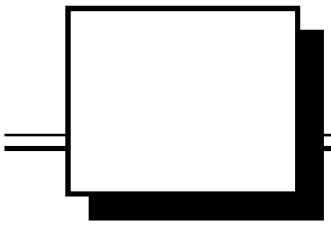


SMEG + Integrated Hardware

Technical specification

Ref.:

LIST OF REVISIONS

Issue	Date	Description of revisions	Author
1	14/10/13	Creation	E. DERET

TABLE OF CONTENTS

1 Introduction

1.1 Scope

The aim of this document is to describe the general hardware architecture of the SMEG+Integrated and to specify its input and output signals regarding the external environment.

1.2 List of abbreviations

FM	Frequency Modulation
AM	Amplitude Modulation
RDS	Radio Data System
CDC	Compact Disc Changer
TMC	Traffic Message Control
I2S	Inter-Integrated circuit-Sound
I2C	Inter-Integrated-Circuit Bus
CD	Compact disc
CAN LS	Low Speed Car Area network driven by BSI
CAN HS	High Speed Car Area Network Point to Point for DGT display
LVDS	Low Voltage Differential signal
CVBS	Chroma Video Blanking and Synchronisation
CPU	Control Process Unit
GPU	Graphic Process Unit
TTS	Text To Speech
USB	Universal Serial Bus
AVR	Camera for reverse gear help (Aide visual au recule)

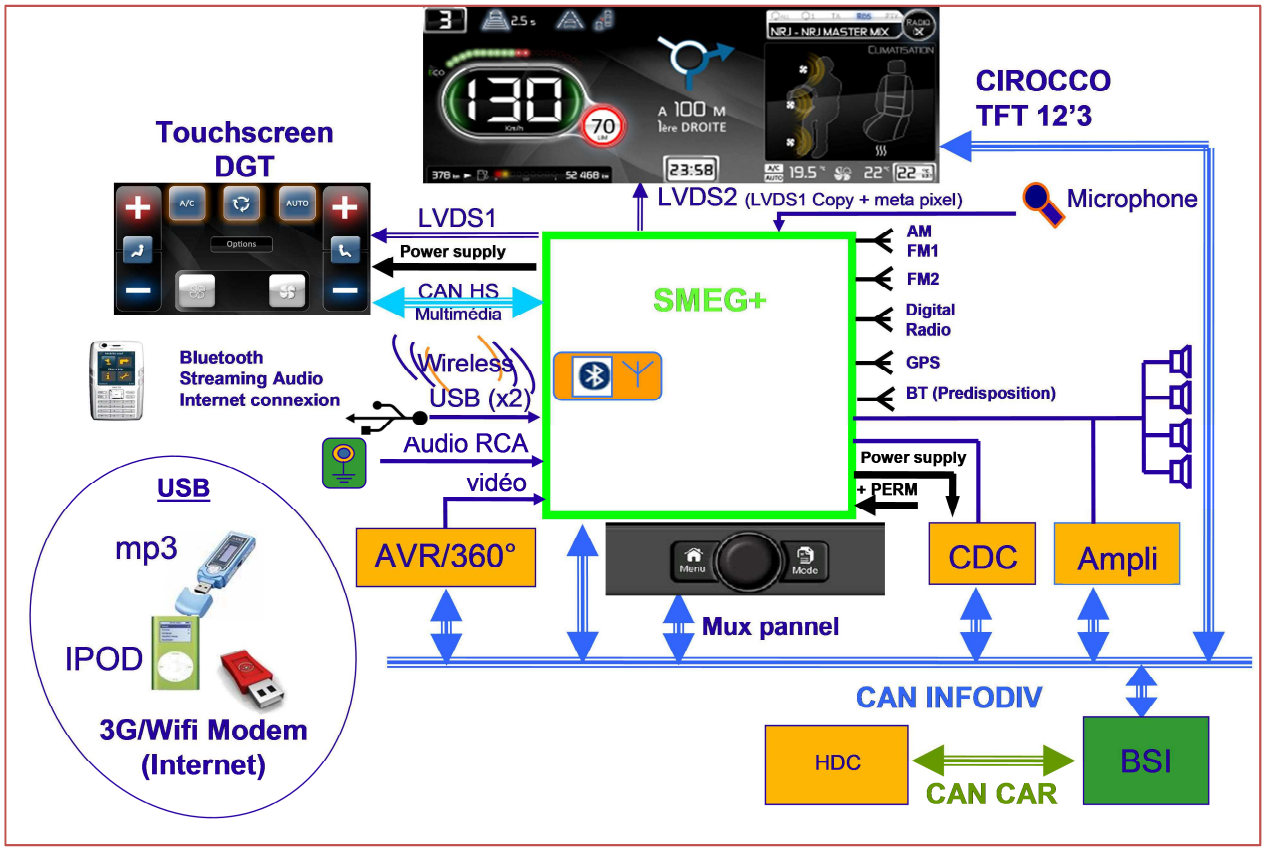
3 Overview

SMEG (for **S**ystème **M**ultimédia **E**ntrée de **G**amme) System, is a full multimedia system developed first for PSA B78 then T9. SMEG+Integrated, interface within car through CAN vehicle network, provide main features like Navigation, AM/FM radio and BT/USB connectivities. IHM is provided by a Touch Screen display.

Depending of vehicle level, many materials variants are delivered to customer:

	Radio AM / FM	DAB	BlueTooth	2nd USB	2nd LVDS	Rear Cam	GPS	uSD	RAM/Flash
A1	X		X						512/512
B1	X		X	X		X			512/512
B2	X	X	X	X		X			512/512
D1	X		X	X	X	X	X	16G	512/512
D2	X	X	X	X	X	X	X	16G	512/512
E1	X		X						256/256
E2	X	X	X						256/256
F1	X		X				X	8G	512/512
F2	X	X	X				X	8G	512/512
H1	X		X	X		X	X	16G	512/512
H2	X	X	X	X		X	X	16G	512/512

4 Features



Logic core and generic peripherals:

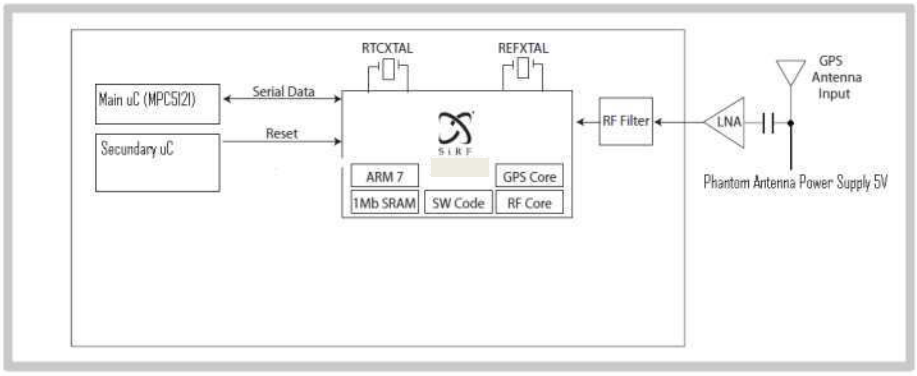
- CPU MPC5121 - 396 MHz.
  - e300 Power Architecture processor core (enhanced version of the MPC603e core), operates up to 350–400 MHz
  - Embedded display controller can support a wide variety of TFT LCD displays with resolution up to 1280 × 720 (720p) at a maximum refresh rate of 60 Hz and a color depth up to 24 bits per pixel
  - DDR2 memory controller
  - NFC – NAND flash controller (4GBytes)
  - SDHC – MMC/SD/SDIO card host controller
  - USB 2.0 OTG controller with integrated physical layer (PHY)
  - USB 2.0 Hub (used in version with two USB connections).

- 16GBytes uSD Card (Cartographic database and Jukebox)

- 512MBytesDDRII RAM 200MHz

Navigation:

- 12 channels GPS receptor based on SiRFstarIV processor:
  - Nominal Cold start under 40 seconds



Sample Architecture Diagram

Audio/Radio:

- Radio with 3 tuners phase diversity build around **DIRANA2 DSP** and **LeafDice analog tuners**.
- **RDS** and **TMC** decoding
- **Audio Power amplifier** (type AB Class) with 4 channel outputs (16 Watt Rms @ 1%THD, 13,5V, 4Ω LS)
- **External HIFI amplifier** compatibility: **Analog (booster)** x4 outputs or **Digital** (driven through CAN commands) x2 outputs
- **External Mono CD Reader** audio stereo inputs with half-differential signals on 3 lines
- **Auxiliary audio stereo inputs** with half-differential signals on 3 lines
- Microphone analog mono inputs

Video out:

- **1 pair LVDS output interface** TFT 7'' 800*480 display, 60Hz
- **Second 1 pair LVDS output interface (copy of the first) in option D1 and D2.**
- DGT display compatibility with **CAN High Speed communication**
    - for touch screen feedback
    - DGT luminosity commands

Others:

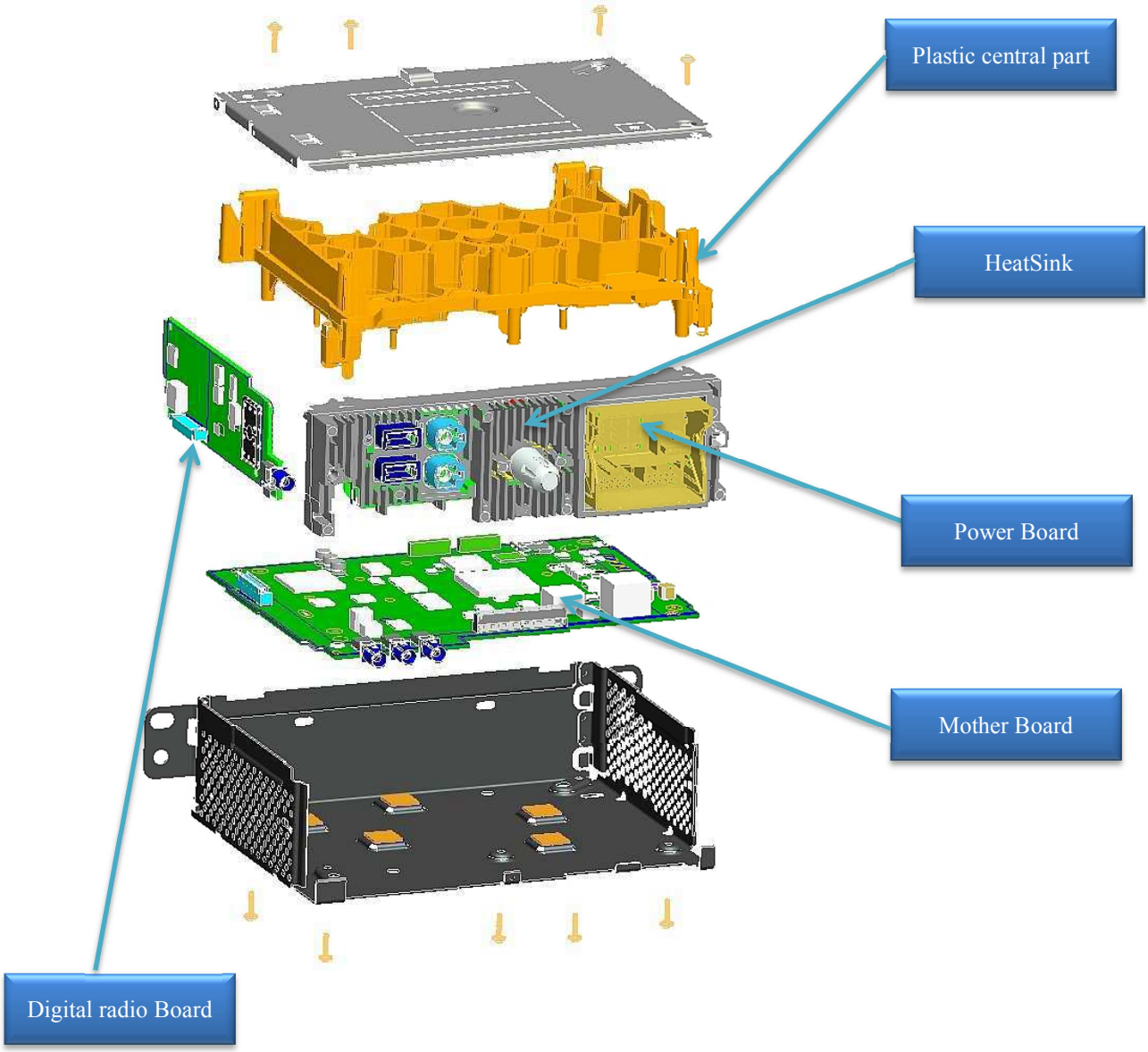
- **USB 2.0** connectivity (1 customer USB port). USB Power supply with minimum guarantee supply current of **1A at 4,75V**
- **Second USB 2.0** connectivity (only on version B1, B2, D1, D2, H1 and H2). USB Power with minimum guarantee supply of **1A at 4.75V**
- Embedded **Apple authentication chip**
- **Bluetooth 1.1** connectivity based on Infineon module PBA31308
    - with **internal printed antenna** (available bom option for external antenna compatibility)
    - **HFP and A2DP profiles**
- Principal node on the vehicle comfort **CAN Low Speed** bus
- Internal cooling through **FAN** managed by temperature sensor
- Standby current less than **1mA worst case at 12V**

Mechanics:

- Connectable by FAKRA connectors (GPS/AM FM1/FM2/BT in option)
- 1 DIN system box.

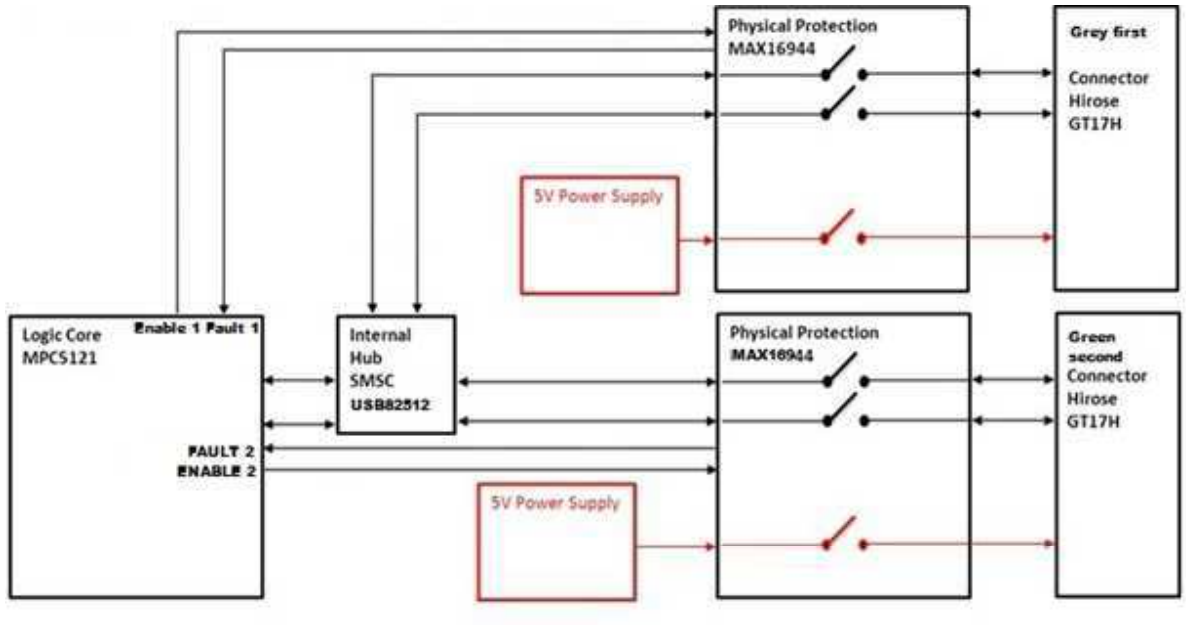
5 Synoptics

5.1 Mechanical Assembling



5.7 USB

SMEG System allows to drive 1 USB port, agrees with USB2.0 norm.



5.7.1 USB Power Supply

(Cf Schematic MB800 p9)
USB Power Supply meets USB2.0 norm supplying more than 1A with 4,75V as guaranteed voltage level at its output.
The physical interface (part MAX16944 from Maxim) is also able to protect both power supply and datas from ESD and short circuit to main Battery voltage and to ground.
When such protection is active, a feedback to logic core (so called OVERCURRENT information), allow to inform final custumer through a dedicated pop up.

5.7.2 USB Datas

(Cf Schematic MB800 p37)
SMEG integrates an internal hub, even when using only one port in order to interface datas between USB peripherals and main microcontroller.

5.9 Audio paths

(Cf Schematic MB800 p20 to 23)
The audio processing of the system is mainly assured by the radio part thanks to an audio DSP (Dirana2 from NXP).
There are three separate audio paths:

- First audio path:

Exclusive permanent inputs		
Signal	*Source*	*Type*
Radio	Tuner	Analogue
Auxiliary	External	Analogue
CD Changer	External	Analogue
GSM out	Bluetooth module	Analogue

Temporary inputs (to be mixed)		
Signal	*Source*	*Type*
TTS	CPU	Digital (I2S)
Beep	Audio DSP	Digital

Audio process 1

Outputs		
Signal	*Destination*	*Type*
HP (x4)	Audio power stage	Analogue
Echo	CPU	Digital (I2S)

- Second audio path:

Permanent input		
Signal	*Source*	*Type*
Micro ana	External microphone	Analogue

Audio process 2

Output		
Signal	*Destination*	*Type*
Micro in	CPU	Digital (I2S)

- Third audio path:

Permanent input		
Signal	*Source*	*Type*
Micro out	CPU	Digital (I2S)

Audio process 3

Output		
Signal	*Destination*	*Type*
GSM in	GSM or Bluetooth module	Analogue

In case of echo cancellation done by the GSM module itself, the audio process 2 and 3 are shorted in a single Audio process 4:

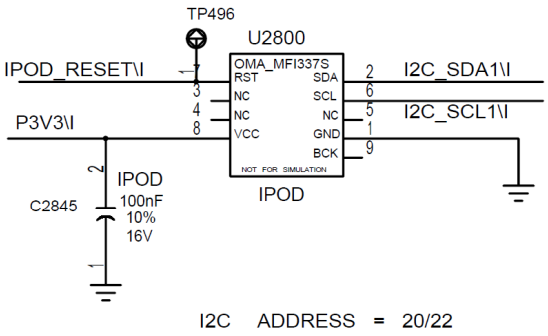
Permanent input		
Signal	*Source*	*Type*
Micro ana	External microphone	Analogue

Audio process 4

Output		
Signal	*Destination*	*Type*
GSM in	GSM module	Analogue

5.11 Apple Chip

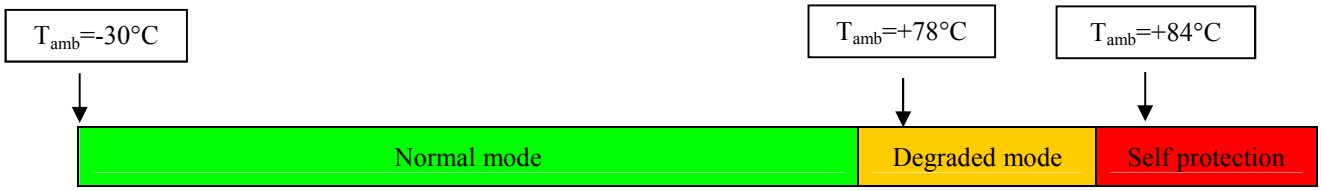
(Cf Schematic MB800 p15)
A dedicated Chip is needed to allow USB communication with Apple product.
When Apple product is plugged to SMEG, a specific code exchanged with the USB peripherals, is checked with the one within the Apple chip (equivalent to an Eeprom).
Apple chip (MFI337S2313) is driven by main microcontroller through a dedicated I2C bus and also for reset command (IPOD_RESET) by the secondary microcontroller.



I2C ADDRESS = 20/22

5.12 Thermal Management

5.12.1 System requirements



“Tamb” represents the ambient temperature.

In “Self protection” state, SMEG System is powered off.
In “Degraded mode” state, SMEG System manages functional limitations.

5.12.2 Thermal Strategy

Here is the strategy applied according to main electronic board temperature:

- ⇨ If internal temperature is equal or exceeds 78°C functional limitations are applied to reduce thermal power dissipation.
- ⇨ Functional limitations are stopped when measured temperature bounce to 74°C
- ⇨ If internal temperature is equal or exceeds 84°C, system enters in self protection mode

5.12.2.1 Functional limitations

To reduce thermal power dissipation, an audio volume limitation is implemented:

- Activation of audio volume limitation: MB temperature > to 78C.
- Deactivation of audio volume limitation: MB temperature < 74℃
- Action : Max volume level is 15
- Popup : Reduction of maximum volume level

5.12.2.2 System self protection

To ensure system self protection, the following behavior is implemented:

- System switched pseudo OFF when temperature > to 84℃.
- System switched ON after 5 minutes with a filter to 5℃ (80℃) before restarted.
- Pseudo OFF: Mother board is switched in default mode. Slave micro-processor is maintained for CAN management.
- Popup : System will be switched OFF

5.13 Power management & current limiter function

(Cf Schematic PB800 p3)
The power management is shared between the power board and the mother board.
A main switch, on the power board, protects the system:

Standby mode:

- The current limiter function is on. The main switch is opened, a resistor in parallel limits the current at a sufficient level to let the system working in a standby mode (<1mA). When a short circuit appears downstream the switch, this resistor dissipates all the power avoiding to create a risk of over heating elsewhere in the product. In this case the current which flows into the resistor is 50mA max upon 12V, 75mA upon 16V. For Vbat =< 16V the power available downstream the current limiter is 300mW maximum.

Normal mode:

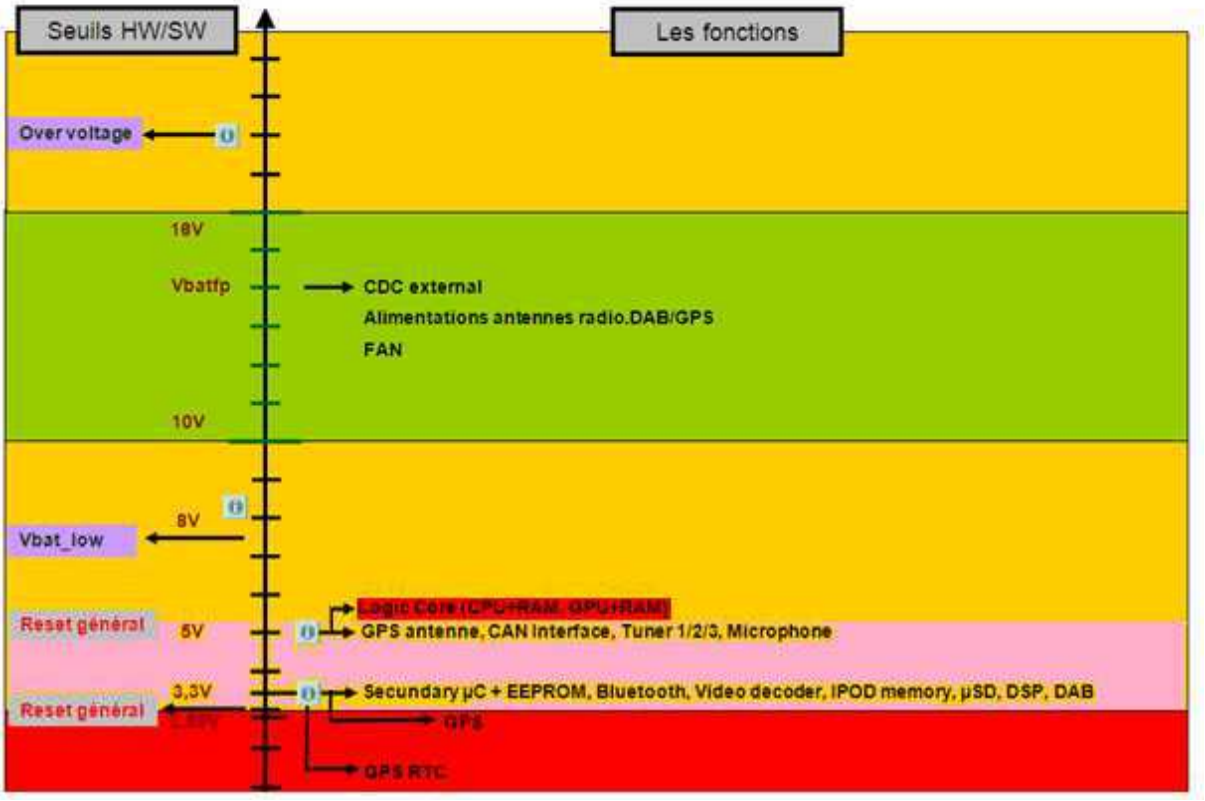
- The main switch is closed, so the current limiter function is off and up to 13A can be used by the SMEG.

A second switch, on the power board, is driven by the CPU in order to supply the external display.
All the different voltages needed by the components are created on the mother board by several DC/DC converters or linear regulators.
The car battery voltage is supervised in order to:

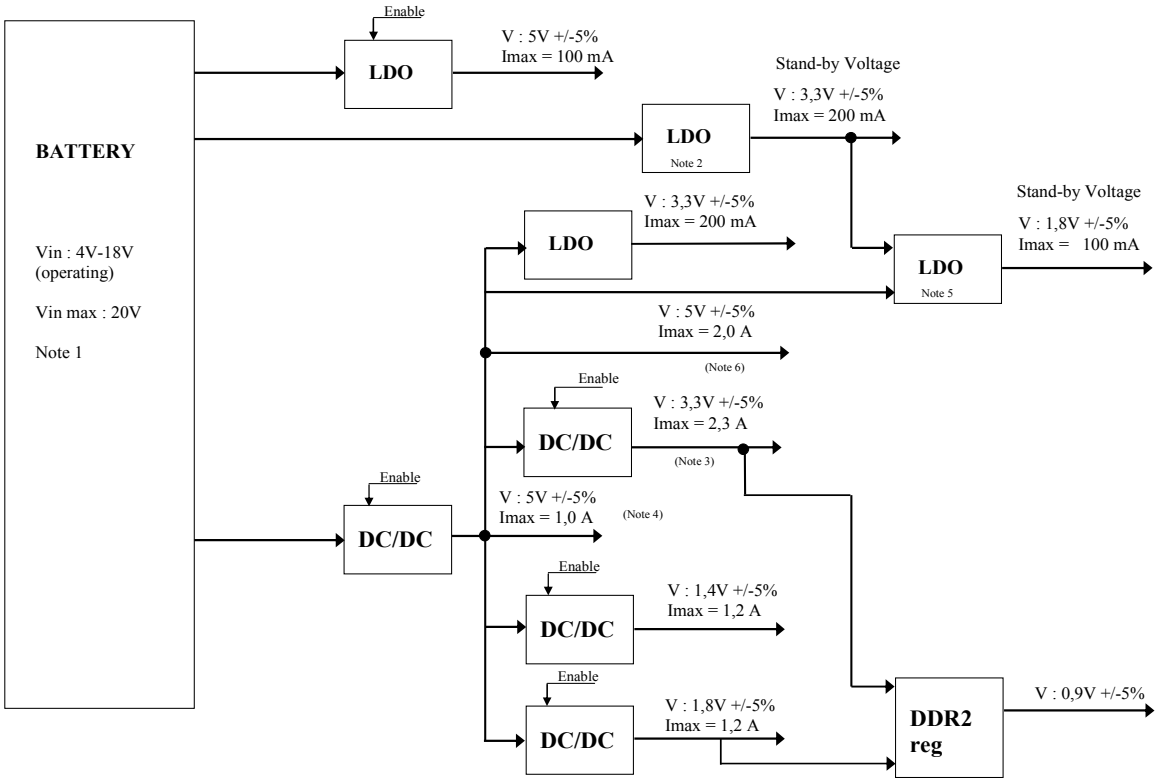
- open the main switch in case of overvoltage (>18V, load dump protection)

- open the main switch in case of external voltage lower than internal voltage (reverse battery protection)

Some peripherals (Mute on power amplifier, Diagnosis,...) can be disabled if the SMEG internal voltage is not sufficient (<9V) but all the vital functions work above 4,75V.



5.13.1 Power Supply synoptic

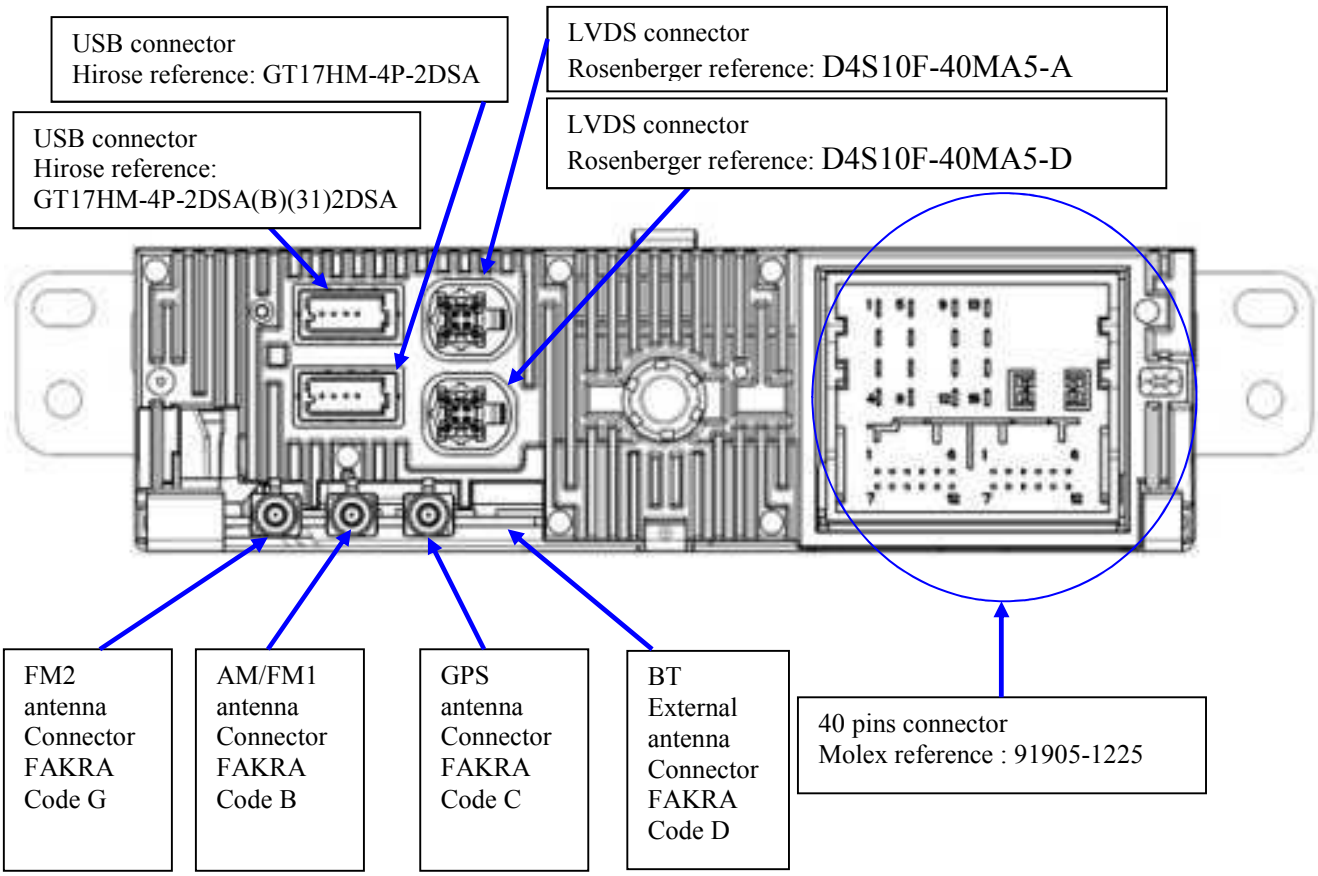


Notes:
1) It doesn't require step-up configuration, only step-down.
2) The quiescent current of stand-by 3,3V DC/DC or linear regulator must be less than : 100µA (in operating mode with output current less than 1mA).
3) Load on 3,3V is 2,3 A just for the native load, without consider the 3 voltages derived.
4) Load on 5V is 1,5 A just for the native load, without consider the 2 voltages derived.
5) The quiescent current of stand-by of 1,5V stand-by must be less than 5 µA (in operating mode with output current less than 50 µA).
6) USB power supply: Can be combined with the standard 5V

General notes :
a) The stand-by quiescent current of each DC/DC and linear regulator must be less than 100µA (when the component is disable).
b) For all DC/DC is required to have the possibility to change PWM frequency.
c) For all DC/DC is required current limit and thermal protection.
d) All the voltage regulator must be able to drive directly ceramic capacitors (extremely low ESR)
e) Operating temperature range -40° to +85°C.

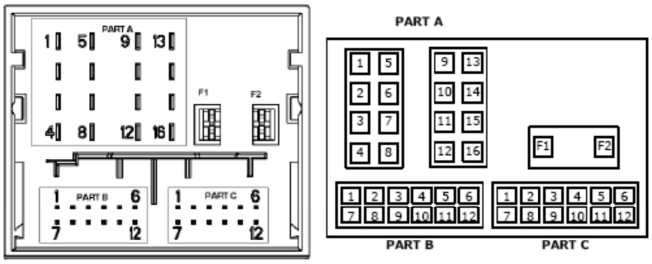
Secondary uC is supplied by + 3V3 STBY, as soon Battery voltage is greater than 5,5V and Reset=1.

5.14 Hardware interfaces – rear face



5.15 40 pins connector: pin assignment

40 pins MOST/FAKRA connector



Connector MOST/FAKRA PART A

PIN	Signal	I/O	Description	Electrical characteristics
1	+SPK-RR	O	Rear right speaker signal	Imax = 5A
2	+SPK-FR	O	Front right speaker signal	Imax = 5A
3	+SPK-FL	O	Front left speaker signal	Imax = 5A
4	+SPK-RL	O	Rear left speaker signal	Imax = 5A
5	-SPK-RR	O	Rear right speaker reference signal	Imax = 5A
6	-SPK-FR	O	Front right speaker reference signal	Imax = 5A
7	-SPK-FL	O	Front left speaker reference signal	Imax = 5A
8	-SPK-RL	O	Rear left speaker reference signal	Imax = 5A
9	ON_DEV	O	Switched display power supply	Imax = 5A peak, 1,5 A DC
10	CAN_H	I/O	LS CAN signal	see PSA CAN specification
11	CAN_HS_L_TS	I/O	HS CAN signal	see PSA CAN specification
12	+PERM COM	I	Main power supply	Imax = 15A
13	CAN_L	I/O	LS CAN signal	see PSA CAN specification
14	CAN_HS_H_TS	I/O	HS CAN signal	see PSA CAN specification
15	DISP-GND	O	Display ground	Imax = 5A peak, 1,5 A DC
16	GND	I	Main ground	Imax = 15A

Connector MOST/FAKRA PART B

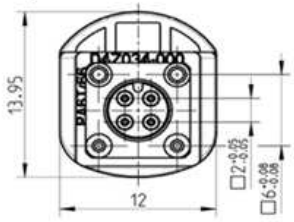
PIN	Signal	I/O	Comment	Electrical characteristics
1	Rear_Cam_IN+	I	Video input n°1	
2	NU			-
3	Micro-	I	Microphone input reference	
4	AUX_audio_right	I	Auxiliary audio right signal	Vdc=4V+/- 10%, Zin=10KW, Va=2Vrms
5	NU			
6	Video_IN_AUX+	I	Video input n°2	-
7	Rear_Cam_IN-	I	Video input n°1 reference	-
8	NU			
9	Micro+	I	Microphone input signal	Signal polarized low tension with 8V signal < 100mV
10	AUX_audio_left	I	Auxiliary audio left signal	Vdc=4V+/- 10%, Zin=10KW, Va=2Vrms
11	AUX audio gnd	I	Auxiliary audio reference	Vdc=4V+/- 10%, Zin=10KW
12	Video_IN1_AUX-	I	Video input n°2 reference	-

Connector MOST/FAKRA PART C

PIN	Signal	I/O	Comment	Electrical characteristics
1	GND_CDC	O	Mass for the changer of CD, Masse reference of the diversity box	
2	CAN_LS_L_CDC	I/O	Data CAN for CD changer	
3	+PER_CDC	O	power supply for CD changer	
4	AUDIO_RIGHT_CDC	I	Audio input signal right of the CD changer	
5	NU			
6	NU			
7	CAN_LS_H_CDC	I/O	Data CAN for CD changer	
8	AUDIO_GND_CDC	O	Audio reference of the CD changer	
9	NU	O	Mute analogical HIFI amplifier	
10	AUDIO_LEFT_CDC	I	Audio input signal left of the CD changer	
11	NU			
12	NU			

5.16 LVDS connector: pin assignment

4 pins LVDS Connector DGT



Code for LVDS 1 :D4S10F-40MA5-A

PIN	Signal	I/O	Comment	Electrical characteristics
1	DATA +	O	LVDS+	
2	NU			
3	DATA-	O	LVDS-	
4	NU			

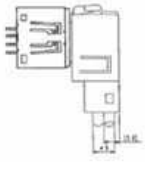
4 pins LVDS Connector 2

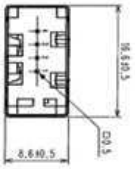
Code for LVDS 2 : D4S10F-40MA5-D

PIN	Signal	I/O	Comment	Electrical characteristics
1	DATA +	O	LVDS+	
2	NU			
3	DATA-	O	LVDS-	
4	NU			

5.17 USB rear connector: pin assignment

Connector USB 1 (Grey)

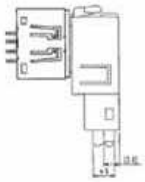


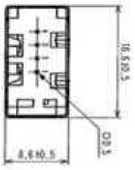


Code for USB 1 : Grey

PIN	Signal	I/O	Comment	Electrical characteristics
1	VBus	S	Power supply	+5V max 1A
2	Data -	E/S	Data signal	
3	Data +	E/S	Data signal	
4	GND	S	Ground associated with the VBus	

Connector USB 2 (Green)



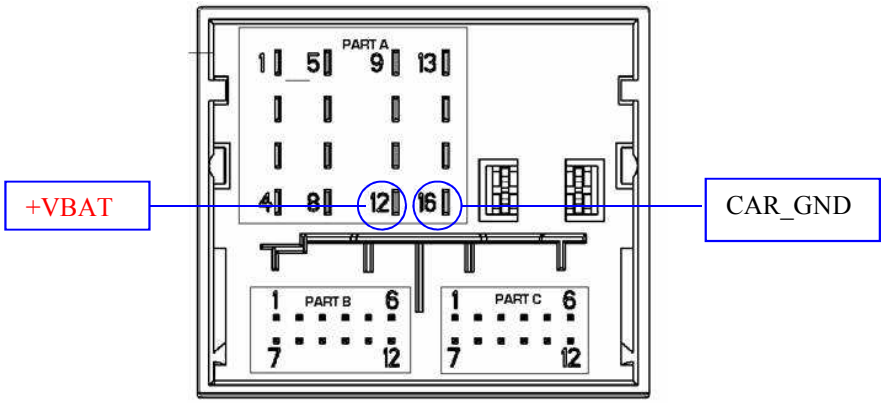


Code for USB 2 : Green

PIN	Signal	I/O	Comment	Electrical characteristics
1	VBus	S	Power supply	+5V max 500mA
2	Data -	E/S	Data signal	
3	Data +	E/S	Data signal	
4	GND	S	Ground associated with the VBus	

5.18 Power supply interface

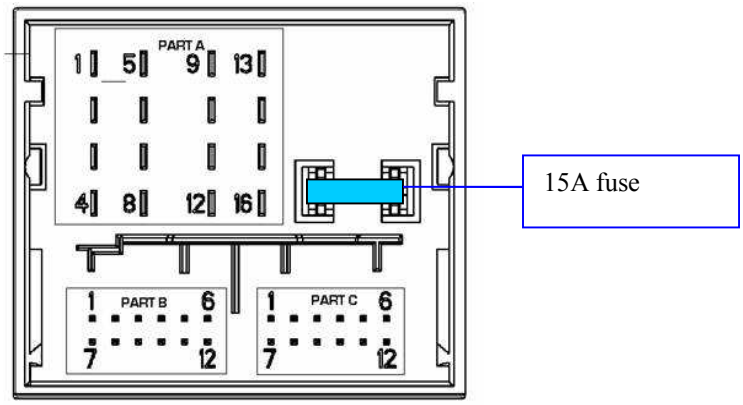
The SMEG is supplied by the pins A12 (+VBAT) and A16 (CAR_GND) of the 40 pins connector.



SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
VBAT	Battery voltage	Operating mode – Full functionality	10	13.5	18	V
VBAT	Unusual power supply voltage	Unusual voltage applied 1 minute only	-13.5	/	24	V
IBAT	Battery current	Sleep mode – 10V ≤ VBAT ≤ 16V Without CD changer	/	/	1	mA
IBAT	Battery current	Normal mode – VBAT=13.5V	1.3	/	15	A
IBAT	Battery current	Active sleep – 10V ≤ VBAT ≤ 16V			1	A

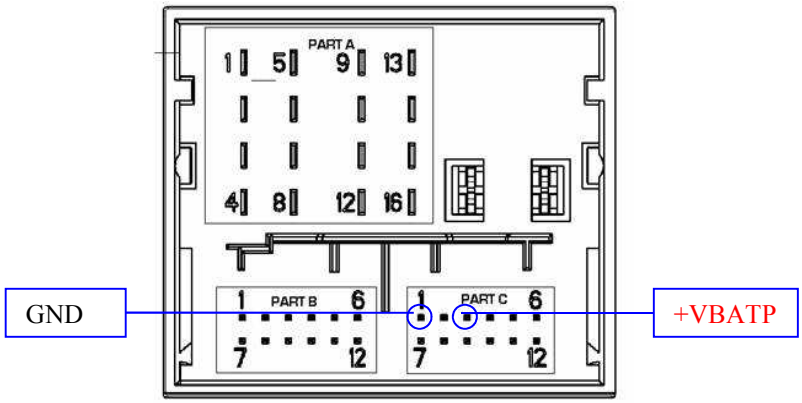
5.19 Fuse interface

A 15A fuse is required in the 40 pins connector in order to protect the SMEG and the CD Changer.



5.20 CD Changer supply interface

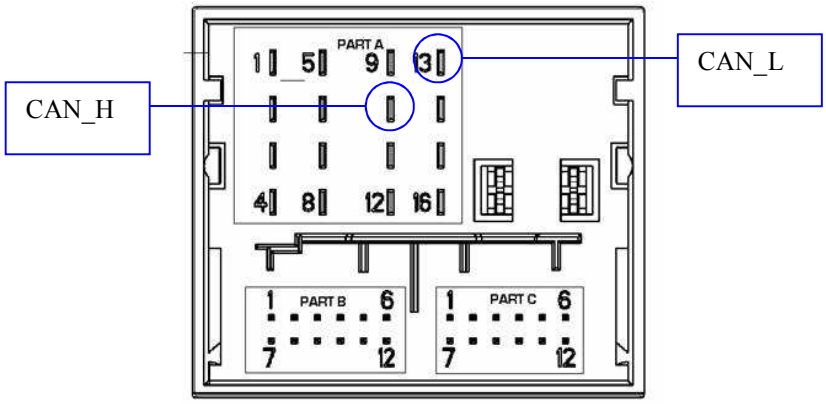
The SMEG supplies the CD changer between the pins C3 (+VBATP_CDC) and C1 (GND) of the 40 pins connector.
VBATP_CDC is 1st protected by the 15A fuse present in the 40 pins connector and then protected by a dedicated SMT Fuse 6A.



SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
VBATP_CDC	Battery protected voltage			VBAT		V
IBATP_CDC	Permissible output current for CD changer		/	0.5	2	A

5.21 Car comfort CAN bus interface

The SMEG is linked to the car comfort CAN BUS through the pins A10 (CAN_H) and A13 (CAN_L) of the 40 pins connector. For this connection, the SMEG acts as a node. The data flow is 125Kbauds.



The signals CAN_H and CAN_L comply with the standard “Road vehicles-Controller area network-Low-speed fault tolerant medium dependent interface” (ISO11898 part 3).

Differential Input: CAN_H-CAN_L

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Vth(dif)	Differential receiver threshold voltage		-3.5	-3.2	-2.9	V

Input/Output: CAN_H

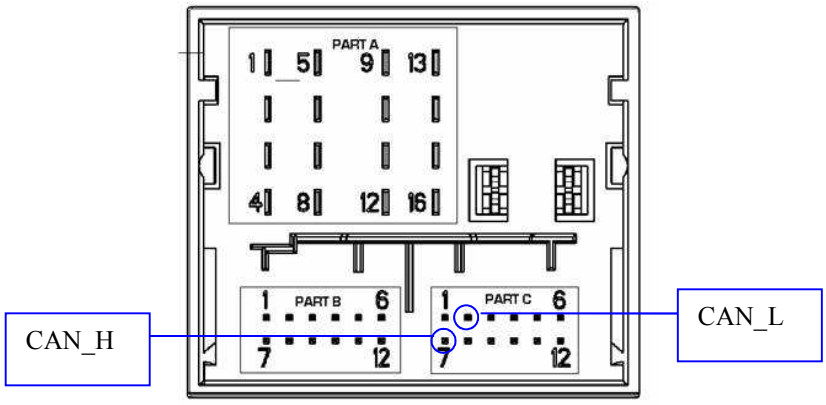
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{O(recess)}$	Recessive output voltage		0	-	0.2	V
$V_{O(dom)}$	Dominant output voltage	I_{CANH}=-40mA	3.6	-	5	V
R_{TH}	Termination resistor		532	560	588	Ω
Cin	Input capacitance		47	-	100	pF

Input/Output: CAN_L

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{O(recess)}$	Recessive output voltage		4.8	-	5	V
$V_{O(dom)}$	Dominant output voltage	I_{CANL}=40mA	0	-	1.4	V
R_{TL}	Termination resistor		532	560	588	Ω
Cin	Input capacitance		47	-	100	pF

5.22 CD Changer CAN bus interface

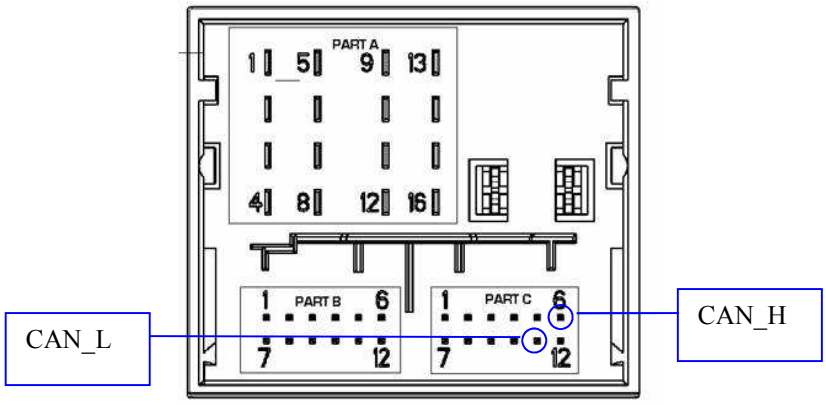
The SMEG links the CD changer to the BSI CAN BUS through the pins C7 (CAN_H) and C2 (CAN_L) of the 40 pins connector. For this connection, the SMEG has only the role of relaying the BSI CAN BUS.



The signals CAN_H and CAN_L comply with the standard “Road vehicles-Controller area network-Low-speed fault tolerant medium dependent interface” (ISO11898 part 3).

5.23 Deported Keyboard CAN bus interface

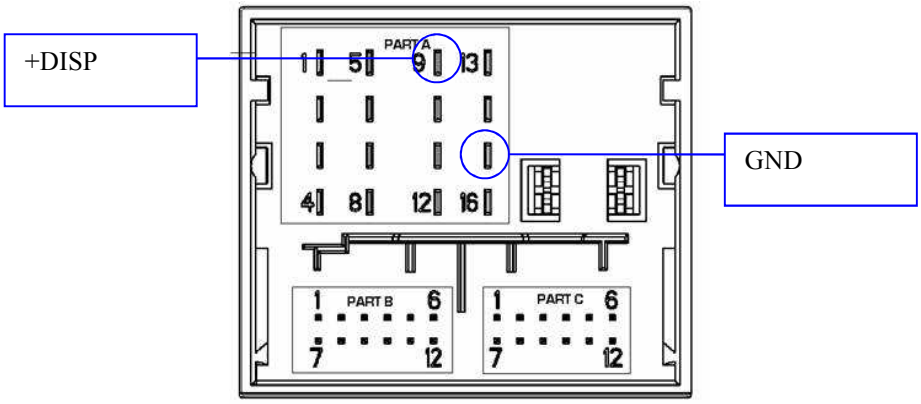
The SMEG links the Deported Keyboard to the BSI CAN BUS through the pins C6 (CAN_H) and C11 (CAN_L) of the 40 pins connector. For this connection, the SMEG has only the role of relaying the BSI CAN BUS.



The signals CAN_H and CAN_L comply with the standard “Road vehicles-Controller area network-Low-speed fault tolerant medium dependent interface” (ISO11898 part 3).

5.24 Power supply display interface

The SMEG supplies the display between the pin A9 (+DISP) and the pin A15 (GND) of the 40 pins connector.
The SMEG can switch on/off the display by the +DISP signal.

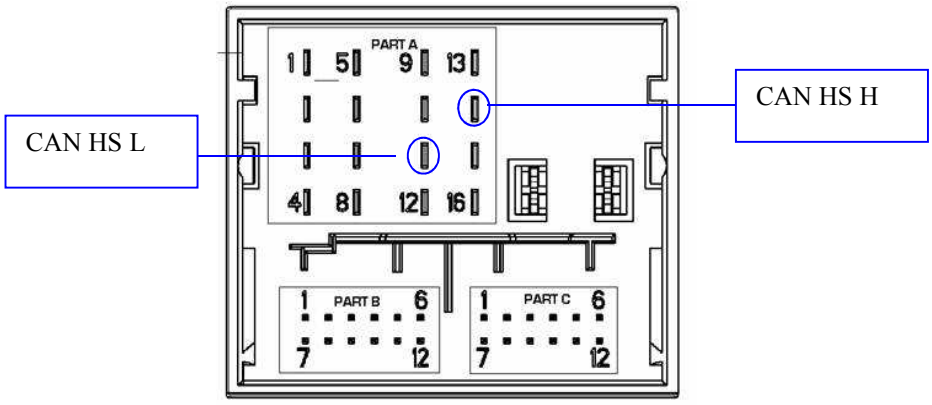


Output: +DISP

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{OH}	HIGH-level output voltage	Io=-0.6A	VBAT-0.15	-	VBAT	V
I_{OH}	Permissible DISPLAY output current		-	0.6	1.5	A

5.25 CAN High Speed for DGT display

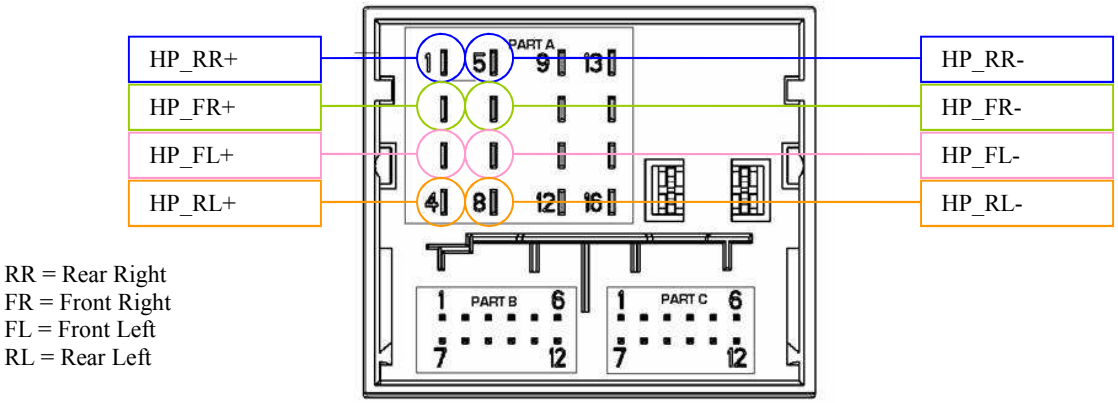
The SMEG communicates with the DGT display thanks to a CAN HS bus on the pin A11/A15 of the 40 pins connector.
The frequency is setting at 250 Kbits/s.



Physical interface complies with ISO 11898-2 CAN HS Transceiver - 19.02.2007.

5.26 Loudspeakers interface

The SMEG supplies the 4 car loudspeakers by the pin A1 to A8 of the 40 pins connector.



RR = Rear Right
FR = Front Right
FL = Front Left
RL = Rear Left

STANDARD MODE:

Outputs: HP_XX+ and HP_XX-

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
P_O	Output power	VBAT=13.5V;f=1KHz;R_L=4Ω; THD=1%	15	16	-	W
P_O	Output power	VBAT=13.5V;f=1KHz;R_L=4Ω; THD=10%	23	24	-	W
V_{DC}	Continuous voltage on each output		-	VBAT/2	-	V

HIFI MODE:

Outputs: HP_XX+ and HP_XX-

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output voltage HP_XX+ - HP_XX-	VBAT=13.5V;f=1KHz;R_L=10KΩ ;THD<0.1%;source=0dB sinus wave on reference CD; volume 30	7.2	8	8.8	Vrms
V_{DC}	Continuous voltage on each output		-	VBAT/2	-	V
E	Output noise	Range 20Hz to 20KHz	-	-	166	µVrms

HIFI/CAN MODE:

Outputs: HP_FX+ and HP_FX-

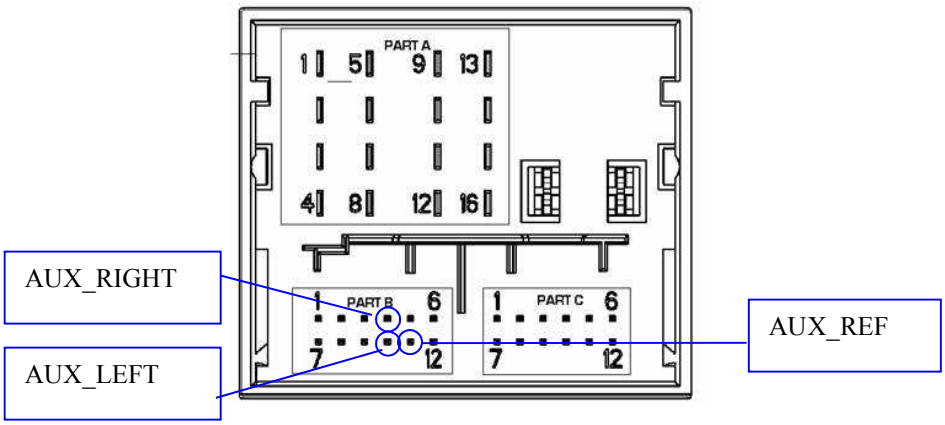
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_O	Output voltage HP_FX+ - HP_FX-	VBAT=13.5V;f=1KHz;R_L=10KΩ ;THD<0.1%;source=0dB sinus wave on reference CD	1.8	2	2.2	Vrms
V_{DC}	Continuous voltage on each output		-	VBAT/2	-	V
E	Output noise	Range 20Hz to 20KHz	-	-	60	µVrms

In case of HIFI/CAN mode the rear outputs are not used.

Each output is protected against short-circuit to VBAT, short-circuit to GND and loudspeaker short-circuit.

5.27 Audio auxiliary interface

The SMEG can input a stereo audio auxiliary signal (half-differential on 3 lines) by the pins B4 (AUX_RIGHT), B10 (AUX_LEFT) and B11 (AUX_REF) of the 40 pins connector.

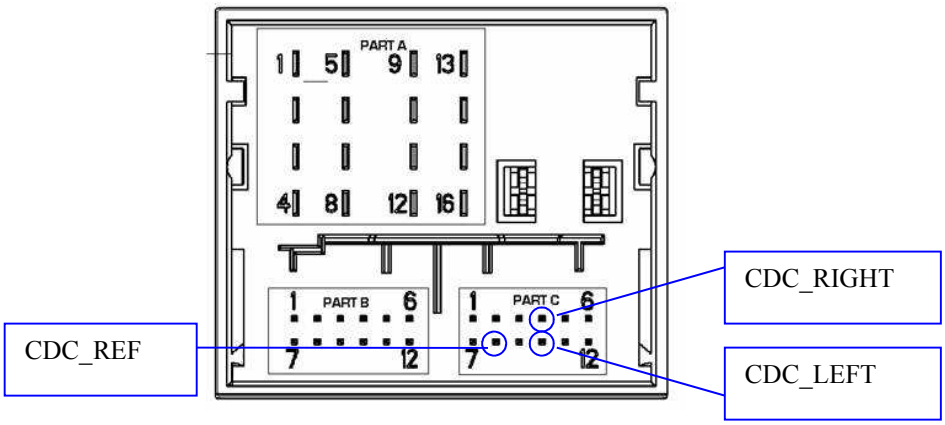


Inputs: AUX_RIGHT, AUX_LEFT and AUX_REF

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Vin	Input voltage AUX_RIGHT-AUX_REF or AUX_LEFT-AUX_REF	f=1KHz	-	0.7	0.77	Vrms
Zin	Input impedance for each signal vs GND		10	-	20	KΩ
Vdc	DC continuous voltage acceptance for each signal		3.6	4	4.4	V
CMRR	Common mode rejection ratio	f=1KHz	60	-	-	dB
S/N	Signal to noise ratio		75	-	-	dB
C_T	Cross talk Channel separation	f=1KHz	60	-	-	dB

5.28 Audio CD Changer interface

The SMEG can input a stereo audio CD Changer signal (half-differential on 3 lines) by the pins C4 (CDC_RIGHT), C10 (CDC_LEFT) and C8 (CDC_REF) of the 40 pins connector.

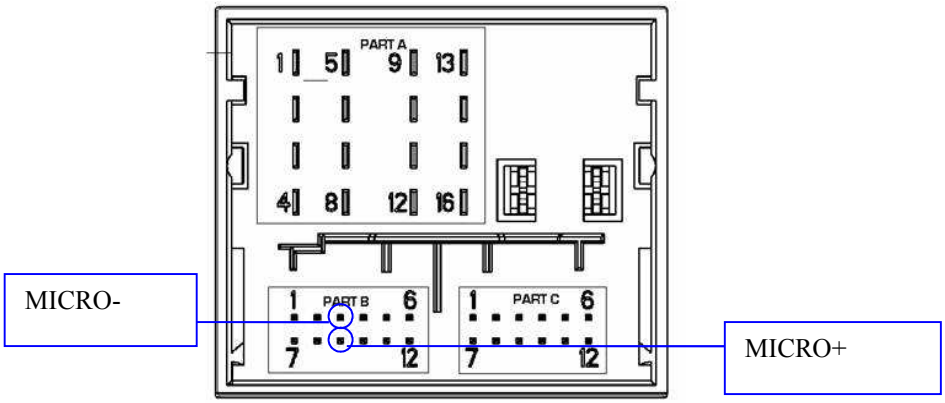


Inputs: CDC_RIGHT, CDC_LEFT and CDC_REF

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Vin	Input voltage CDC_RIGHT-CDC_REF or CDC_LEFT-CDC_REF	f=1KHz	-	2	2.2	Vrms
Zin	Input impedance for each signal vs GND		10	-	20	KΩ
Vdc	DC continuous voltage acceptance for each signal		3.6	4	4.4	V
CMRR	Common mode rejection ratio	f=1KHz	60	-	-	dB
S/N	Signal to noise ratio		75	-	-	dB
C_T	Cross talk Channel separation	F=1KHz	60	-	-	dB

5.29 Car microphone interface

The SMEG inputs a differential connection with the car microphone on the pins B9 (MICRO+) and B3 (MICRO-) of the 40 pins connector. These two pins also provide the phantom power supply for the active microphone.

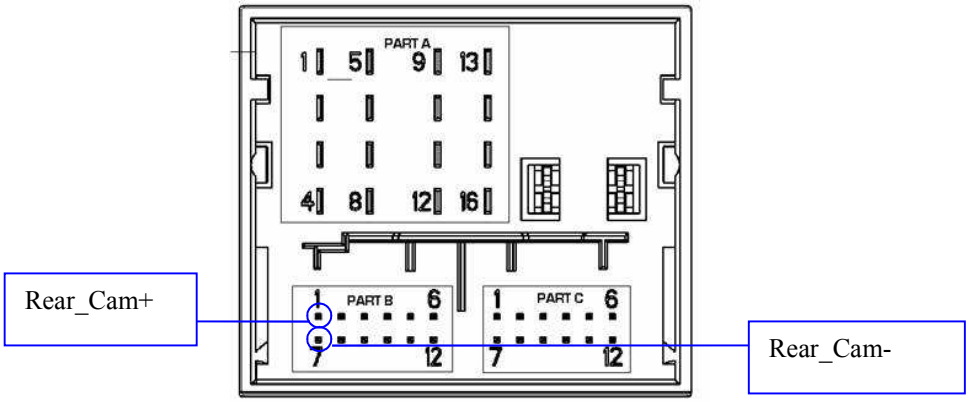


Inputs: MICRO+ and MICRO-

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Vin	Input voltage MICRO+-MICRO-	f=1KHz	-	-	1	Vrms
Zin	Input impedance between MICRO+ and MICRO-		10	-	20	KΩ
Vmicro+	MICRO+ supply voltage		-	-	5	V
Vmicro-	MICRO- supply voltage		0	-	-	V
Rup	Pull-up resistance to +5V for MICRO+		-	231	-	Ω
Rdown	Pull-down resistance to GND for MICRO-		-	231	-	Ω

5.31 External Video 1 interface (not available on A1 version)

The SMEG inputs integrate a differential Video 1 signal between the pins B1 (VIDEO_1+) and B7 (VIDEO_1-) of the 40 pins connector. The video signal is a differential CVBS one. It is used to connect the REAR CAM.

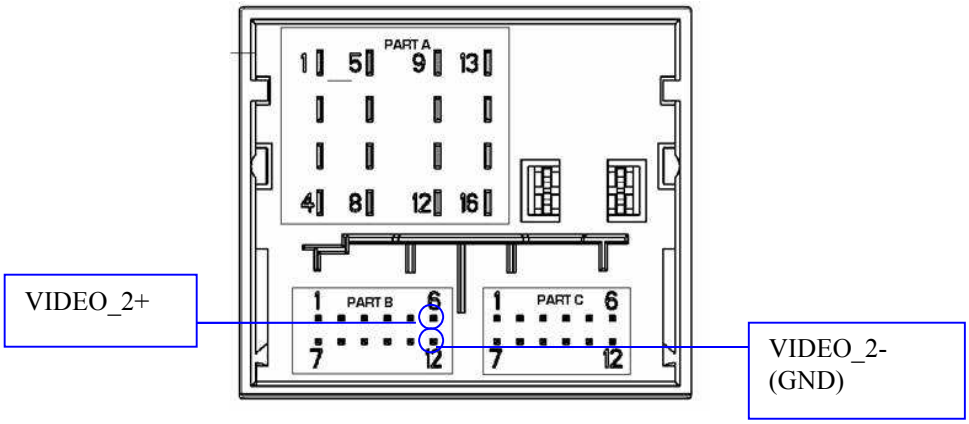


Input: VIDEO_1+

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Vi(p-p)	Input voltage (peak to peak value)	Differential input	-	1	-	V
Zin	Dif Input impedance		-	120	-	Ω
	CM input impedance			10k		Ω

5.32 External Video 2 interface (option for SMEG)

The SMEG inputs integrates an external Video 2 signal between the pins B6 (VIDEO_2+) and B12 (VIDEO_2-) of the 40 pins connector. The B12 pin is directly connected to the general ground of the SMEG+Integrated. The video signal is a standard CVBS one.



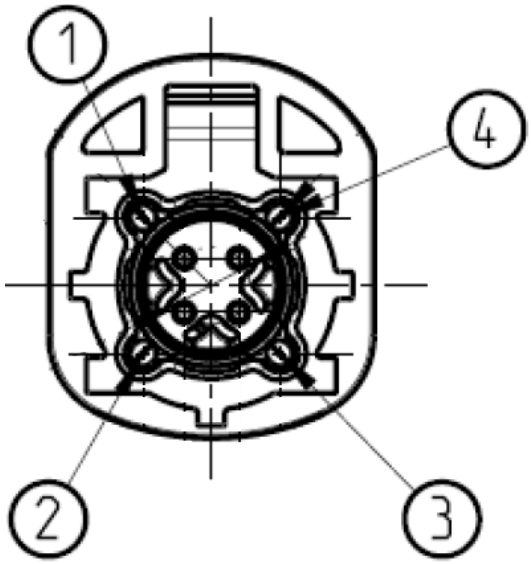
Input: VIDEO_2+

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Vi(p-p)	Input voltage (peak to peak value)		-	1	-	V
Zin	Input impedance		-	75	-	Ω

(*) Removed from PRS 1.0

Display LVDS interface

Image generation is done by a LVDS transmission from the SMEG towards the DISPLAY. The signals are sent through the LVDS connector whose pin assignment is presented below:



Coding	Plug	Colour
A		black
D		bordeaux

The LVDS transmission is composed of one pairs of data (A0) without clock.

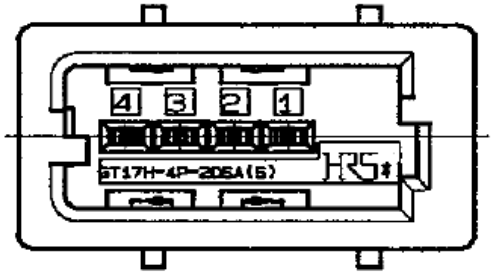
The signals that are serialized are :
R0…R5 => coding of red colour
G0…G5 => coding of green colour
B0…B5 => coding of blue colour
DE => data enable
VSYNC => vertical synchronisation
HSYNC => horizontal synchronisation

Image characteristics for WVGA 800*480 display

5.33 USB 2.0 interface

USB connexion is possible on the SMEG+Integrated in order to load musical files archived in a USB key.
The pin assignment on the rear USB connector is presented below:

On both USB connectors:



Pin	Signal	Input/Output	Description
1	VBUS	Output	5V voltage supply for USB peripheral
2	USB_DN	Input/Output	USB data negative signal
3	USB_DP	Input/Output	USB data positive signal
4	USB_REF	Output	Ground reference for USB peripheral

The pin USB_REF is connected directly to the SMEG+Integrated ground GND.

Output: USB_P5V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{OUT}	Output Voltage	Iout<500mA	4.75	4.9	5.2	V
I_{LIMIT}	Short-Circuit Output Current	V_{OUT}=0V	1,04	1,30	1,56	A

Inputs: USB_DP, USB_DN (LS or FS)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DI}	Differential input sensitivity	Differential receiver	0.2	-	-	V
V_{CM}	Common mode voltage	Differential receiver	0.8	-	2.5	V
V_{IL}	Low-level input voltage	Single ended receiver	-	-	0.8	V
V_{IH}	High-level input voltage	Single ended receiver	2	-	-	V

Outputs: USB_DP, USB_DN (LS or FS)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{OL}	Low-level output voltage		-	-	0.3	V
V_{OH}	High-level output voltage		3	-	3.3	V

Inputs: USB_DP, USB_DN (HS)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DI}	Differential input sensitivity	Differential receiver	0.175	-	-	V
V_{CM}	Common mode voltage	Differential receiver		0		V
V_{IL}	Low-level input voltage	Single ended receiver	-0,01	0	0,01	V
V_{IH}	High-level input voltage	Single ended receiver (After transition)	0,15	0,4	0,475 0,525	V

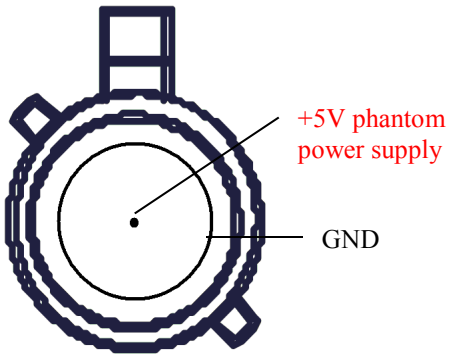
Outputs: USB_DP, USB_DN (HS)

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{OL}	Low-level output voltage		-0,01	0	0,01	V
V_{OH}	High-level output voltage		0,36	0,4	0,44	V

The USB PHY is an USB2.0 compatible PHY integrated on-chip. See Chapter 7 in the USB Specification Rev. 2.0

5.34 GPS antenna interface

The SMEG is connected to an active GPS antenna through a FAKRA connector code C (blue).
The 5V supply of the antenna is assumed by the SMEG.

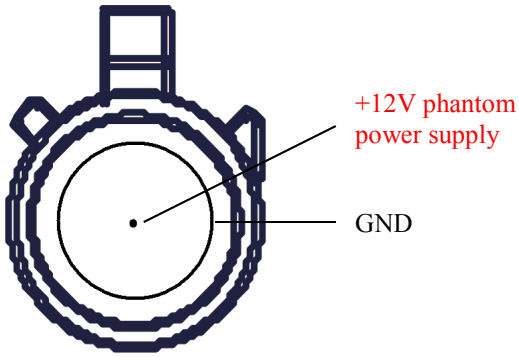


SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zin	Input impedance			50		Ω
Vout	Voltage output	Iout≤50mA	4.5	-	5.1	V
Ish	Short-circuit current detection		60	65	-	mA
Iop	Open-load current detection		-	13	15	mA
f	Central frequency			1575.42		MHz
G_{FE}	Front end gain suggested $G_{FE}=G_{LNA}$-cable loss		24	27	30	dB

5.35 Radio interface

AM/FM1 antenna interface

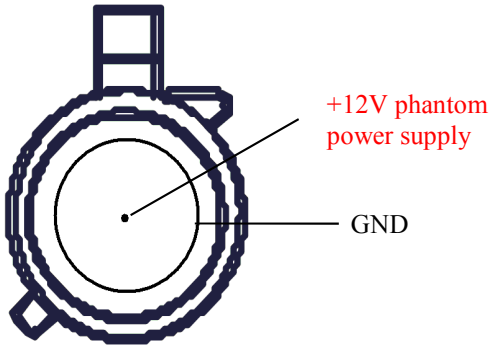
The SMEG is connected to a passive or active AM/FM1 antenna through a FAKRA connector code B (cream white). The choice passive/active is done par diagnostic configuration.



SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zin	Input impedance			50		Ω
f_{R_AM}	AM reception frequency		0.1	-	1.65	MHz
f_{R_FM}	FM reception frequency		70	-	120	MHz
Vout	Voltage output	9.5V ≤ VBAT ≤ 16V;Iout=100mA	8.2	-	16	V
Ish	Short-circuit current detection	Phantom power supply activated	190	-	-	mA
Iop	Open-load current detection	Phantom power supply activated	-	-	17	mA
Iout	Normal load output current	Phantom power supply activated	28	-	101	mA

FM2 antenna interface

The SMEG is connected to a passive or active FM2 antenna through a FAKRA connector code G (grey). The choice passive/active is done par diagnostic configuration.



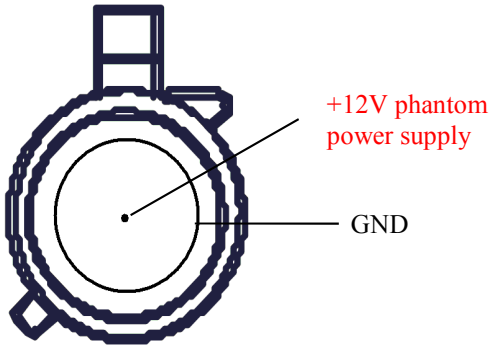
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zin	Input impedance			50		Ω
f_{R_FM}	FM reception frequency		70	-	120	MHz
Vout	Voltage output	9.5V ≤ VBAT ≤ 16V;Iout=100mA	8.2	-	16	V
Ish	Short-circuit current detection	Phantom power supply activated	190	-	-	mA
Iop	Open-load current detection	Phantom power supply activated	-	-	17	mA
Iout	Normal load output current	Phantom power supply activated	28	-	101	mA

Radio receiver characteristics

Measurements conditions according to IEC 60315 norms.
Values correspond to the HF level on tuner input.

DAB antenna interface

The SMEG is connected to an active DAB antenna through a FAKRA connector code (Orange). The choice passive/active is done par diagnostic configuration. The option DAB is available only on version B2 and D2.



SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zin	Input impedance			50		Ω
f_{R_III}	Bande III reception frequency		174.928	-	239.2	MHz
f_{R_L}	Bande L reception frequency		1452.96	-	1490.624	MHz
Vout	Voltage output	9.5V ≤ VBAT ≤ 16V;Iout=100mA	8.2	-	16	V
Ish	Short-circuit current detection	Phantom power supply activated	190	-	-	mA
Iop	Open-load current detection	Phantom power supply activated	-	-	17	mA
Iout	Normal load output current	Phantom power supply activated	28	-	101	mA

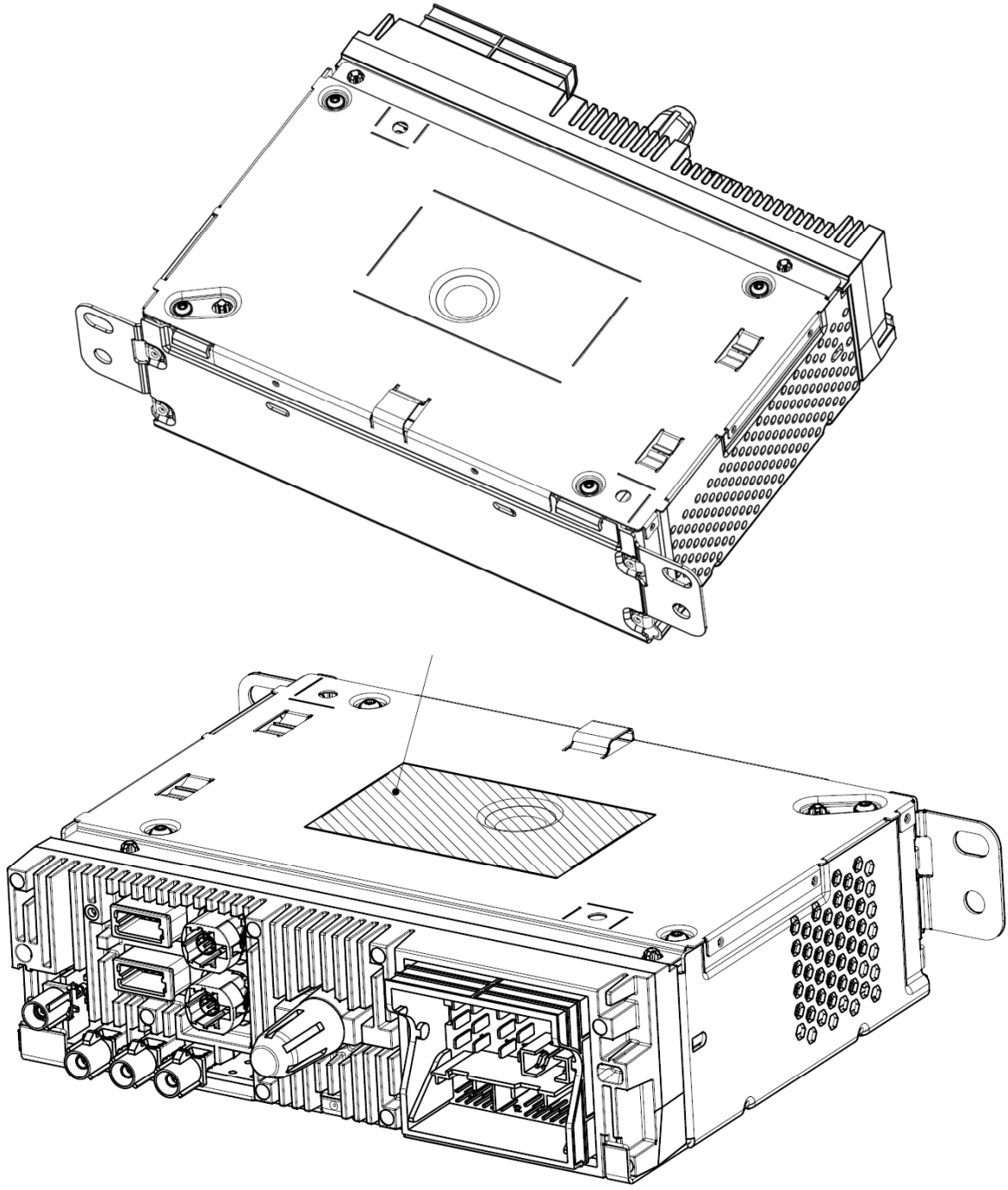
Radio receiver characteristics

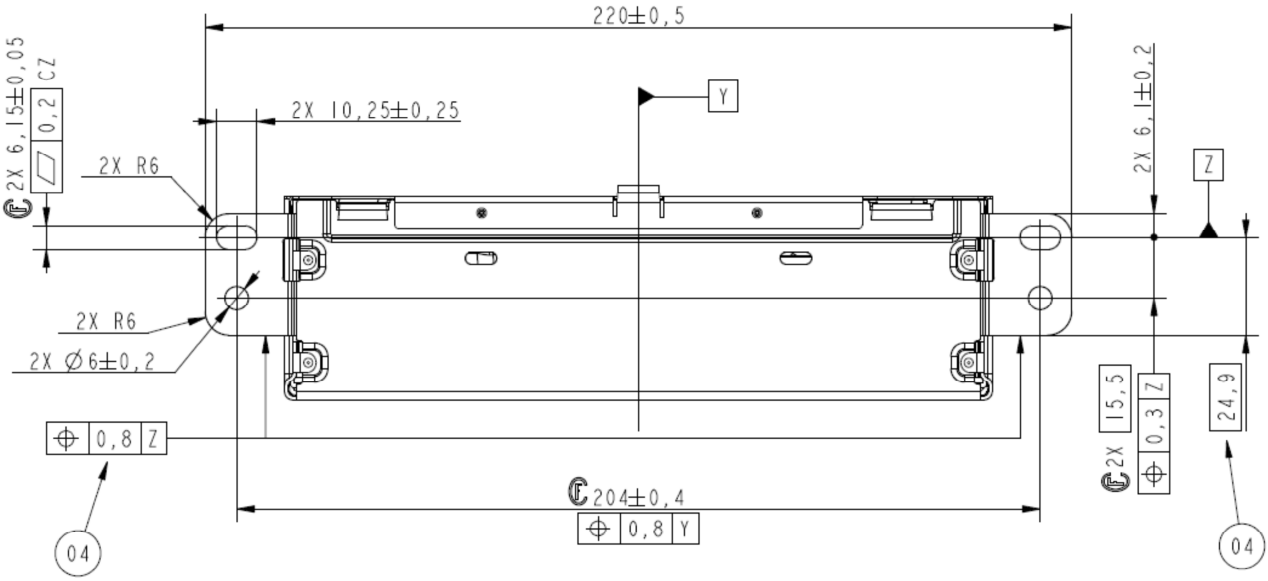
Measurements conditions according to IEC 60315 norms.
Values correspond to the HF level on tuner input.

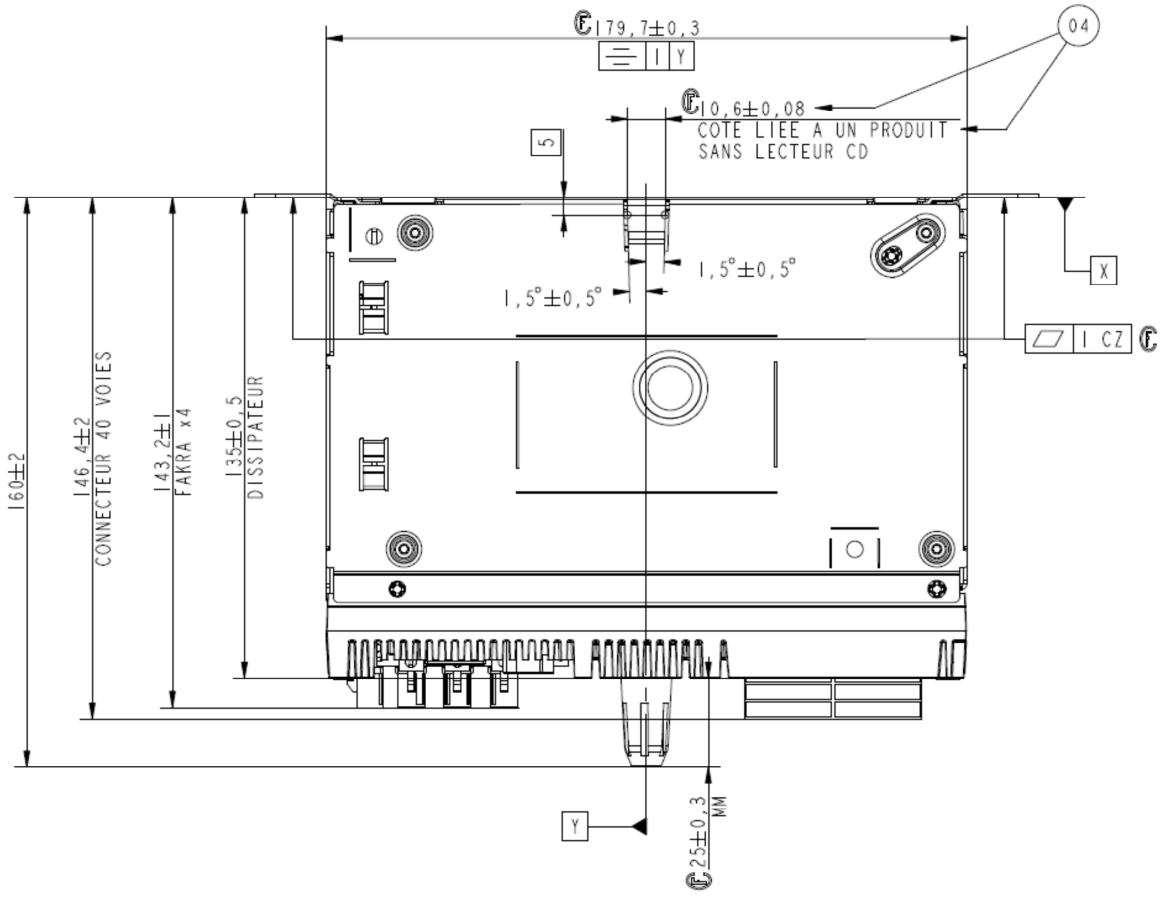
PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Sensitivity limited by the noise in FM	S/N = 26dB Phase diversity activated	-	-	0	dBµV
Sensitivity limited by the noise in LW	S/N = 26dB	-	-	28	dBµV
Sensitivity limited by the noise in MW	S/N = 26dB	-	-	22	dBµV
RDS sensitivity on phase diversity tuners	PS decoding in less than 10sec Phase diversity activated	-	-	18	dBµV
RDS sensitivity on TMC tuner	PS decoding in less than 10sec	-	-	18	dBµV
DAB band III sensitivity limited by the noise	BER ≤ 10^-4	-	-	-90	dBmV
DAB band L sensitivity limited by the noise	BER ≤ 10^-4	-	-	-90	dBµV

For others characteristics, please refer to the document: 01255_09_01264_GEN_ST_Recepteur_Radio V18.doc

9 Mechanical dimensions







10 Weight

The weight of the SMEG is 900g maximum. The exact weight depends on MTB option.

11 Installation and use angle

	MIN.	MAX.
Horizontal position - Front to Back orientation (y axis)	-5° (Installation) -15° (Slope)	+45 (Installation) +15° (Slope)
Horizontal position – Left to Right orientation	-5°	+5°