Audi Virtual Cockpit Teardown

FEATURES:

- Virtual Cockpit
- NVIDIA Tegra 3, 4-core 1.4GHz
- 12.3-inch 1440 x 540 IPS LCD

Click here for detailed data from Fomalhaut's teardown analysis.

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Manufacturer	Bosch
Model Number	Audi FPK gen1
Carrier	-
Assembled in	Portugal
Retail Price	Approx. USD4,000
Product Release	2015.06.01
Document ID	1029 - Sample

SPECIFICATIONS

manufactured bu German Bosch. Graphic processor by U.S. NVIDIA. NVIDIA has largest market share in the field of on-vehicle graphic processors. DRAM has 8M-bite-capacity, while the flash memory has a large capacity 4G bites, which holds geographical map data inside.

BASIC	Product Name	Audi FPK gen1					
	Manufacturer	Bosch Corporation					
	Minimum Size (mm)	323 x 190 x 87					
	Weight (g)	16000					
BATTERY TIME	Standby (hours)	3.9G: FDD-LTE: -	3.9G: TD-LTE: -	3G: WCDMA: -	3G: CDMA: -	3G: TD-SCDMA: -	2G: GSM: -
	Voice Call (minutes)	3.9G: FDD-LTE: -	3.9G: TD-LTE: -	3G: WCDMA: -	3G: CDMA: -	3G: TD-SCDMA: -	2G: GSM: -
	Video Call (minutes)	-					
	Digital TV (minutes)	-					
	Other	-					
	Battery (size in mm)	-					
SYSTEM	OS	unknown					
	CPU / ROM / RAM	CPU: NVIDIA Tegra 3 T30AGS-Q-A3, quad core, 1.4GHz ROM: 4GByte + 64MByte RAM: 8MByte					
DISPLAY	Main Display	12.3-inch, 16,777,216 colors, 1440 x 540 dot, IPS LCD					
	Sub Display	-					
COMMUNICATION	Protocol (MHz)	3.9G: FDD-LTE: - 3.9G: TD-LTE: - 3G: WCDMA: - 3G: CDMA: - 3G: TD-SCDMA: - 2G: GSM: -					
	HSDPA/HSUPA (Mbps)	3G: -			LTE: -		
	Wireless LAN	-					
	Bluetooth	-					
	GPS	-					
	Infrared	-					
	RFID/NFC	-					
CAMERA	Main Camera	-					
	Sub Camera	-					
SENSOR	Motion	Accelerometer: -	Digital Compass: -		Gyroscope: -		Barometer: -
		Gesture Recognition: -	-		-		-
	Ambient	Light Sensor: -	Proximity Sensor: -		Temperature Sensor: Yes		Humidity Sensor: -
	Security	Fingerprint Sensor: -	-		-		-
	Healthcare	Heart Rate Monitor: -					
	Touch Panel	-					
OTHER	HDMI	-					
	MicroSD (max capacity)	-					
	Waterproof/Anti-shock	-					

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OUTLOOK / PRODUCT INFORMATION

Thickness of the body is circa. 10cm. A bit large size speaker is on the back side,。
threads or adhesive are not used to assemble the body. Instead, the parts are fitted by means of folding stops, whose structure accepts dismantling with only one hand tool.

TEARDOWN

Rear Panel

Front Panel

Consisted of a back-side-cover, PCBs, a display, display-supporting panel, and a cosmetic cover.
One of the remarkable feature is the hex-displey instead of rectangle.
The graphic processor is mounted on PCB#2, together with a cooling fan.

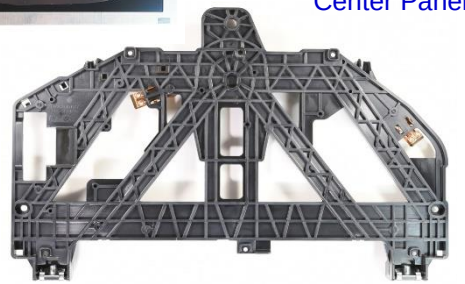
PCB#3

PCB#4

PCB#5

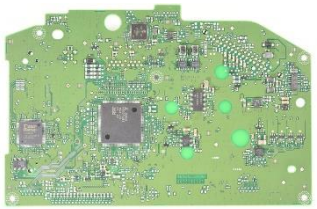
Display

Center Panel



PCB#1

Cooling Fan



Rear Cover

PCB#2

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PCB DIMENSION & MARKING

Unit: millimeter otherwise specified

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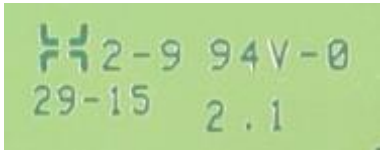
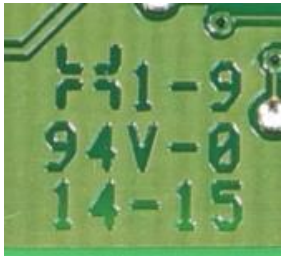
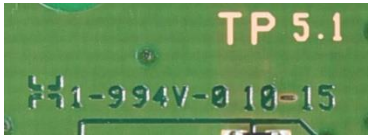
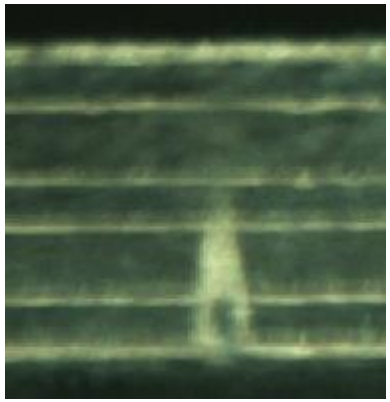
5 PCBs are used, with 2 large boards and 3 LED-based ones for display of fuel level ...,etc.

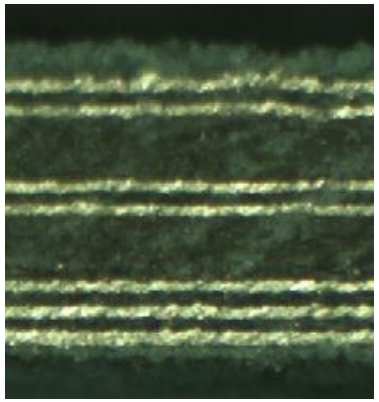
	PCB #1	PCB #2	PCB #3	PCB #4	PCB #5	-
Manufacturer	Tripod	AT&S	Tripod	Tripod	unknown	-
Dimension	185.0 x 121.3 x 1.70	85.12 x 85.01 x 1.24	138.56 x 23.07 x 1.74	113.67 x 20.50 x 1.70	113.63 x 20.65 x 1.58	-
Layer	6	8	2	2	2	-
Connector (pin)	0	0	0	0	0	-
Connector (socket)	12	0	1	1	1	-
Connector (ACF)	0	0	0	0	0	-

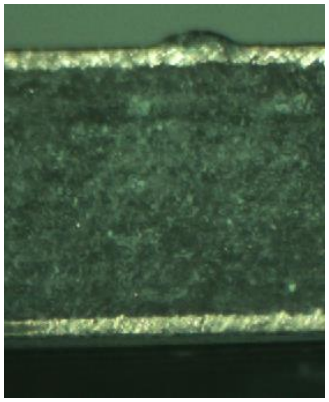


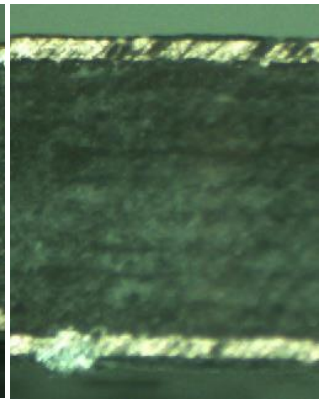


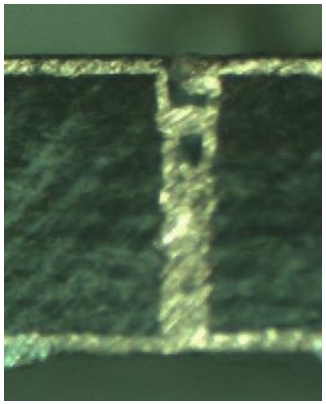












PCB#1 SIDE A: KEY COMPONENTS

1 notch = 1mm

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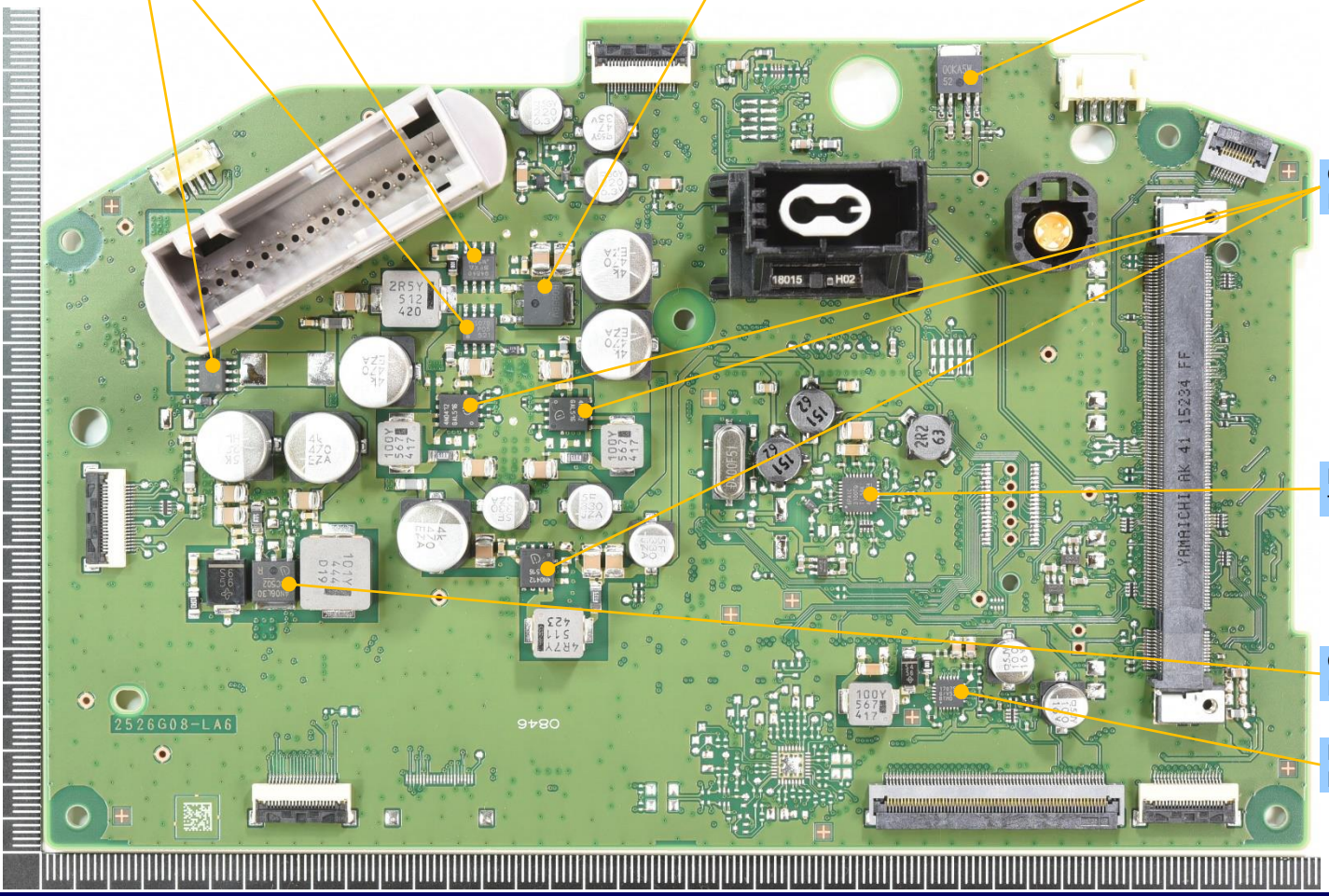
Many of the electrical components on the shown side function as system power supply.
The rectangular object on the right end of the board is an electric connector to connect the graphic board PCB.



PCB#1 SIDE B: KEY COMPONENTS

1 notch = 1mm

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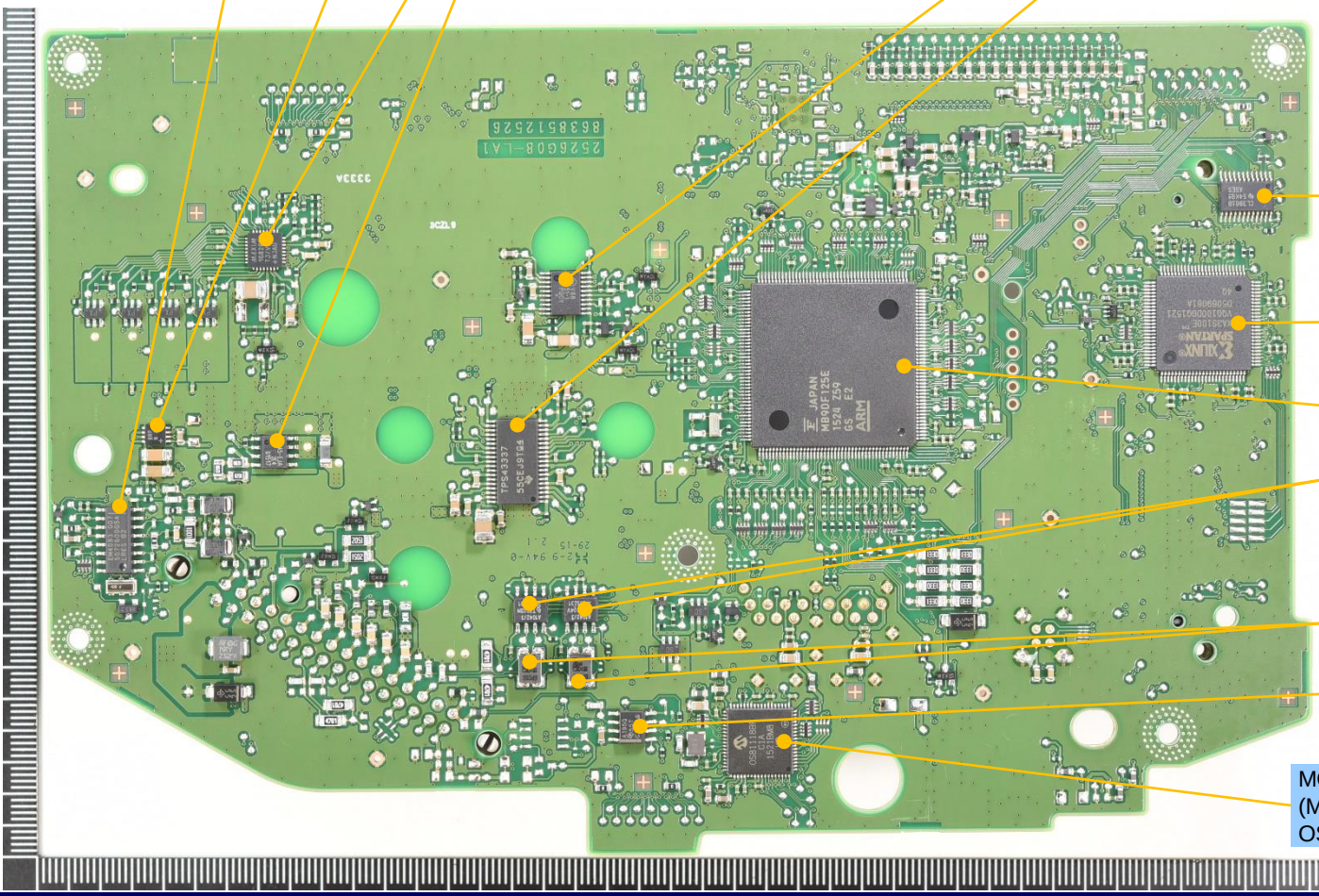
PCB#1 has a 32-bit microcontroller on it, which communicates with the system power supply and other on-vehicle components.
The on-vehicle communication adopts CAN, though graphic contents are contained.



Car Immobilizer Chip (EM Microelectronic)
EM4093

Unknown
BRP
N AV

Programmable Four-String HB LED Driver (Maxim)
MAX16826

Smart High-Side Power Switch (Infineon)
BTS5045-1EJA

Synchronous Buck Controller (ON Semiconductor)
NCV8851-1

Fixed-Voltage Dual Synchronous Buck Controller (TI)
TPS43337-Q1

Low-Voltage 10-bit FET Bus Switch (TI)
SN74CBTLV3861-Q1

XA Spartan-3E Automotive FPGA (Xilinx)
XA3S100E

32-bit Microcontroller (Cypress)
MB9DF125

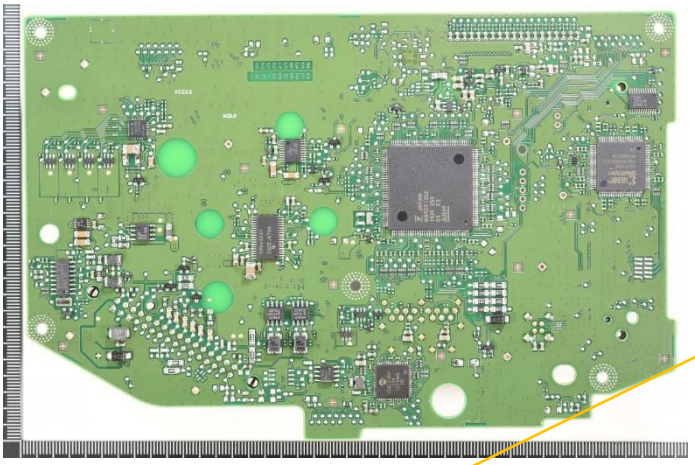
High-Speed CAN Transceiver (NXP)
TJA1042

Choke Coil (TDK)
C104H

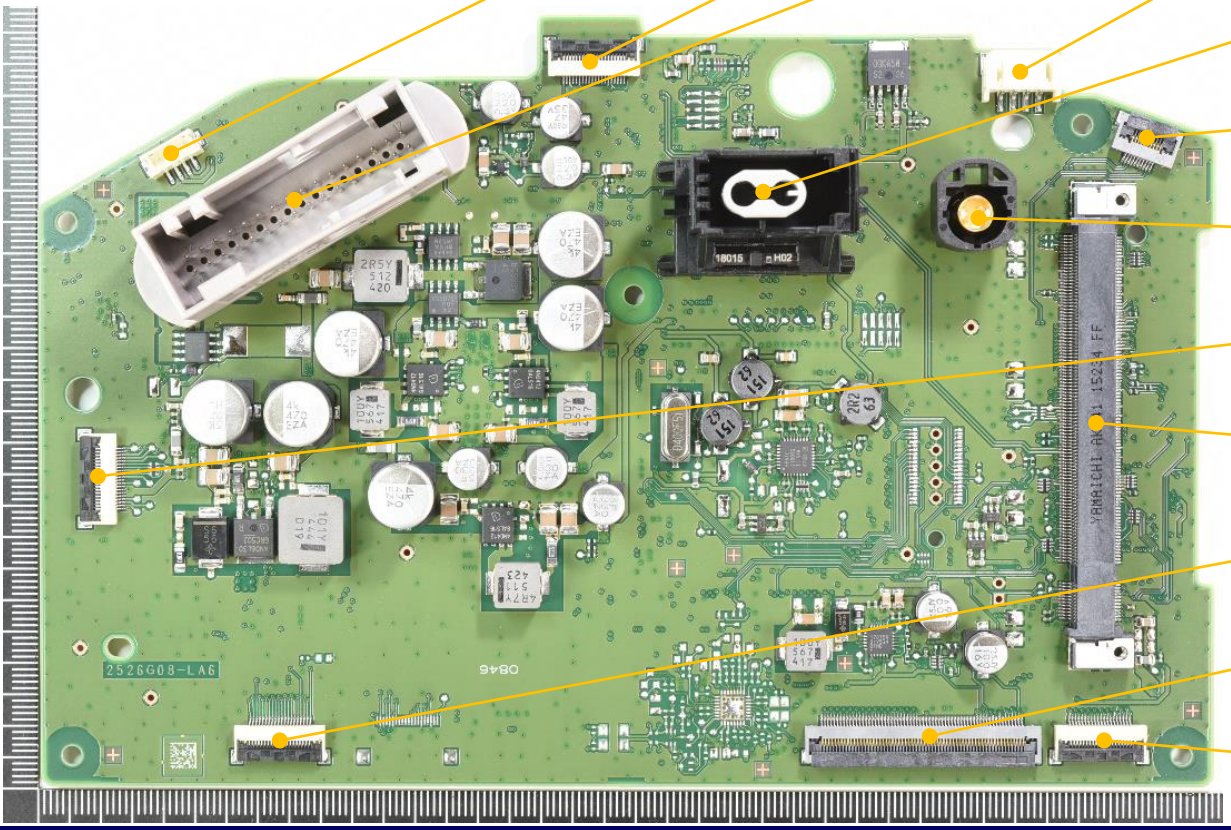
LIN & Most ECL Physical Interface (TI)
SN65HVDA195-Q1

MOST150 Intelligent Network Interface Controller (Microchip)
OS81118

PCB#1: CONNECTORS



Many connectors are ZIF type.
In the photo below, a gray connector on the above left is a connection port to vehicle main frame.



Connecting to	**Speaker**		
Mnf.	unknown	L (mm)	3.63
Pin Pitch (mm)	1.50	W (mm)	8.91
Pin #	4	(H) (mm)	5.14
Connecting to	**PCB #3**		
Mnf.	unknown	L (mm)	5.80
Pin Pitch (mm)	0.50	W (mm)	14.22
Pin #	20	(H) (mm)	2.12
Connecting to	**Input/Output**		
Mnf.	TE	L (mm)	57.59
Pin Pitch (mm)	2.50	W (mm)	15.72
Pin #	32	(H) (mm)	20.08
Connecting to	**Cooling Fan**		
Mnf.	unknown	L (mm)	7.71
Pin Pitch (mm)	2.00	W (mm)	11.91
Pin #	4	(H) (mm)	5.66
Connecting to	**Input/Output**		
Mnf.	TE	L (mm)	18.14
Pin Pitch (mm)	6.00	W (mm)	30.52
Pin #	2	(H) (mm)	30.60
Connecting to	**not in use**		
Mnf.	Hirose	L (mm)	6.65
Pin Pitch (mm)	0.50	W (mm)	9.89
Pin #	10	(H) (mm)	2.55
Connecting to	**Input/Output**		
Mnf.	unknown	L (mm)	13.90
Pin Pitch (mm)	2.00	W (mm)	12.05
Pin #	4	(H) (mm)	15.32
Connecting to	**Display Backlight LED**		
Mnf.	unknown	L (mm)	6.26
Pin Pitch (mm)	0.50	W (mm)	14.19
Pin #	20	(H) (mm)	2.00
Connecting to	**PCB #2**		
Mnf.	Yamaichi	L (mm)	6.48
Pin Pitch (mm)	0.50	W (mm)	75.74
Pin #	103 + 12	(H) (mm)	7.77
Connecting to	**PCB #4**		
Mnf.	unknown	L (mm)	6.26
Pin Pitch (mm)	0.50	W (mm)	14.22
Pin #	20	(H) (mm)	1.98
Connecting to	**Display**		
Mnf.	Hirose	L (mm)	6.35
Pin Pitch (mm)	0.50	W (mm)	37.05
Pin #	64	(H) (mm)	2.53
Connecting to	**PCB #5**		
Mnf.	unknown	L (mm)	6.23
Pin Pitch (mm)	0.50	W (mm)	14.29
Pin #	20	(H) (mm)	2.04

PCB#2 SIDE A: KEY COMPONENTS

1 notch = 1mm

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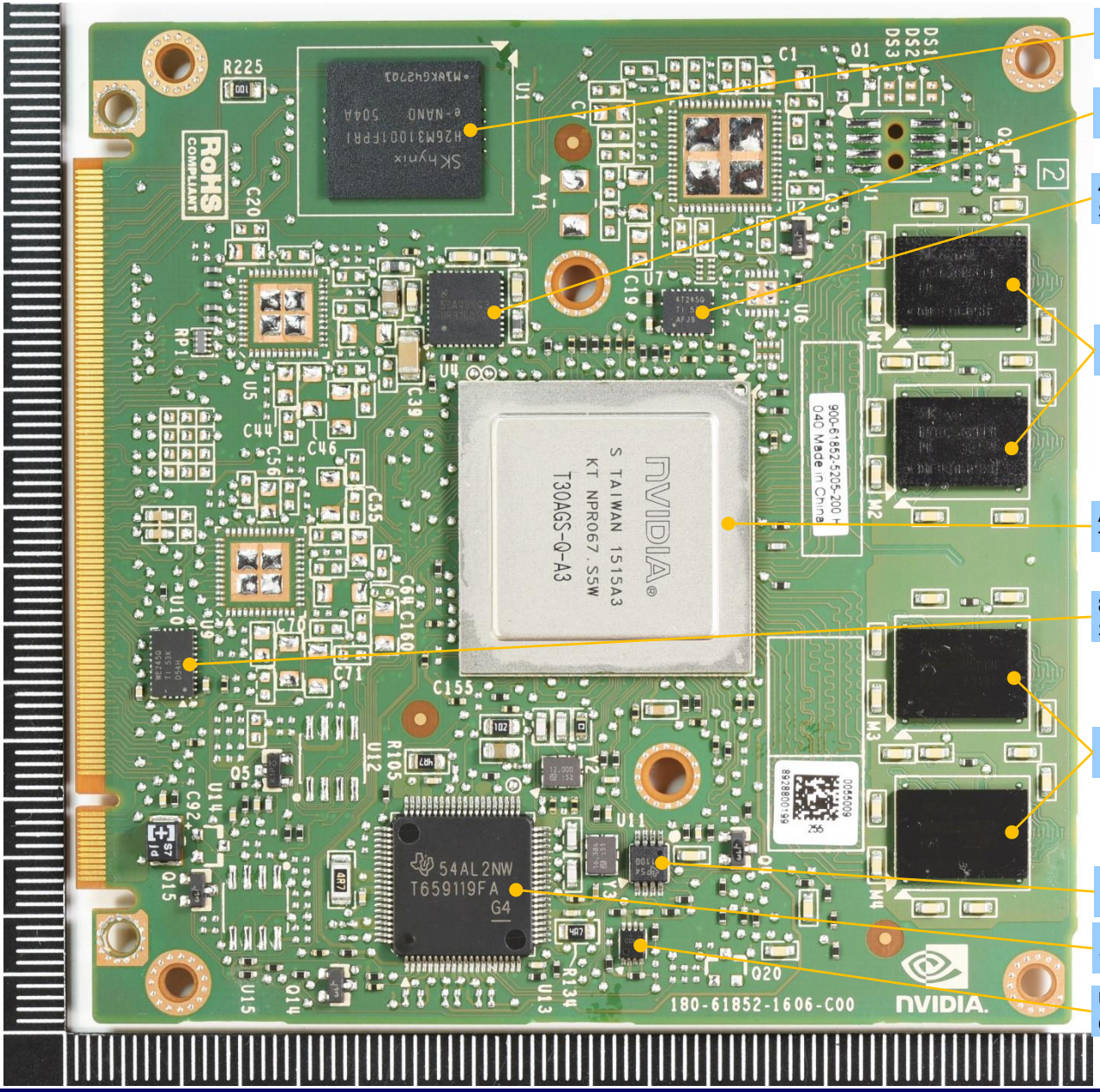
The graphic processor is Tegra3 by NVIDIA. Similar to those used in smartphones until a few years ago.



PCB#2 SIDE B: KEY COMPONENTS

1 notch = 1mm

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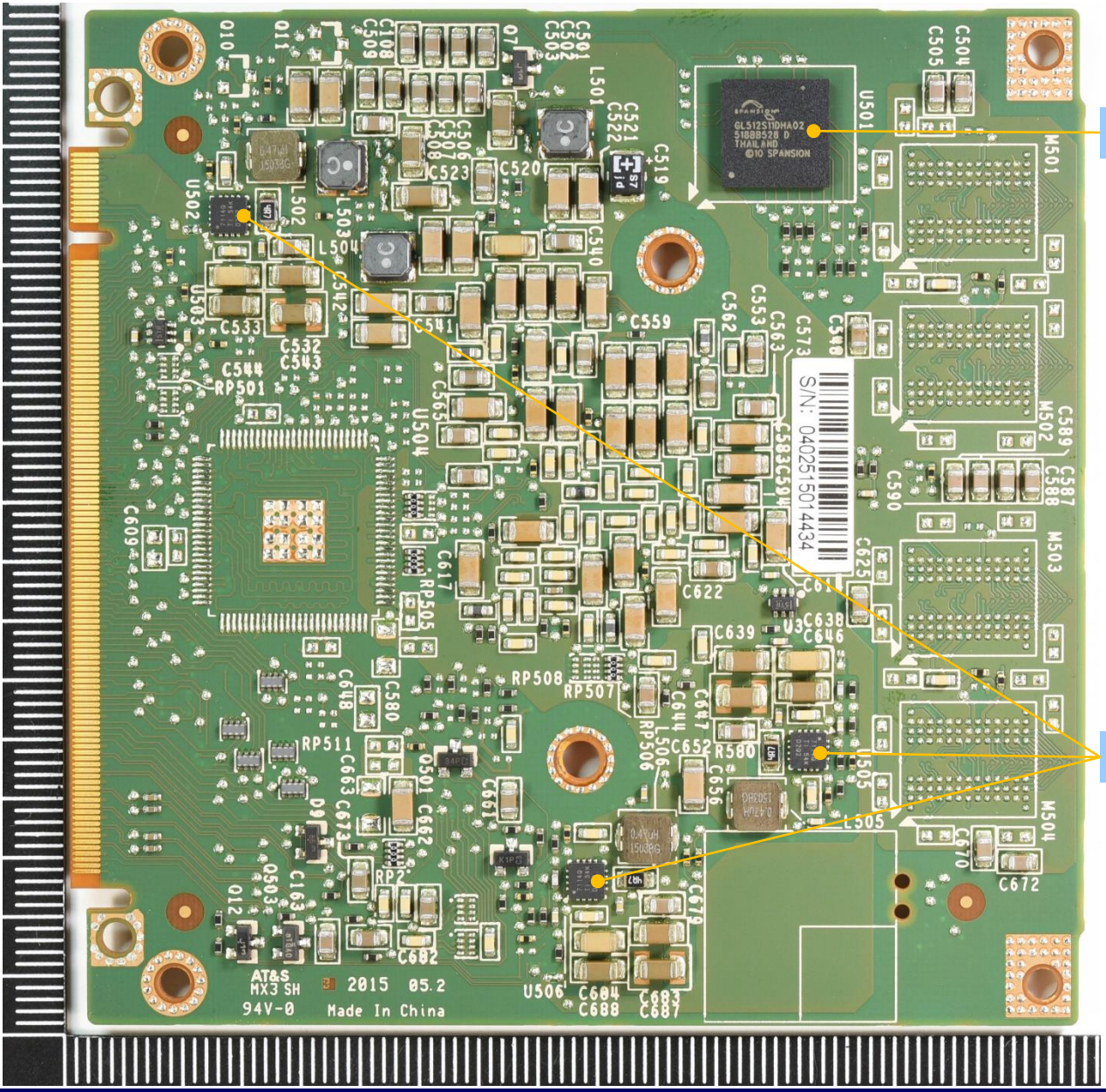
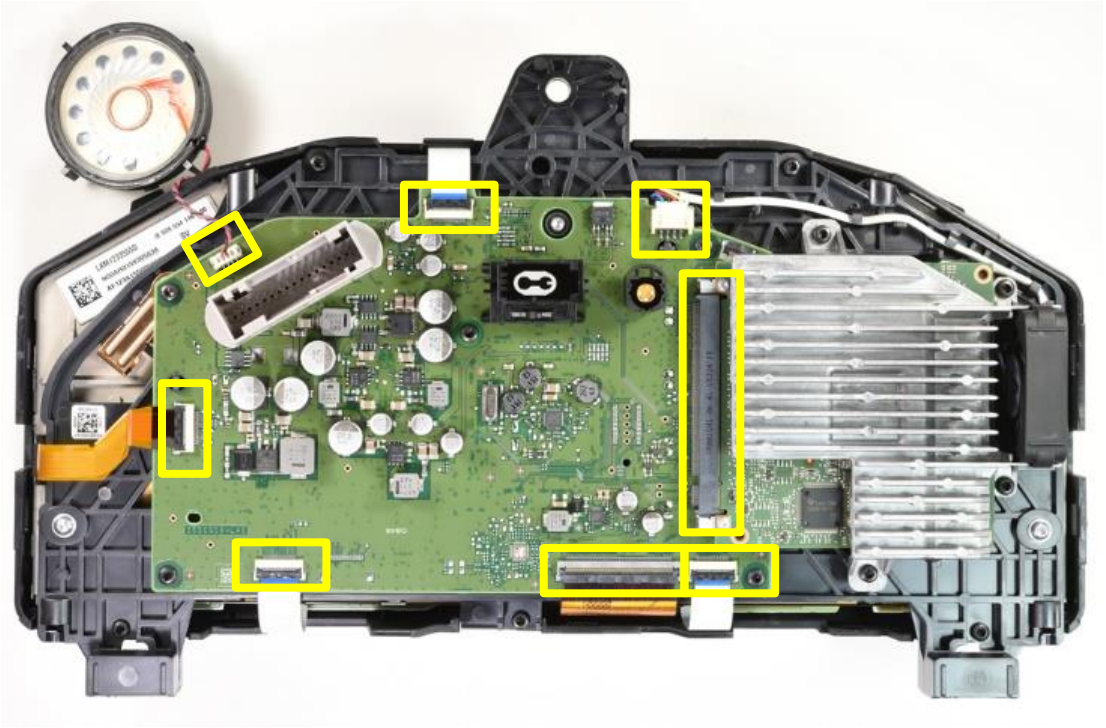
The flash memory on the right above is embedded the system OS. The type is NOR which enables high speed readout.



PCB#1/#2/#3/#4/#5: CONNECTORS PLUGGED

The photo includes connectors.
Some parts of indication uses LED and adopt separated boards instead of LCD.
(Example; fuel level indication)



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MAIN DISPLAY DIMENSION

Unit: millimeter otherwise specified

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The display is manufactured by Japan Display (12.3-in IPS liquid crystal). About 30–%–expensive comparing to same sized display.
Not necessarily pursuiting thin-sized, nevertheless the total thickness of the materials consisting the display is thin (3.69mm).
Liquid crystal panel has 44 pieces of back–lighting LED to secure visibility under the condition of sunlight reflection.
Quite blight panel.

Display Module Size		315 x 127 x 13.3
Display Marking (location)		LAM1233555D N00AH0159305630 18 928 554 146-00 AF123A155000006VBH0A MADE IN CHINA (bottom metal plate)
Display Panel Manufacturer		JDI
Display Diagonal Size (inch)		12.3
Display Mode (alignment)		IPS (stripe alignment)
Pixel Count (dot)		1440 x 540
Resolution (pixel per inch)		125
Peripheral Margin (from reverse side)	Left	8.30
	Top	3.15
	Right	8.37
	Bottom – up	0.29
	Bottom – low	6.72
Seal marking: Y/N (length in mm)		No
Display Component Thickness	1a: LCD Top Polarizer	0.12
	1b: LCD Panel	1.22
	1c: LCD Lower Polarizer + Reflector	0.27
	2. Diffuser	-
	3: Brightness Enhancement Film	0.34
	4: Brightness Enhancement Film	0.14
	5: Diffuser	0.12
	6: Light Guide	1.27 - 3.57
	7: Reflector	0.21
	Display Component Total Thickness (clearance)	3.69 (9.61)
Display Backlight LED Count (size)		44 (3.04 x 1.45 x 0.55)
Display Cable Width (mm) / Pin Pitch (mm) / Pin Count		32.54 / 1.00 x 64

MAIN DISPLAY: PIXEL & FOOTPRINT

Unit: millimeter otherwise specified

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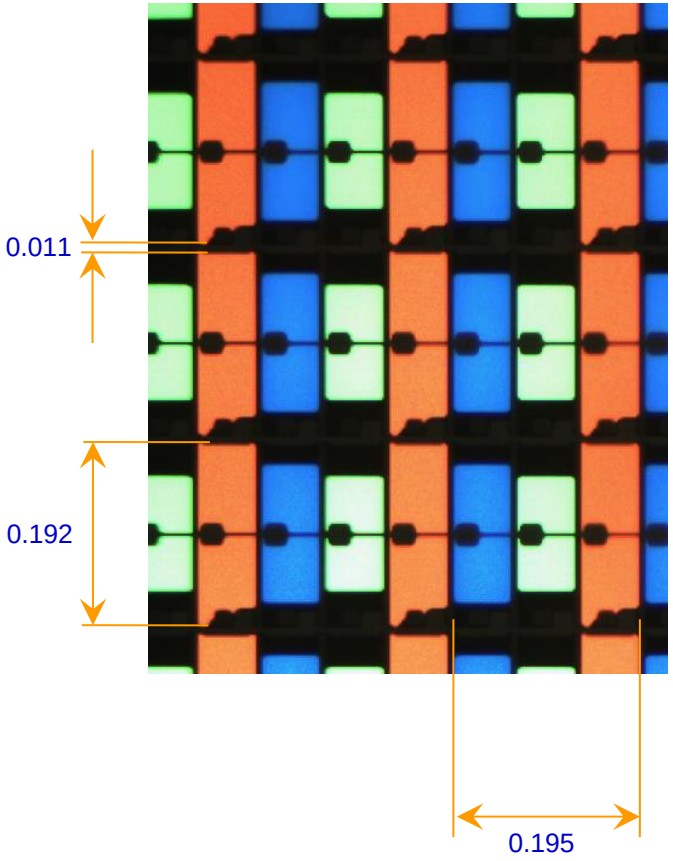
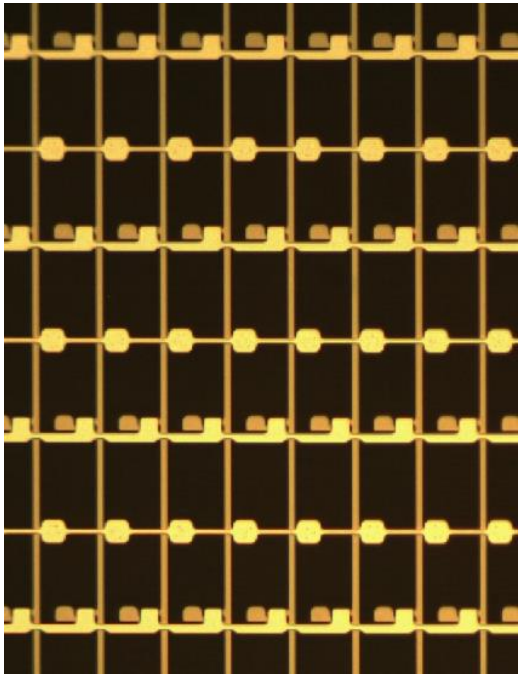
The photo on the left is at the state of ″back light ON″.
The central photo shows "back light OFF" and "lighting on whole surface of the panel ON″. Under the condition, the wiring is observed.
The photo on the right shows ″both lights ON″.

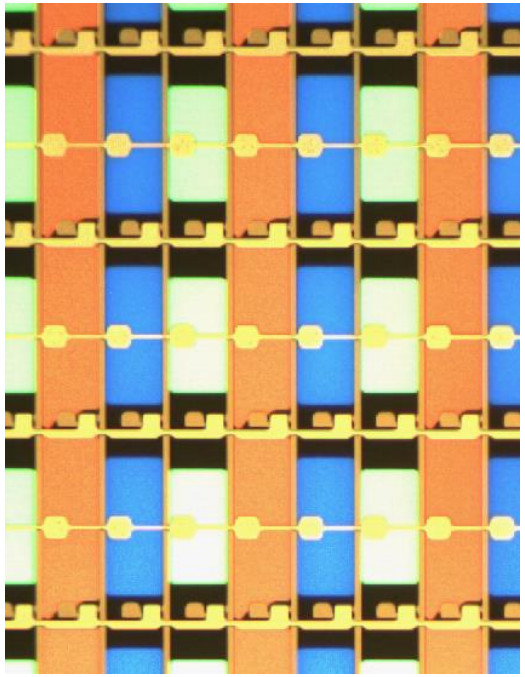
Backlight: ON
Front Light: OFF



Backlight: OFF
Front Light: ON



Backlight: ON
Front Light: ON



Information is displayed on LCD switching several operation modes.
Feasible to show large graphics of speed and rev meters like a conventional cars.
Instead, shrunk meter graphic with a large navigation graphic is able to be combined on the display.
Expected high cost, approx. $4,000, spoils wide spread of adoption on ordinary vehicles.
Another concern is unnatural behavior of the virtual needle of the meter graphics, comparing to analog meter needles.

https://www.audi.co.uk/content/dam/audi/production/PDF/PriceAndSpecGuides/tt.pdf

SERVICES

- TEARDOWN: on cellular phone, smartphone, tablet, laptop PC, digital still camera, LCD TV, and other mobile equipments.
- BILL OF MATERIALS: all-component-cost breakdown into more than 100 categories.
- MARKET REPORT: based on requests.
- SEMINAR: based on requests. Free seminars offered to regular subscribers every quarter.
- INTELLECTUAL PROPERTY: old phones available since 1996 up to date. Most of them are functional.

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