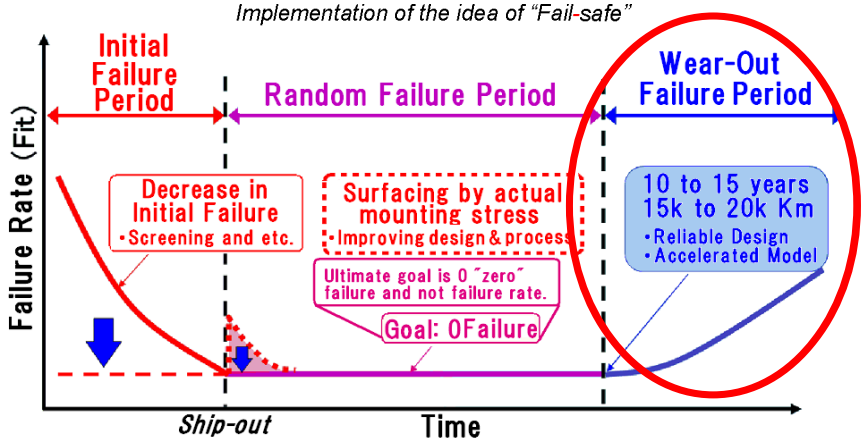
h. Obstacles in Car Development

- *Development Trend :*
  - *—Shortening of development lead time*
  - *—Lowering prime cost while sustaining quality*
- *Obstacles :*
  - *—Application environment getting severe*
  - *—Reliability testing not being able to keep the pace with development lead time*
  - *—Cost increase due to increase in both the number of testing and test samples*
- *What's ahead :*
  - *—Improvement of simulation technique (Implementation of CAE)*
  - *—Shortening of test time (Adaptation of accelerated test)*
  - *—Establishment of legitimate reliability testing procedures*

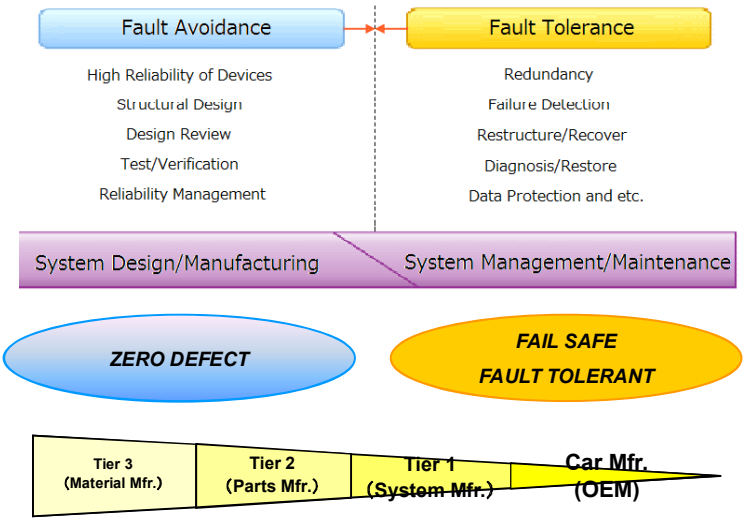
i. An Ideal and Reality

In QA, main goal is to decrease initial and random failures. However, if the products are used in extreme conditions, decrease in wear-out failure will be the key.

Implementation of the idea of "Fail-safe"



j. Zero Defect and Fault Tolerance



Contents

a. Types of Standards

- *International, Industrial Standards*
  - *– ISO, IEC, JEDEC, AEC and etc.*
  - *– Open to public and available for purchase.*
- *Corporate Standards – supplier certification*
  - *– Non-Keiretsu*
    - *New suppliers are welcome.*
    - *Standards are available for purchase. (mostly online)*
  - *– Keiretsu (mostly Japanese OEMs)*
    - *Basically disclosed.*
    - *Test background and how-to are only supplied certified vendors.*

b. Electronics-Related (1)

- ***International Standards***
  - ***ISO16750-2003***

    Road vehicles -- Environmental conditions and testing for electrical and electronic equipment
  - ***ISO10487-1995***

    Passenger Car Radio Connections
- ***Domestic (National) Standard***
  - ***JIS Japanese Industrial Standard***
    - ***D1601*** ***Vibration Testing Methods for Automobile Parts***
    - ***C0024～28*** ***Environmental Testing (Electric/Electronics)***
    - ***D0205*** ***Test Method of Weatherability for Automotive Parts***
  - ***DIN Deutsches Institut für Normung (Germany)***
    - ***DIN 10599*** ***Car radios - Coaxial aerial connectors***

c. Electronics-Related (2)

- *Industrial Organizations and Standards*
  - *(US)AEC* *AEC Q100 Rev F2*
  - *(US)JEDEC* *JESD22-A100-B ～JESD22-A121*

    AEC was established in 1993, established by Chrysler, Ford, and GM for the purpose of establishing common part-qualification and quality-system standards.

    The JEDEC Solid State Technology Association is the semiconductor engineering standardization body of the Electronic Industries Alliance (EIA), a trade association that represents all areas of the electronics industry. JEDEC was originally created in 1960 as a joint activity between EIA an NEMA, to cover the standardization of discrete semiconductor devices and later expanded in 1970 to include integrated circuits.
  - *(US)SAE* *J2446, J1211, J771 and etc.*

    SAE or Society of Automotive Engineers is one of the oldest trade organization, which was established in 1905.
  - *(JPN)JASO* *D001-94*

    JASO is standards published by JSAE or Society of Automotive Engineers of Japan.
- *Corporate Standards*
  - *GM-CM, BMW GS, VW, Delphi, Navistar and etc.*

d. AEC Standards

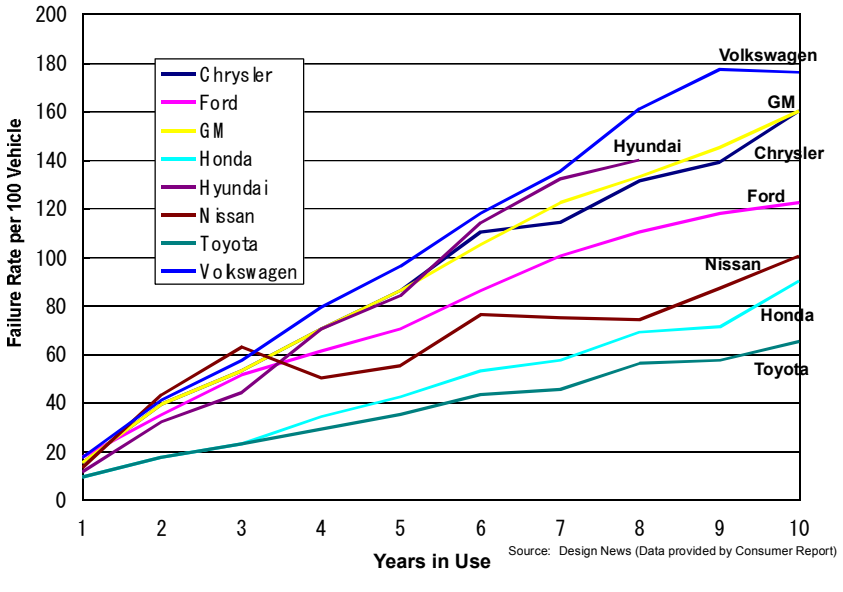
- *Primary members of the AEC are Tier 1 and Tier 2 manufacturers. The standards are valid mainly among American and European manufacturers.*
  - *AEC-Q100-REV F2*
  - *Target: Integrated Circuits (IC)*
  - *AEC-Q200-REV C*
  - *Target: Passive Components*
  - *Testing Procedures:*
    - *MIL-STD-202 Method 103, 106, 107, 108, 204, 210, 213 etc.*
    - *JESD22 Method JA-104、JESD47 Method JA-105 etc.*

e. Where Can We Find Them?

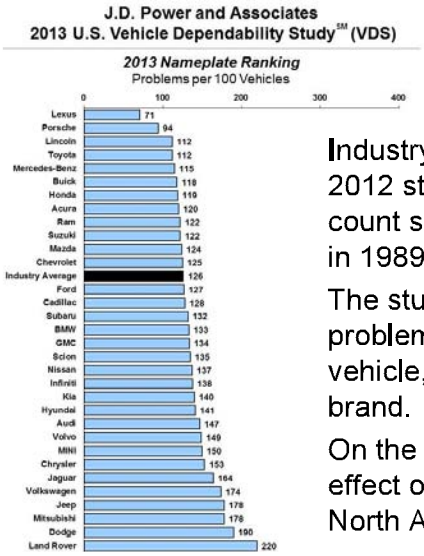
- *ISO* http://www.iso.org/iso/home/store/catalogue_ics.htm
- *IEC* http://webstore.iec.ch/?ref=menu
- *MIL* http://www.landandmaritime.dla.mil/
- *JIS* http://www.jisc.go.jp/app/JPS/JPSO0020.html *(Japanese only)*
- *DIN* http://www.beuth.de/cmd?level=tpl-home&languageid=en
- *JEDEC* http://www.jedec.org/standards-documents
- *SAE* http://standards.sae.org/automotive/
- *AEC* http://www.aecouncil.com/AECDocuments.html
- *Corporate Standards*
  - *IHS* http://www.ihs.com/products/design/industry-standards/organizations/
  - *FREESTD* http://www.freestd.us/

Contents

a. Failure Rate Trend per Mfr.



b. Failure Rate Trend per Mfr.

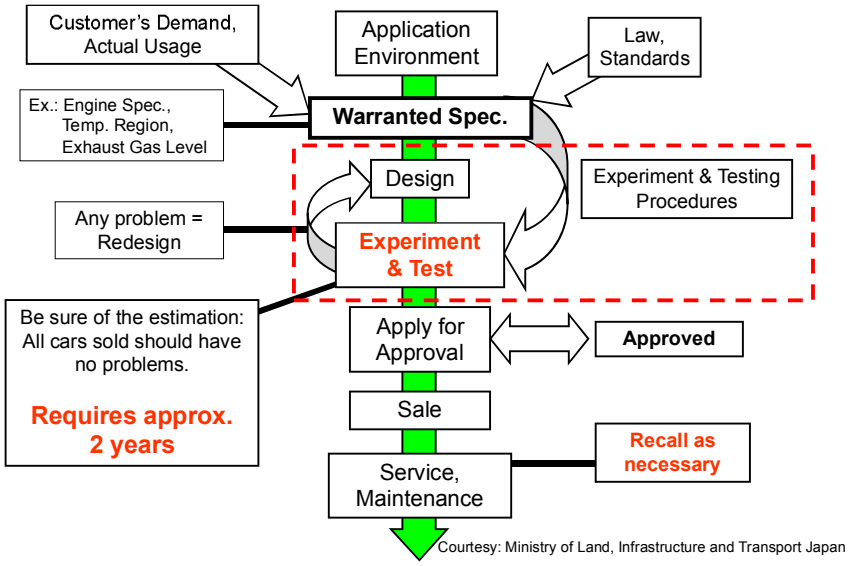


Industry average improved 5% from 2012 study and is the lowest problem count since the inception of the study in 1989.

The study finds that the fewer problems owners experience with their vehicle, the greater their loyalty to the brand.

On the regard, VW is yet to see the effect of modularization, at least in the North American market.

c. "Quality" in Auto Industry



Courtesy: Ministry of Land, Infrastructure and Transport Japan

d. Corporate Standard (Test Procedures)

General Motors & Delphi Delco

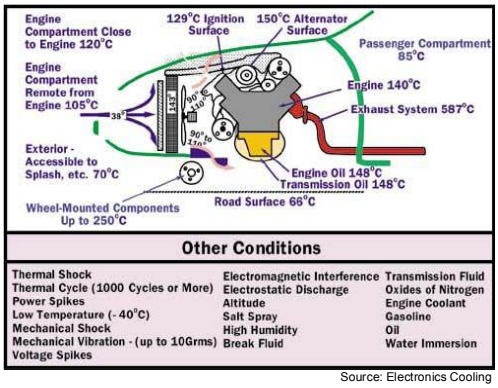
Temperature	Driver interior	-40°C to +85°C
	Underhood	-40°C to +125°C
	On-engine	-40°C to +150°C
	In the exhaust and combustion areas	-40°C to +200-600°C
Mechanical Shock	During assembly (drop test)	3000g
	On the vehicle	50-500g
Mechanical Vibration		15g, 100Hz to 2kHz
Electromagnetic Impulses		100 to 200V/m
Exposure to	Common	Humidity, salt spray
	In some applications	Fuel, oil, brake fluid, transmission fluid, ethylene glycol, exhaust gases

Toyota Motors

ECU Location	Detail Position	Required Operation Temperature
Passenger Room	Under dash board	-30 to +85°C
Engine Room	ECU Box	-30 to +105°C
	Underhood	-30 to +125(150)°C
	Connected to Engine	-30 to >+175°C

R. Wayne, IEEE Transaction on Electronics packaging manufacturing, Vo.27, No.3, 2004

e. Actual Environment

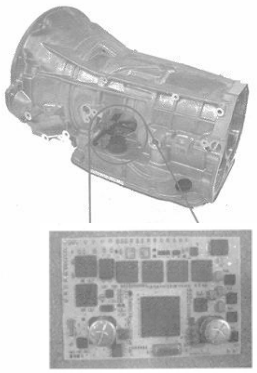


Source: Electronics Cooling

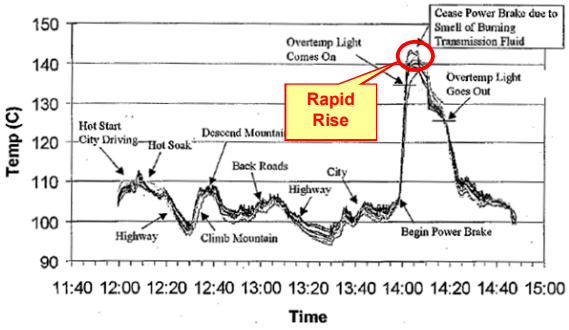
Each manufacturers gather their own data from their own cars. With ambient temperature considered, the temperature that electronic parts may get exposed to, can range from -40 to as high as +600 degrees. *(Exhaust gas for sports cars may reach as high as +1,000 degrees!)*

f. Actual Evaluation (DCX & Siemens VDO)

Sample: Transmission Control Unit



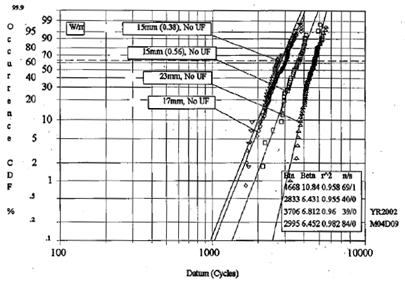
Temperature Profile during an Actual Drive



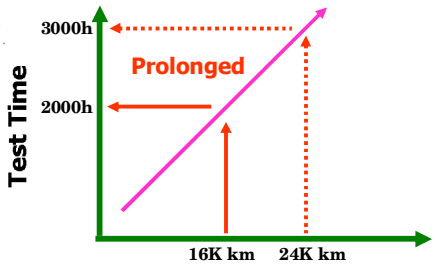
R. Wayne Johnson ,The Changing Automotive Environmental, IEEE CPMT Society, Vol.3 No.3, 2004

g. Actual Evaluation (DCX & Siemens VDO)

Test Result



Obstacles



<Test Time>
Temp. Cycle (-40/+125℃)
>5000 Cycles
<Verdict>
Material testing requires too much time.

<Engineers' Complain>
·Increasing test samples
·Far-Stretched test hours
·Different test procedures among OEMs.

R. Wayne Johnson ,The Changing Automotive Environmental, IEEE CPMT Society, Vol.3 No.3, 2004

h. Actual Evaluation (Panasonic)

Power Choke Coils for Automobile ECUs

Test	Condition	Evaluation Time	Last Check Time
Thermal Shock	-40°C(10min) to +150°C(10 min)	2000 cyc.	5000 cyc.
Vibration	10G (5Hz - 2kHz)	XYZ (4h each)	XYZ (24h each)
	30G (50Hz - 2kHz)		
Heat Resistance	150°C	2-3000h	4000h
High Temp. Life	150°C, DCA		
Humidity Resistance	85°C, 85% RH	2-3000h	4000h
Humidity Life	85°C, 85% RH, DCA		
Cold Resistance	-40°C	2-3000h	4000h
PCT	121°C, 100% RH	192h	-
PCBT	121°C, 100% RH, DCA	192h	-

Typical data, specifications are subject to change without notice.

Courtesy: Panasonic Industrial Company

PCT: Pressure Cooker Test
PCBT: Pressure Cooker Biased Test

i. AEC Members

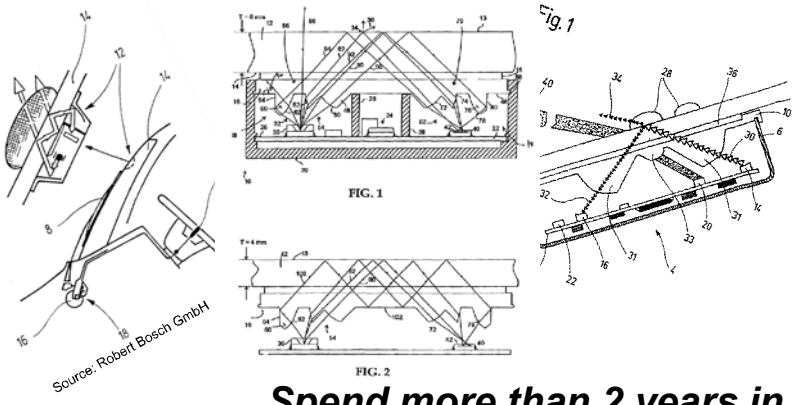
j. Development of Automatic Wiper (1)

Source: BMW

Courtesy: James Fike

They were asked to make an Automatic Windshield Wiper System for a luxury car segment.

j. Development of Automatic Wiper (2)



Spend more than 2 years in research and development of fundamental technologies

j. Development of Automatic Wiper (2)

They have done all related international and industrial standards and passed…

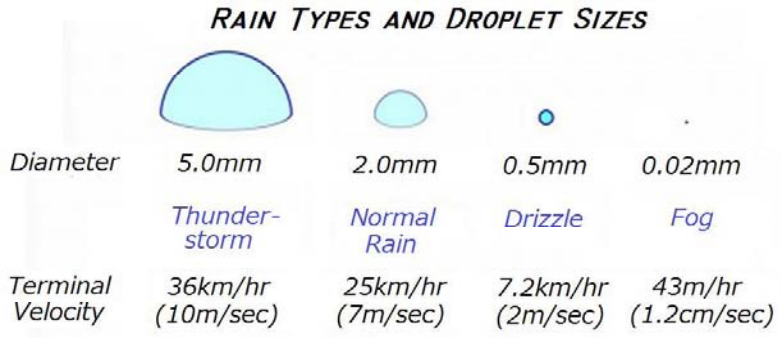
However, is that enough?

NO!!

All the tests done in a lab are simulations.
How do you know for sure that this system would work in real world??
What should you consider in addition to the standards?

j. Development of Automatic Wiper (3)

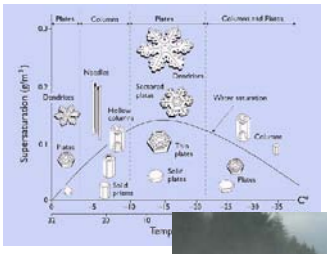
In real world, there are many variations of rain!!



The wiper should work in ALL types of rain.

j. Development of Automatic Wiper (4)

But the rain is not the only thing to obscure your visibility!!



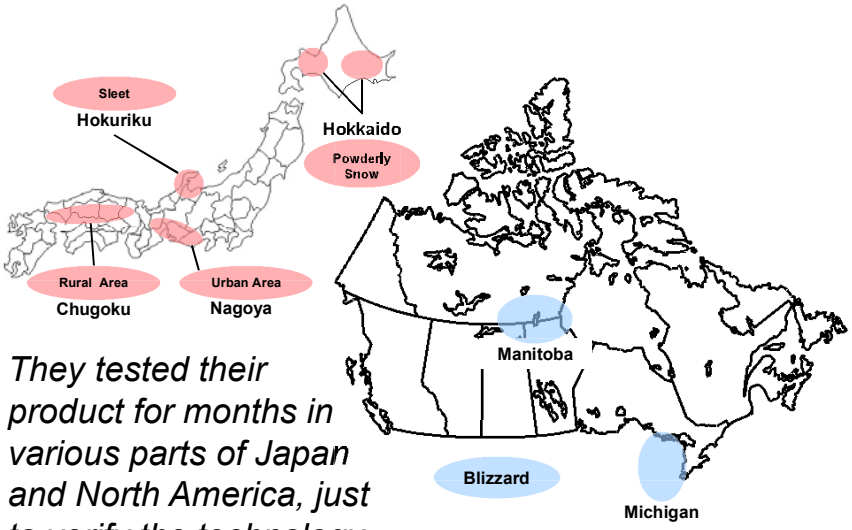
How about snow?

How about spray from the vehicles ahead?

What about sleet?

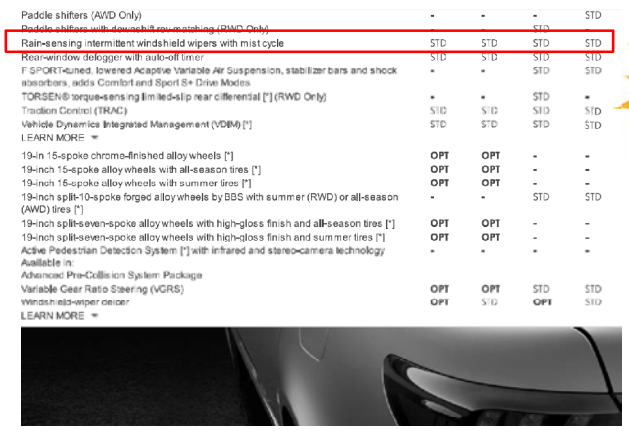
All of these need to be taken into consideration.

j. Development of Automatic Wiper (5)



They tested their product for months in various parts of Japan and North America, just to verify the technology.

j. Development of Automatic Wiper (6)



Paddle shifters (AWD Only)	-	-	-	STD
Rain-sensing intermittent windshield wipers with mist cycle	STD	STD	STD	STD
Rear-window defogger with auto-off timer	STD	STD	STD	STD
F SPORT-tuned, lowered Adaptive Variable Air Suspension, stabilizer bars and shock absorbers, adds Comfort and Sport S+ Drive Modes	-	-	STD	STD
TORSEN® torque-sensing limited-slip rear differential [*] (RWD Only)	-	-	STD	-
Traction Control (TRAC)	STD	STD	STD	STD
Vehicle Dynamics Integrated Management (VDIM) [*]	STD	STD	STD	STD
LEARN MORE				
19-in 15-spoke chrome-finished alloy wheels [*]	OPT	OPT	-	-
19-inch 15-spoke alloy wheels with all-season tires [*]	OPT	OPT	-	-
19-inch 15-spoke alloy wheels with summer tires [*]	OPT	OPT	-	-
19-inch split-10-spoke forged alloy wheels by BBS with summer (RWD) or all-season (AWD) tires [*]	-	-	STD	STD
19-inch split-seven-spoke alloy wheels with high-gloss finish and all-season tires [*]	OPT	OPT	-	-
19-inch split-seven-spoke alloy wheels with high-gloss finish and summer tires [*]	OPT	OPT	-	-
Active Pedestrian Detection System [*] with infrared and stereo-camera technology	-	-	-	-
Available in:				
Advanced Pre-Collision System Package				
Variable Gear Ratio Steering (VGRS)	OPT	OPT	STD	STD
Windshield-wiper deicer	OPT	STD	OPT	STD
LEARN MORE				

Their effort was paid off as a Japanese luxury brand adopted the product as a standard equipment on almost all of their cars.

k. What can ESPEC provide?

ESPEC can provide chambers to reproduce temperature and humidity conditions in the circled tests.

k. What can ESPEC provide? (2)

I. What can ESPEC provide? (1)

TSA-201D-W

Thermal Shock	
Test Conditions	*3 Zones* *Low: -65℃(30min) ↔ Ambient (10 min) ↔ High:: +25℃90%rh (20min)* *Samples: Plastic mold IC 5kg*
Transfer Time	*to hot from ambient: Less than 10 min..* *to cold from ambient: Less than 10 min.*

Condensation Cycle 1	
Test Conditions	*2 Zones* *Low: +5℃(20min) ↔ High:: +25℃90%rh (20min)* *Samples: PCB 2kg*
Transfer Time	*to hot: Less than 20 sec.* *to cold: Less than 3 min.*

Condensation Cycle 2	
Test Conditions	*2 Zones* *Low: -30℃(60min) ↔ High:: +25℃95%rh (60min)* *Samples: Empty*
Transfer Time	*to hot: Less than 5 min.* *to cold: Less than 5 min.*

I. What can ESPEC provide? (2)

SDT-200
Siloxane Tester

Model	SDT-200
Concentration Range	0(Purge)、1-25ppm
Concentration Resolution	1ppm
Gas Creation	Bubbling Method
Siloxane	Cyclosiloxane D4
Temperature Range	RT+15℃ to +70℃
Temp. Resolution	+/-0.1℃ (no load)
Temp. Distribution	+/-0.5℃ (no load)
Test Space	W600 x H600 x D600 mm
Exterior Dimensions	W1190 x H1880 x D1315 mm

I. What can ESPEC provide? (3)

PVL/PVS/PVU/PVG

Combination system for
Temperature, Humidity and Vibration
testing.

Parameter	Range
Temperature	-70 ~ +100℃
Relative Humidity	20 ~ 98%
Force Peak	1176N ~ 29400N

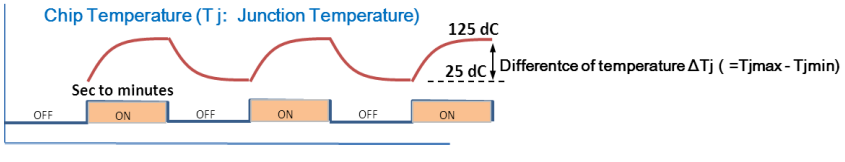
I. What can ESPEC provide? (4)

Power cycle test system for IGBT device

Water cooled type

Max. 1000 Ampere test

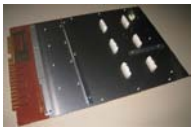
Air cooled type



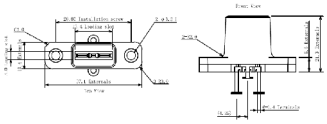
I. What can ESPEC provide? (5)

High Temperature Reversed Bias Test system for IGBT device

Burn-in Board: 200dC or more



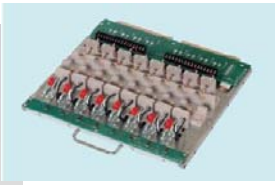
***To-220 , 247, 3P* common use socket**



Drain voltage: 0 to 3,000 V Setting resolution: 1 V

Leakage current monitor: 10 µA to 3 mA Setting resolution: 1 µA

I. What can ESPEC provide? (6)



For Cylindrical Cells

For Laminated Cells

Mono Triple

ADvanced Battery Tester

Battery Jig

I. What can ESPEC provide? (7)

http://test-navi.com/

Test Standard Guide, Test Handbook, Case Study and etc.

Thank you for your attention

On our products:

SITHIPORN ASSOCIATES CO LTD

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Bangplud, Bangkok 10700
Tel.+662 433 8331 Fax. +662 434 9510

We welcome your questions, suggestions, and/or comments on this presentation!!

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