Doc.-Name:	**Technical Specification AMLCD-065-NB-WVGA-EC-SH_new_TP**
Author:	**Juergen Baethis, Steffen Immel**
Doc.-No.:	**40454881**

Technical Specification

AMLCD-065-NB-WVGA-EC-SH

Active Matrix LCD Module
6.5" / NB / WVGA
Incl. Resistive Type Touchpanel
Glass/Glass Technology
Circular Polarizer

Supplier: SONY Deutschland GmbH

Module Type: L5F30818P05 / A2C00080200

Supplier	Date / Signature	**CONTINENTAL**	Date / Signature
Print Name Nagamisa Ono	15. 02. 2011	Print Name Steffen Immel	2011-03-22 i.A. S. Immel

Version history

Document version	Previous version	Change description (including number)
AA		See history in document

		Date	Department
Designed by:	steffen.immel@continental-corporation.com	2010-10-12	I IC RD G HW D1
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Continental	Designation AMLCD-065-NB-WVGA-EC-SH_new_TP	Status DR
	Documentkey 40454881	Pages 1 of 41
Continental Automotive GmbH		A4 : 2002-07

Continental technical spec ("40454881 AMLCD-065-NB-WVGA-EC-SH_new_TP" dated 2010-10-12)					SMD	Note
1	Page	General charactristics				
1.1	5	Luminance w/o touchpanel (Min.)		570	delete	SMD would like to delete the parameter w/o touchpanel.
1.3	7	Absolute maximum rating	data signal voltage	Max: +4.0	Max: VCC+0.3	
2		Mechanical charateristics				
2.4.4	12	Protection Foils		-	SMD would like to use an unmarked foil, when it is covering front side only.	It is possibility for electrical parts to damage when covering film of backside because of static electricity.
2.4.7	13	FPC Shielding and Glueing		-	Electrical parts and IC is mounted on FPC, FPC can not be attached by shield paste.	-
3		Optical characteristics				
3	14	Luminance over viewing angle range	θ 90& θ 270 (up & down)	Remarks: Cpk>1.0	Remarks: SMD defines the minimum value under the condition of Cpk>1.0 that is calculated from measurement value by intepolation.	SMD would like to same with RNS-8inch, and add Remarks.
3	14	Contrast ratio vs. temperature	TA=60°C	MAX 15	MAX 40 Remarks: Cpk>1.0	SMD would like to same with RNS-8inch, and add Remarks.
			TA=80°C	MAX 40	MAX 50 Remarks: Cpk>1.0	
3	15	Color homogeneity	perpendicular	MAX 0.004	delete	SMD would like to delete from specification.
			viewing angle range	MAX 0.01 Remarks: Not applicable for VW RNS proj.	delete	
3	15	Surface reflection w/o touchpanel		TYP 4.0 MAX 4.5	delete	SMD would like to delete from specification.
3	15	Backlight reflector sheet Type, supplier		TSUJIDEN RF195E2	TORAY E-6SR	-
		Transmissivity		5 without Remarks	5 Remarks: Only for reference	SMD would like to add remarks as same as RNS-8inch.
		Reflectance		95 without Remarks	95 Remarks: Only for reference	SMD would like to add remarks as same as RNS-8inch.
4		Electrical Interface(panel)				
4.2	21	Display Driver			delete	SMD would like to delete from specification.
4.2.1	21	Block Diagram		The supplier has to provide a block diagram to illustrate the electronic functionality.	delete	SMD would like to delete from specifcation.
4.2.2	21	Characteristics		The supplier has to provide specification and information about the electronic devices integrated on grass.	delete	SMD would like to delete from specification.
5		Electrical characteristics				
5.2	23	Application circuit		The supplier has to provide: - schematic of the electronic components (on glass, on FPC, on PCB)	delete	SMD would like to delete from specification.
5.2.1	23	Supply voltage	Supply voltage	Min. 3.0 Typ. 3.3 Max. 3.6	delete	Voltage of VCC is defined in 5.1.
			Continuous current (Max.)	TBD	delete	Current of VCC is defined in 5.1.
			peak current(Max.)	TBD	delete	It is difficult to define to receive the influence of customer system.
5.4.3	29	LED backlight life time		-	LED chip (Reference data)	SMD would like to specify life time only LED chip.
7		Appendix				
7.5	41	Display module Drawing		40454882_DRW_00_0_AA_P079252-11-00_Outline.pdf	P081130-11-01.Outline.pdf	Change of backlight and metal frame based on PCN No. CQ-10032 is added to this new drawing.
		Others				
-		Handling		-	Please do not bend FPC terminal area and stiffener edge, because there is a possibility that the wiring for FPC is disconnected.	-

2011-03-22
i.A. S. Immel
Steffen Immel

4. Mar. 2011 Nagamasa Ono

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ACHTUNG
HANDHABUNGSVORSCHRIFTEN
BEACHTEN
ELEKTROSTATISCH
EMPFINDLICHE BAUTEILE

ATTENTION
CONTENTS STATIC SENSITIVE
HANDLING PRECAUTIONS
REQUIRED

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	Designation	Status
Continental	AMLCD-065-NB-WVGA-EC-SH_new_TP	DR
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CONTENTS

I. History

Version	*Modification*	*Chapter*	*Date*	*Name*
AA	First Draft : Bases on: 40411065_SPE_000_AC_AMLCD-065-NB-WVGA-EC-SH.doc (2010-07-15) Changes acc. to SONY VA (2010-08-03)	- 1st page 1.3 2.3.1 4.1.1 5.2.2 7.5	2010-11-12	S.Immel

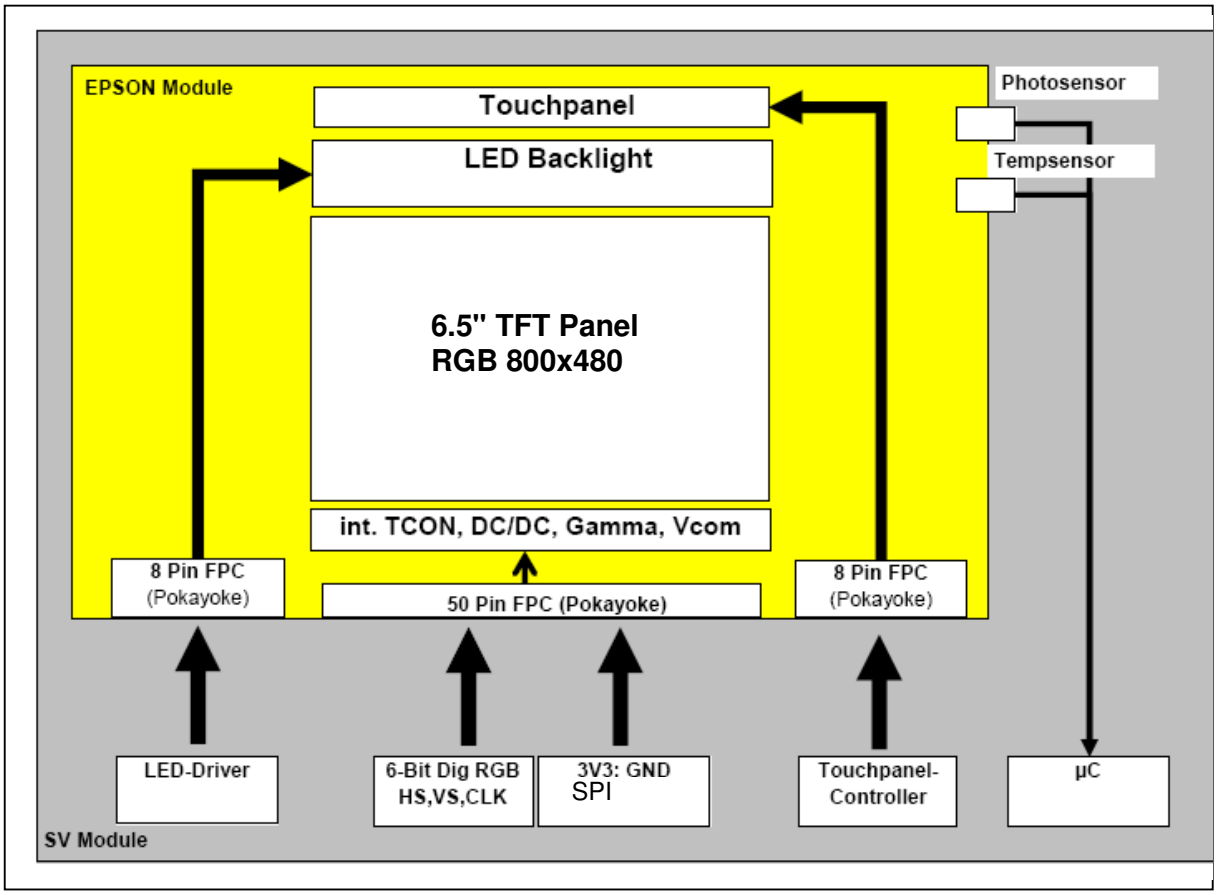
1 General characteristics

1.1 Features

Parameter	*Specification*	*Units*	*Remarks*
Scope	TFT panel with: - connection foil and connector - system electronic on glass - backlight & housing - Touchpanel (Resistive type, glass/glass incl. circular polarizer)		Timing controller, DC/DC, VCOM and gamma circuit has to be integrated on glass. Touchpanel to be assembled by Display module supplier
Display technology	Full color, transmissive, normally black, a-Si TFT active matrix, super-wide view COG drivers		IPS or MVA technology
Screen size (Diagonal)	6.5	inch	diagonal
Aspect ratio	15 : 9	-	
Active area	144.0 x 78.24	mm	horizontal x vertical
Display resolution	800 x 480	dots	horizontal x vertical
Dot configuration	RGB stripes	-	Note **1.1**
Dot pitch	0.18 x 0.0163	mm	horizontal x vertical
Gray-scale inversion direction	No gray-scale inversion allowed		
Polarization axis	Readable with polarized sunglasses		
Luminance incl. touchpanel	380	cd/m²	min., perpendicular (T_A=+25°C)
Luminance w/o touchpanel	570	cd/m²	min., perpendicular (T_A=+25°C)
Contrast ratio	500:1		min., perpendicular (T_A=+25°C)
Input Video Signal	digital RGB 18bpp		for recommended timing controller
Front surface treatment	Anti-Glare AG		
Light source	wLED		
Operating temperature	-40 ... +85	°C	Panel surface
Storage temperature	-40 ... +90	°C	
Outline dimension	159.9 (W) x 93.4 (H) x 13.8 (D)	mm	(D)except FPC & Touchpanel
Weight	240	g	max.

Note 1.1: Pixel configuration like existing 6.5" module

1.2 Block diagram



The shown block diagram gives an overview of the requested TFT panel (marked yellow) and it's application circuit.
Backlight and display have to be packaged with housing (metal housing is required).

1.3 Absolute maximum ratings

Parameter		Symbol	Extreme Ratings		Unit	Remarks
			Min.	Max.		
data signal voltage		Note 1.2	-0.2	+4.0	V	Data signals for timing controller
Logic supply voltage	+3,3V	VCC	-0.2	+4.2	V	Supply voltage supply for timing controller, gate driver, source driver
Operating temperature	on panel surface	Top	-40	85	℃	Note 1.3
	ambient temperature	TA	-40	85	℃	
Storage temperature	ambient temperature	TSTG	-40	90	℃	Note 1.4

Note 1.2 digital RGB Interface: CLK, R0~5, G0~5, B0~5, HSYNC, VSYNC

Note 1.3 Operating temperature between -40℃ to -31℃ does not require the full optical performance of the LCD, but no damage of the display function will occur.
The supplier has to define restrictions and limitations in the optical performance.

Note 1.4 500h at 90℃ -> only 30% of contrast loss is allowed

1.4 Extended Operating Area (@Ambient Temperature)

Temperature Range [℃]	Consequence
-30 to –40	Remarkably slow response time Lower contrast ratio Color shift No irreversible damages allowed
+85 to +95	Slow degradation of performance. Blocking Point: Polarizer Possibility to reach clearing point of liquid crystal (reversible process)

1.5 Touchpanel

The module is delivered as a display module including an assembled touchpanel.
For the touchpanel, the following specification is valid:

Touchpanel Type/Supplier	*Specification Name*	*Version / Date*	*Remark*
TP065-RGGCP	40450753	See Reference 7	

The referred document is valid for all touchpanel issues. The quality requirements of the display including touchpanel are defined in this module specification only.

1.5.1 Touchpanel Assembly

The touchpanel will be assembled within the display submodule production process. The assembly will be done under clean-room conditions.
The outgoing inspection will be done after the assembly of the touchpanel.

The gluing between the metal frame of the display and the touchpanel will be done with a double-sided adhesive elastic cushion tape (fully surrounding O-Ring, to seal the module against moisture and dust). A proposal for the tape type has to be given by Epson in discussion with touchpanel supplier. Final tape type will be released by CONTINENTAL.

Tape Type	*Supplier*	*Thickness*	*Remark*
PORON H-48	Rogers Inoac Corporation	0.5 mm	
5000NS	Nitto Denko	2 x 0,16 mm	

Total nominal thickness of layer between touchpanel and display is 0,82 mm.

2 Mechanical Characteristics

2.1 Dimensions

In case of any discrepancies between the information given in this specification and the mechanical drawing, the mechanical drawing has higher priority.

Parameter	*Symbol*	*Value*	*Unit*	*Remark*
Overall Dimensions	L H T	159.90 93.40 13.80	mm mm mm	Please always also refer to the mechanical drawing. Tolerances are given in the mech. drawing
Center of Active Area	L_{MAA} H_{MAA}	77.70 44.40	mm mm	Reference is upper left edge
Active Area Dimension	L_{AA} H_{AA}	144.00 78.24	mm mm	
Pixel Pitch		0.18 x 0.163	mm	
Subpixel Pitch		0.06 x 0.163	mm	
Subpixel Size		0.04 x 0.143	mm	
Subpixel Configuration		RGB stripe		
Interconnection		COG		

2.2 Mechanical Drawing

For the mechanical drawing (display module with assembled touchpanel), please refer to *Reference 10.*

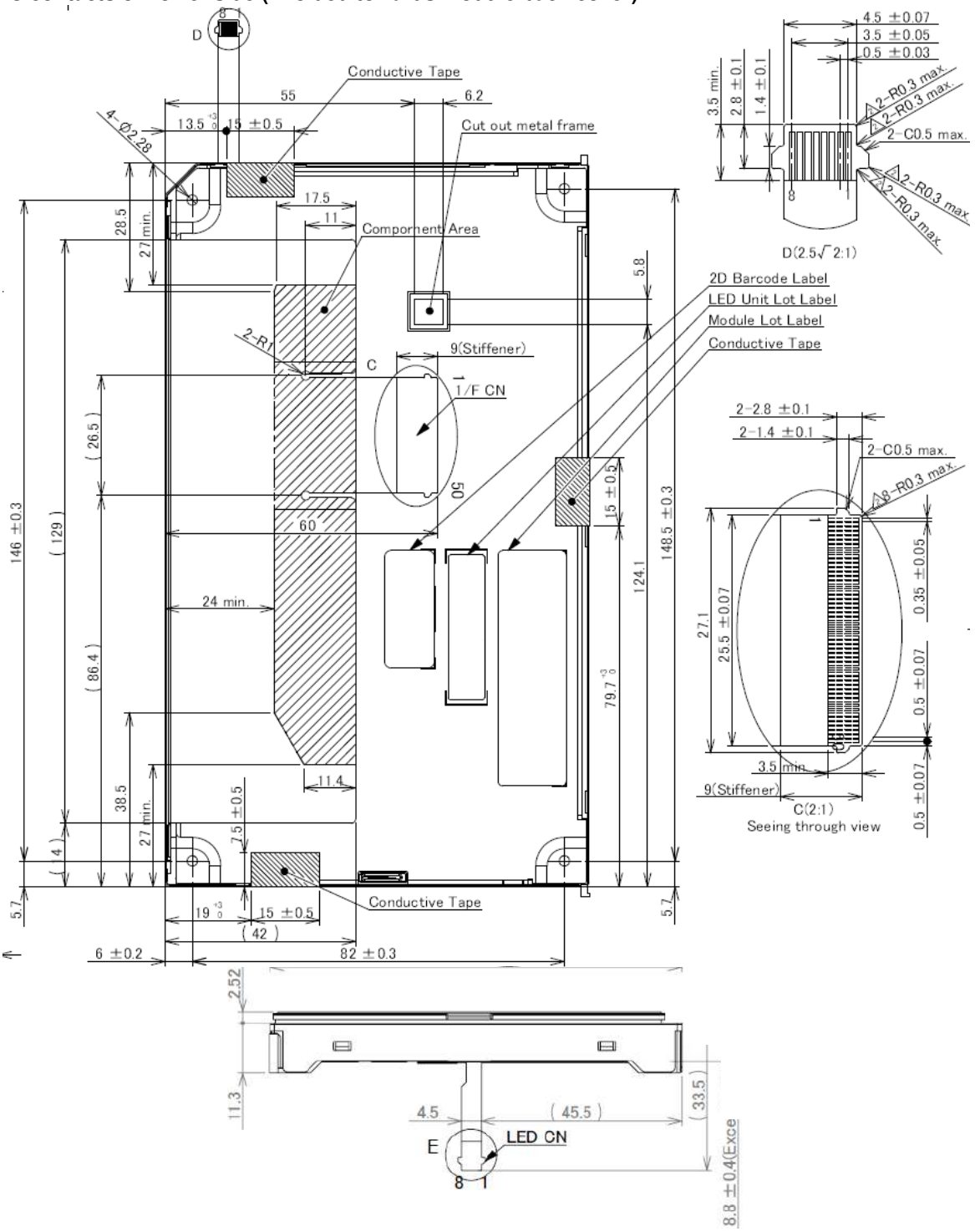
2.3 Connectors

For the connection between the submodule and the CONTINENTAL front module, one foil will be used. The foil for the RGB Input will have 50 pins, Pin pitch has to be 0.5 mm. (*see Reference 12*)
Connectors 1 and 2 and 3 include a Pokayoke feature to guarantee a safe connection between connector and FPC. FPCs stiffeners have to be designed / selected in that way, that sufficient stability of the FPC ending is given. Production handling test at CONTINENTAL has to be done before release of FPC design.

Connection	*Name*	*Comment*	*Pins*	*Interconnection to*
Dig RGB, HSYNC,VSYNC, PCLK,3V3,GND	CN1	AVX / 6288, au-plating	50	Display Module to Front PCB
Chain1 (A/K) to Chain4 (A/K)	CN2	AVX / 6288, au-plating	8	LED-B/L to Font PCB
Touchcontroller	CN3	AVX / 6288, au-plating	8	TP to Front PCB

2.3.1 FPC pinning

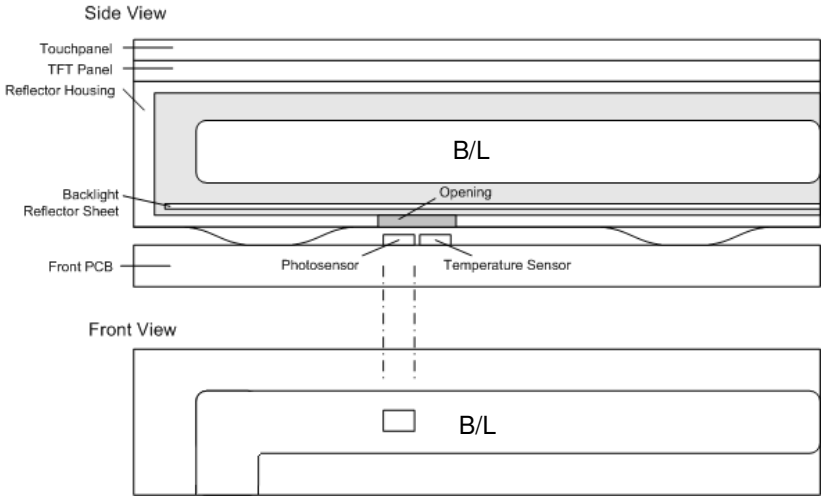
For easier orientation concerning FPC pinning, a schematical drawing of the display module is given here.
FPC contacts on lower side (if folded towards module back cover)



2.4 Other Mechanical Features

2.4.1 Preparation for Photosensor

The lightguide has to be ready for the integration of a photosensor. It will be mounted directly on the front PCB. The following mechanical sketch drawing shows the principle. The photosensor will be located directly under the Backlight. Please refer to the mechanical drawing for the detailed location of the holes.

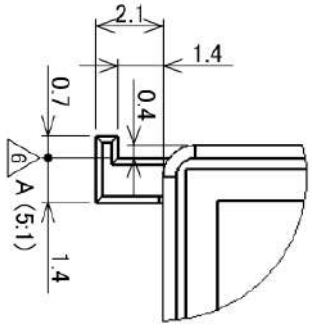


2.4.2 Preparation for Temperature Sensor

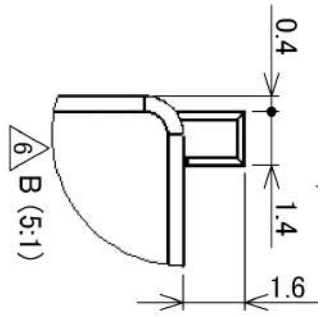
The lightguide has to be ready for the integration of a temperature sensor to measure the temperature of the photosensor and of the Backlight. Therefore, the temperature sensor will be placed directly besides the photosensor. The sensor will be mounted directly on the front PCB.
For the position of the sensor holes, please refer to the mechanical drawing.

2.4.3 Definition of mechanical referencing

The display and touchpanel unit is referenced to the front unit by plastic pins. Two pins are defined for the referencing in vertical direction and one additional pin is defined for the referencing in horizontal direction. For further information refer to the drawing.



Upper left corner (front view)
plastic referencing pin for vertical and horizontal direction



Upper right corner (front view)
plastic referencing pin for vertical direction

2.4.4 Protection Foils

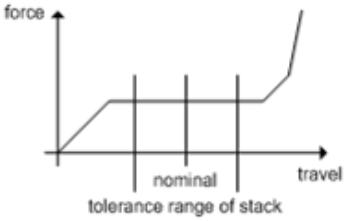
EID protection foil is used. The protection foil has to have printed markings. With this measure, the risk of forgotten protection foils on the unit, shall be avoided.
Adding a Pull-Of-Strip is required for this module.

As a second option, an unmarked foil without pull-off strip can be used, when it is covering front side and backside of the module.

Also if the protection foil is bigger then the module outline dimension, pull off stripe and marking is not required.

2.4.5 Mounting method for application

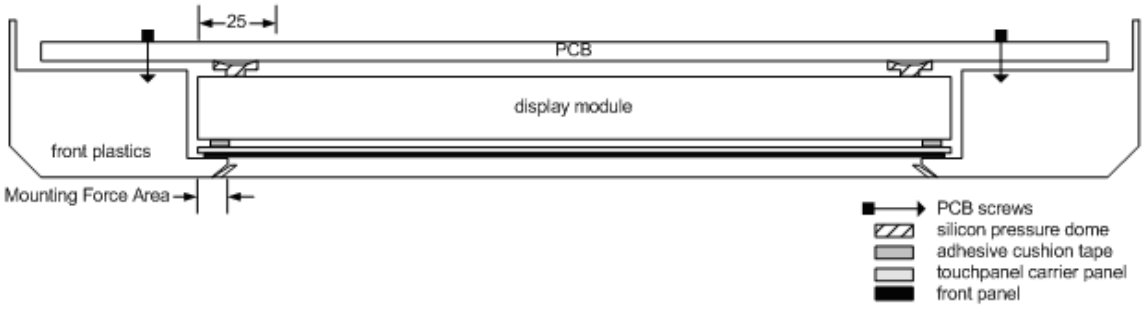
The display will be mounted into the front unit by the use of silicon pressure domes, which have a linear force/travel characteristics over some distance (refer to drawing below). This travel distance is enough to cover the complete tolerance range of the construction. Therefore, the mounting force can be controlled very accurate, independently from the thickness tolerance of the display.



Same force for whole tolerance range

The goal is to hold the display with a force, in the same range as the specified misuse force of 50N (tbd.). If the module is pushed with this misuse force, it will move backwards a little bit to tell the user, that he is doing something, which might hurt the module.

The following drawing defines the concept:



The touchpanel supplier confirms, that the position, where the pressure is applied, is no problem. If a plane front plastics cannot be guaranteed, the supplier recommends the usage of a cushion material to improve the equal distribution of the mounting force and to avoid glass cracking or breakage.
The specified mounting force has to be confirmed after tests of the C-samples.
The mounting force defines the total force, which can be applied to the backside of the display-touchpanel unit. This force is applied by several silicon pressure domes. The number of the domes and the force for each dome are defined below.

Parameter	*Symbol*	*MIN*	*TYP*	*MAX*	*Unit*	*Remark*
Mounting Force Area			outside of 79,7 x 42,02		mm	referenced to center of active area
Number of domes			2 x 6			6 on each edge
Force per dome			5		N	2 x 30 N = 60 N = total mounting force

2.4.6 Reinforcement tapes

Three reinforcement tapes are used, for the following reasons:

- Improvement of mechanical connection between front part / touchpanel and back part of display
- Minimize slices between front and backpart of display in order to improve ESD performance
- Better connection between the different metal parts of the display housing

Positioning of the tapes can be found in the mechanical drawing.

2.4.7 FPC shielding and gluing

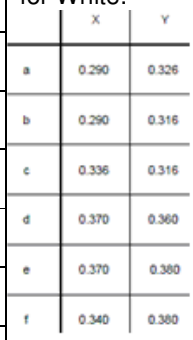
The main FPC (and optionally also the LED FPC) has to be shielded with a second layer (additional ground layer), which is connected to GND.
EMC performance of display and application will be improved by this.
The main FPC is additionally glued with double-sided adhesive tape to the display housing in order to simplify the application assembly.

2.4.8 Light leakage on module backside

Light leakage on module backside is not allowed.
Appropriate measures (design of the back cover) have to be implemented.
For specific positions (like LED FPC Area) a limited light leakage could be acceptable but needs to be approved by customer.

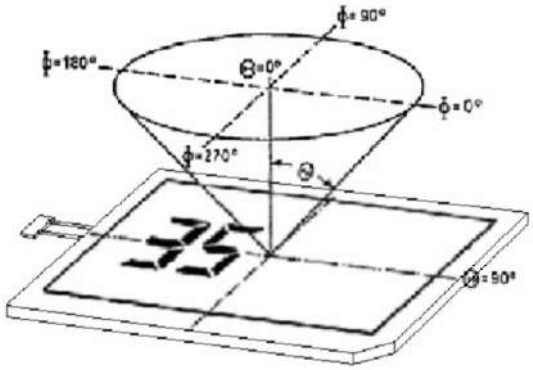
3 Optical characteristics

Parameter		Symbol	Conditions	MIN	TYP	MAX	Unit	Remarks
Contrast over viewing angle range		θ_0&θ_{180} (right&left)	min CR ≥ 100:1	70	80	-	°	Note 3.3
		θ_{90}&θ_{270} (up&down)	min CR ≥ 100:1	70	80	-	°	
		θ_{45}&θ_{135} (upper right&left)	min CR ≥ 100:1	30	40	-	°	Cpk >1.0
		θ_{315}&θ_{225} (lower right&left)	min CR ≥ 100:1	30	40	-	°	Cpk >1.0 Note 3.3
Luminance over viewing angle range		θ_0&θ_{180} (right&left)	min L ≥ 50% of perpendicular	40	45	-	°	Cpk >1.0
		θ_{90}&θ_{270} (up&down)	min L ≥ 50% of perpendicular	29	35	-	°	
Contrast ratio		CR	perpendicular	500	700	-	-	
Contrast over viewing angle range (illuminated)		θ_0&θ_{180} (right&left)	min CR ≥ 3:1	n.a.	-	-	°	Note 3.3 / 3.9
		θ_{90}&θ_{270} (up&down)	min CR ≥ 3:1	n.a.			°	
Contrast ratio vs. temperature		ΔCR	T_A = -30℃ perpendicular	-	-	15	%	Note 3.6
		ΔCR	T_A = -10℃ perpendicular	-	-	10	%	
		ΔCR	T_A = 60℃ perpendicular	-	-	15	%	
		ΔCR	T_A = 80℃ perpendicular	-	-	40	%	
Response time White ⇔ Black	Rise	t_R	T_P = 25℃ perpendicular	-	(tr+tf) 30	(tr+tf) 40	ms	
	Fall	t_F		-			ms	
	Rise	t_R	T_P = 0℃ perpendicular	-	-	(tr+tf) 100	ms	
	Fall	t_F		-	-		ms	
	Rise	t_R	T_P = -20℃ perpendicular	-	-	(tr+tf) 300	ms	
	Fall	t_F		-	-		ms	
	Rise	t_R	T_P = -30℃ perpendicular	-	-	(tr+tf) 1000	ms	
	Fall	t_F		-	-		ms	

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit	Remarks
Luminance incl. touchpanel	L	$T_A = 25°C$	380	550	-	cd/m²	LED If=80mA
Luminance w/o touchpanel	L	$T_A = 25°C$	570	800	-	cd/m²	Only for reference
Luminance homogeneity incl. TP	U	max brightness	75	80	-	%	Note 3.4
White chromaticity	x	max brightness	see remark	0.330	see remark	-	Tolerance Range for White: 
	y	max brightness	see remark	0.340	see remark	-	
Red chromaticity	x	max brightness	0.580	0.615	0.650	-	
	y	max brightness	0.325	0.346	0.367	-	
Green chromaticity	x	max brightness	0.298	0.332	0.366	-	
	y	max brightness	0.520	0.566	0.612	-	
Blue chromaticity	x	max brightness	0.138	0.163	0.188	-	
	y	max brightness	0.057	0.095	0.133	-	
Colour homogeneity	Δu'v'	perpendicular	-	-	0.004		Note 3.5
Colour homogeneity	Δu'v'	viewing angle range	-	-	0.01		Note 3.3 Not applicable for VWRNS proj.
Surface reflection incl. touchpanel	-		-	-	6.5	%	
Surface reflection w/o touchpanel	-		-	4.0	4.5	%	
Surface polarizer type, supplier Touchpanel				AG			Dye Type / Polatechno SH44ZK3-45U
Surface polarizer type, supplier Display				HC			Supplier, type-no. tbd
Touchpanel Surface polarizer angle		Φ		0		°	For max. absorption
LCD panel transmissivity				4,5		%	Only for reference
Backlight reflector sheet Type, supplier			TSUJIDEN RF195E2				Note 3.10
Transmissivity				5.0		%	
Reflectance				95.0		%	
Gamma	-	max brightness	1,8	2.2	2.6	-	Cpk >1.33

	X	Y
a	0.290	0.326
b	0.290	0.316
c	0.336	0.316
d	0.370	0.360
e	0.370	0.380
f	0.340	0.380

Note 3.3 Definition of viewing angle range



Θ = inclination angle from the display normal
Φ = counter-clockwise angle in the display surface plane

The viewing angle range defines all possible viewing angles when display is used in CONTINENTAL application.
Within this range the luminance and contrast should have a smooth characteristic.
No contrast inversion is allowed in this range.

Note 3.4 Luminance homogeneity
Measuring procedure according chapter 3.7 (luminance homogeneity in GQAS based on VESA standard)

Note 3.5 Colour homogeneity
Measuring procedure according chapter 3.7 (luminance homogeneity in GQAS based on VESA standard). Δu'v' has to be evaluated based on CIE-1976

Note 3.6 Contrast ratio vs. temperature
ΔCR defines the allowed contrast reduction at the defined temperature based on the CR at room temperature.
For example: ΔCR = (CR@25°C – CR@-30°C) / CR@25°C x 100%

Note 3.9 Contrast (illuminated) – Direct sunlight Exposure Simulation (tbd.)

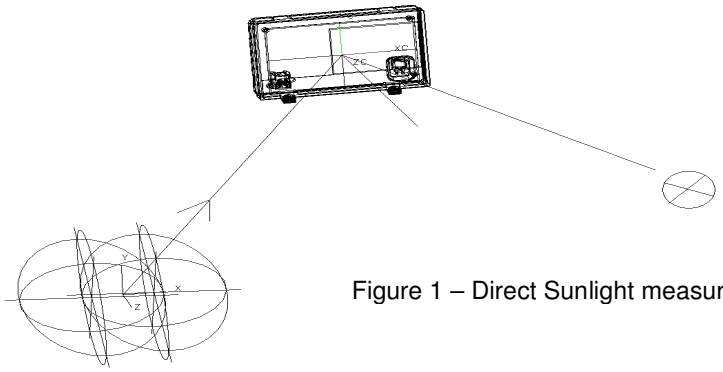


Figure 1 – Direct Sunlight measurement condition

The contrast ratio of the display has to be evaluated according SAE J1757-1 (Real Life / In Car Measurements Using High Ambient Light Illumination Simulation). The display has to meet minimum contrast ratio requirements under direct sunlight. The measurement position is defined by the critical viewing angle.
The illuminance (caused by the light source) measured on the display surface covered for adjustment with a standard reflective diffuser should be 45 klx.

The position for the measurement equipment is:

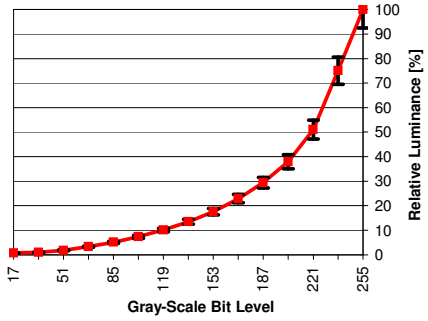
	Sun Position		Occupant Position	
	α [degrees] (horizontal)	β [degrees] (vertical)	α [degrees] (horizontal)	β [degrees] (vertical)
case 1	0	45	0	0
case 2	+/-45	0	+/- 30	0
case 3	+/- 5°	+/- 5°	+/- 30	0
case 4	+/- 65	+/- 15	+/- 30	+/-15

Note 3.10 Backlight reflector sheet

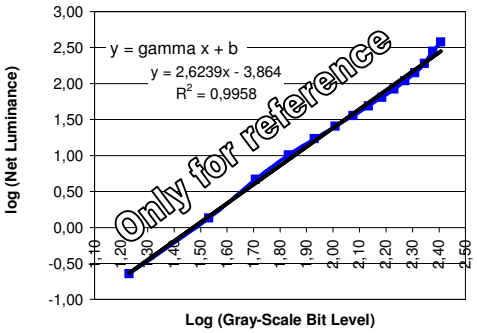
Relevant information for external light and temp. sensor design on application PCB.

Note 3.11 Transfer function Electrical/Optical “Gamma”

Gamma is the exponent in an exponential relation between the electrical input and the optical output of the imaging system.



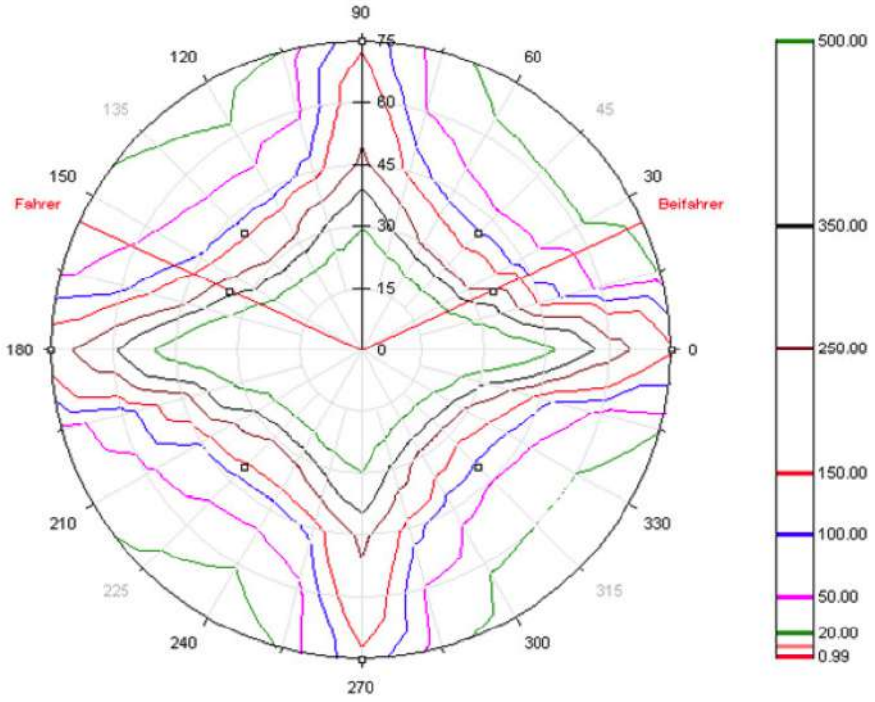
Tolerance range of the lower 15 data points = +-7.5%
Data points are relative to the 100% absolute value.



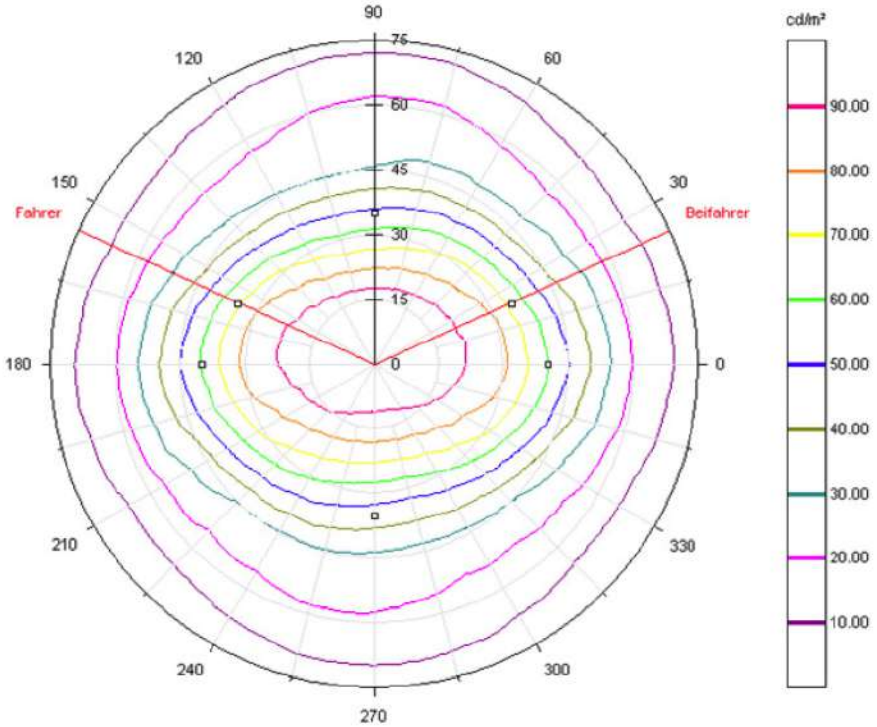
Net Luminance: Black Level (L0 = 0) corrected Luminance
The slope of the straight line is equal to the exponent gamma.

The production tolerances of the TFT module concerning the electrical / optical characteristic curve shall be smaller than +/- 7.5%, as mentioned in the above diagram.

3.1 Iso-contrast diagram



3.2 Iso-Luminance distribution



4 Electrical interface (panel)

4.1 Interface

The supplier has to specify the functional description of board to board connector terminals (signal name, signal functional description, timing chart, input level threshold, …)

4.1.1 CN1 Main Connector

The supplier has to specify the pin numbers, timing controller input signals and the number of ground pins needed in addition. The supplier has to define the pin assignment together with CONTINENTAL.

Pin No.	*Symbol*	*Description*	*Remarks*
1	GND_SHIELD	Ground	
2	GND_DISPLAY	Ground	
3	R(0)	Display Data (Red)	(LSB)
4	R(1)	Display Data (Red)	
5	R(2)	Display Data (Red)	
6	R(3)	Display Data (Red)	
7	R(4)	Display Data (Red)	
8	R(5)	Display Data (Red)	(MSB)
9	GND_DISPLAY	Ground	
10	GND_SHIELD	Ground	
11	GND_DISPLAY	Ground	
12	G(0)	Display Data (Green)	(LSB)
13	G(1)	Display Data (Green)	
14	G(2)	Display Data (Green)	
15	G(3)	Display Data (Green)	
16	G(4)	Display Data (Green)	
17	G(5)	Display Data (Green)	(MSB)
18	GND_DISPLAY	Ground	
19	GND_SHIELD	Ground	
20	GND_DISPLAY	Ground	
21	B(0)	Display Data (Blue)	(LSB)
22	B(1)	Display Data (Blue)	
23	B(2)	Display Data (Blue)	
24	B(3)	Display Data (Blue)	
25	B(4)	Display Data (Blue)	
26	B(5)	Display Data (Blue)	(MSB)
27	GND_DISPLAY	Ground	
28	GND_SHIELD	Ground	
29	GND_DISPLAY	Ground	

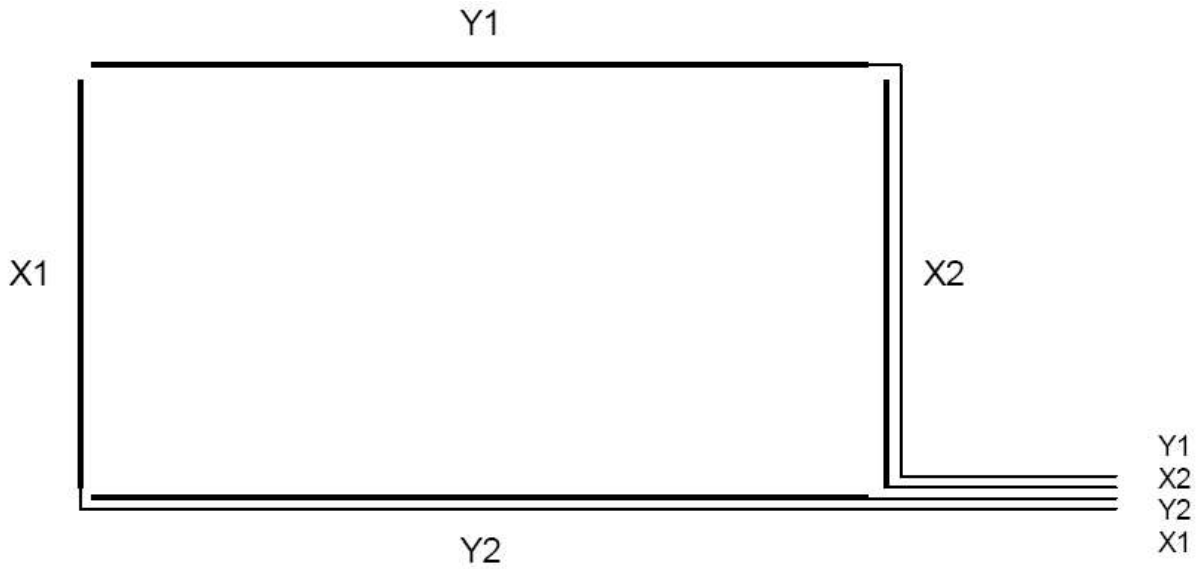
Pin No.	Symbol	Description	Remarks
30	GND_DISPLAY	Ground	
31	PCLOCK	Clock for display data	
32	GND_DISPLAY	Ground	
33	GND_DISPLAY	Ground	
34	VSYNC	Vertical synchrounous signal	
35	GND_DISPLAY	Ground	
36	GND_SHIELD	Ground	
37	GND_DISPLAY	Ground	
38	HSYNC	Horizontal synchronous signal	
39	GND_DISPLAY	Ground	
40	3V3	Power supply	
41	3V3	Power supply	
42	GND_3V3	Ground	
43	GND_3V3	Ground	
44	n_shutdown	Reset	
45	GND_SHIELD	Ground	
46	*SPI (XCS)*	Chip select for serial data	
47	*SPI (SCL.)*	Serial clock	
48	*SPI (SDIN)*	Serial data	
49	*SPI (SDOUT)*	Serial data	
50	*GND_SHIELD*	Ground	

4.1.2 CN2 LED Connector

Pin No.	Symbol	Description	Remarks
1	Anode Chain 1		
2	Cathode Chain1		
3	Anode Chain 2		
4	Cathode Chain 2		
5	Anode Chain 3		
6	Cathode Chain 3		
7	Anode Chain 4		
8	Cathode Chain 4		

4.1.3 CN3 Touchpanel Connector

Symbol	*PIN*	*I/O*	*Description*	*Remark*
Y1	1	I/O	top wire of the touchpanel	
Y1	2	I/O	top wire of the touchpanel	
X2	3	I/O	right wire of the touchpanel	
X2	4	I/O	right wire of the touchpanel	
Y2	5	I/O	bottom wire of the touchpanel	
Y2	6	I/O	bottom wire of the touchpanel	
X1	7	I/O	left wire of the touchpanel	
X1	8	I/O	left wire of the touchpanel	



4.2 Display driver

4.2.1 Block diagram

The supplier has to provide a block diagram to illustrate the electronic functionality.

4.2.2 Characteristics

The supplier has to provide specification and information about the electronic devices integrated on glass.

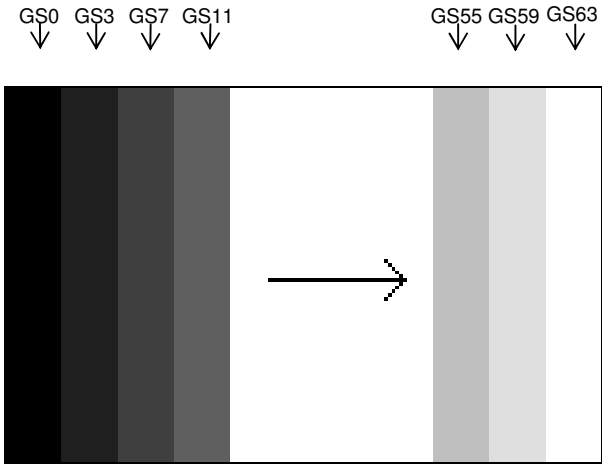
5 Electrical characteristics (incl. application circuit)

5.1 Recommended operating conditions (application circuit)

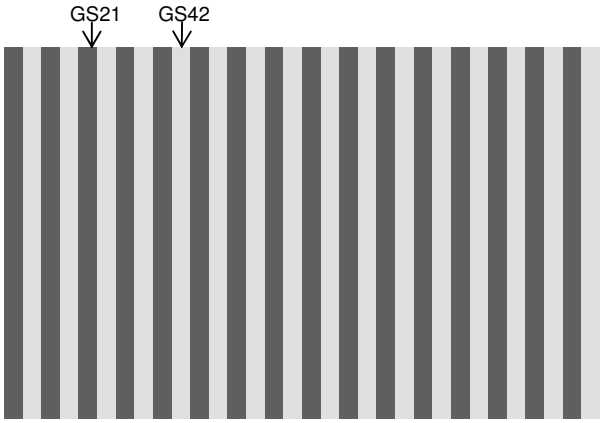
Parameter		Symbol	Min.	Typ.	Max.	Unit	Remarks
Signal (TTL)	high	V_{IH}	3.0	3.3	3.6	V	Note 5.1
		I_{IH}	-	1.0	-	µA	
	low	V_{IL}	0	0.3	0.6	V	
		I_{IL}	-	1.0	-	µA	
Power supply	+3,3V	Vsup	+3,0	+3,3	+3,6	V	Note 5.2
		Isup	-	-	160	mA	
permissive input ripple		V_{RF}	-	-	200	mV_{PP}	

Note 5.1 V_{CC} = 3.3V; signals: CLK, R0~5, G0~5, B0~5, Hsync, Vsync

Note 5.2 Typical current situation: 16-gray-bar pattern; at recommended operating timing conditions



Max current situation: Vertical stripe pattern alternating 21 gray scale (GS21) with 42 gray scale (GS42) every 1 dot; at recommended operating timing conditions



5.2 Application circuit

The supplier has to provide:

- schematic of the electronic components (on glass, on FPC, on PCB)
- application notes
- specification of the required components (drivers, TCON, Gamma, DC/DC, VCOM)

5.2.1 Supply voltage

Parameter		Symbol	Extreme Ratings			Unit	Remarks
			Min.	Typ.	Max.		
Supply voltage		VCC	3.0	3.3	3.6	V	Note 5.3
Continuous current	Digital supply continuous current	I_Vcc	-	-	tbd	mA	
Peak current	Digital supply peak current	I_Vcc_peak	-	-	tbd	mA	

Note 5.3 interface to gate and source drivers, typical values and permissive input ripple have to be defined by display supplier if not integrated on glass

Specification of needed power up and power down sequencing

5.2.2 Timing

A timing change (e.g. to reproduce a 50Hz and 60Hz image source) has to be possible during the vertical black period without a flickering.

Vertical timing of RGB interface

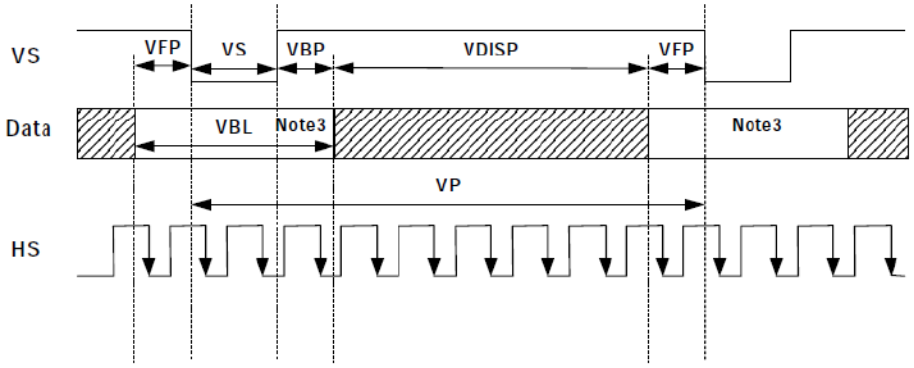


Figure 9: Vertical timing diagram of RGB interface

Table 5: Vertical timing of RGB interface in Normal mode.

Ta = -40 - +85 °C, VDD = 3.0 – 3.6 V, VSS = 0 V

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical cycle	VP		525	525	525	Line
Vertical low pulse width	VS		2	2	2	Line
Vertical front porch	VFP		13	13	13	Line
Vertical back porch	VBP		30	30	30	Line
Vertical data start point		VS+VBP	32	32	32	Line
Vertical blanking period	VBL	VFP+VS+VBP	45	45	45	Line
Vertical active area	VDISP		480	480	480	Line
Refresh rate	VRR		54	60	63	Hz

Note1: Signal rise and fall times are equal or less than 5 ns.

Note 2: Logic high and low levels of input signals are specified as 0.3 x VDDI for low state and 0.7 x VDDI for high state.

Note 3: Data lines can be high or low during blanking time.

6.1.4 Horizontal timing of RGB interface

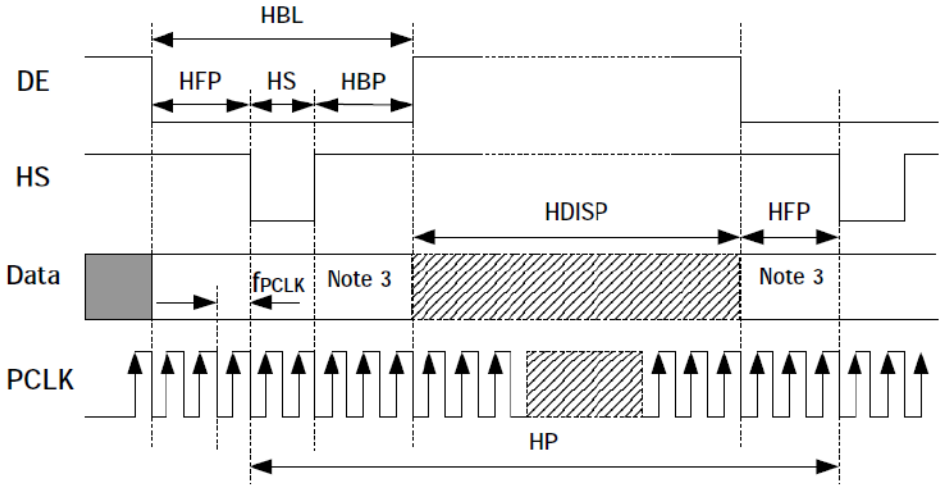


Figure 10: Horizontal timing diagram of RGB interface.

Table 6: Horizontal timing of RGB interface in Normal mode.

Ta = -40 - +85 °C, VDD = 3.0 – 3.6 V, VSS = 0 V

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Horizontal cycle	HP	Note 3	1048	1048	1048	dot
Horizontal low pulse width	HS		13	13	13	dot
Horizontal back porch	HBP		203	203	203	dot
Horizontal front porch	HFP		32	32	32	dot
Horizontal data start point		HS+HBP	216	216	216	dot
Horizontal blanking period	HBL	HFP+HS+HBP	248	248	248	dot
Horizontal active area	HDISP		800	800	800	dot
Pixel clock frequency	f_{PCLK}		28.9	30.3	33.6	ns
when RGB is running	T		29.7	33.0	34.6	MHz

Note1: Signal rise and fall times are equal or less than 5ns.

Note 2: Logic high and low levels of input signals are specified as 0.3 x VDD for low state and 0.7 x VDD for high state.

Note 3: Data lines can be high or low during blanking time.

General timing of RGB interface

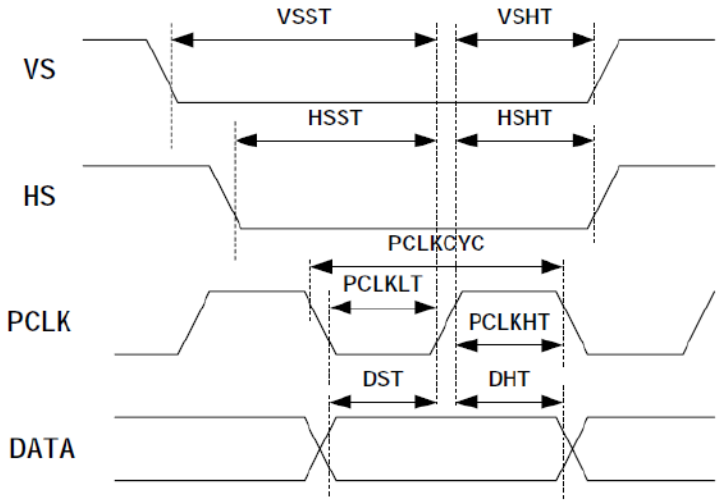


Figure 11: General timing diagram of RGB interface.

Table 7: General timing of RGB interface in Normal mode.

Ta = -40 - +85 °C, VDD = 3.0 – 3.6 V, VSS = 0 V

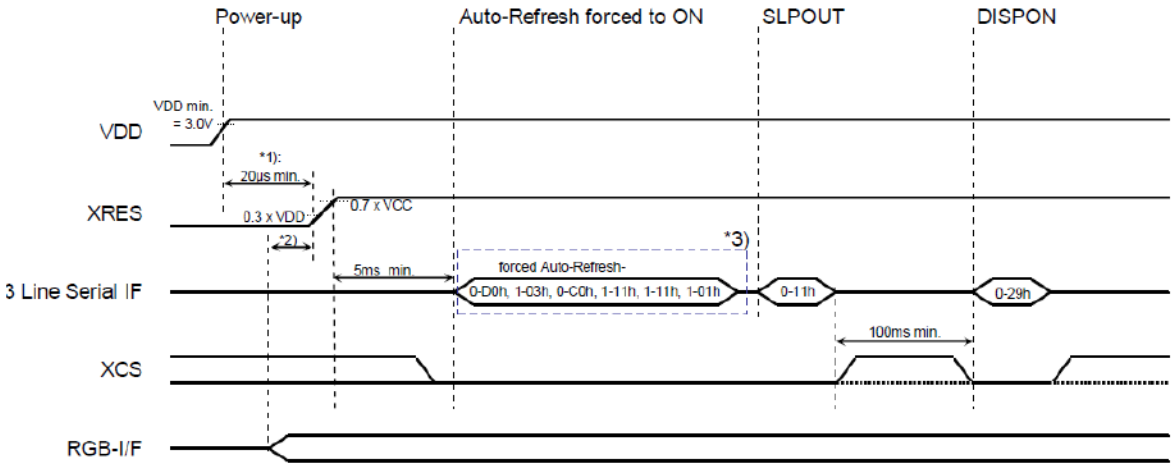
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
VS setup time	VSST		8	-	-	ns
VS hold time	VSHT		8	-	-	ns
HS setup time	HSST		8	-	-	ns
HS hold time	HSHT		8	-	-	ns
Pixel clock cycle when RGB interface is running	PCLKCYC		28.9	30.3	33.6	ns
Pixel clock low time	PCLKLT		12	13	-	ns
Pixel clock high time	PCLKHT		12	13	-	ns
Data setup time	DST		8	-	-	ns
Data hold time	DHT		8	-	-	ns

Note1: Signal rise and fall times are equal or less than 3ns.

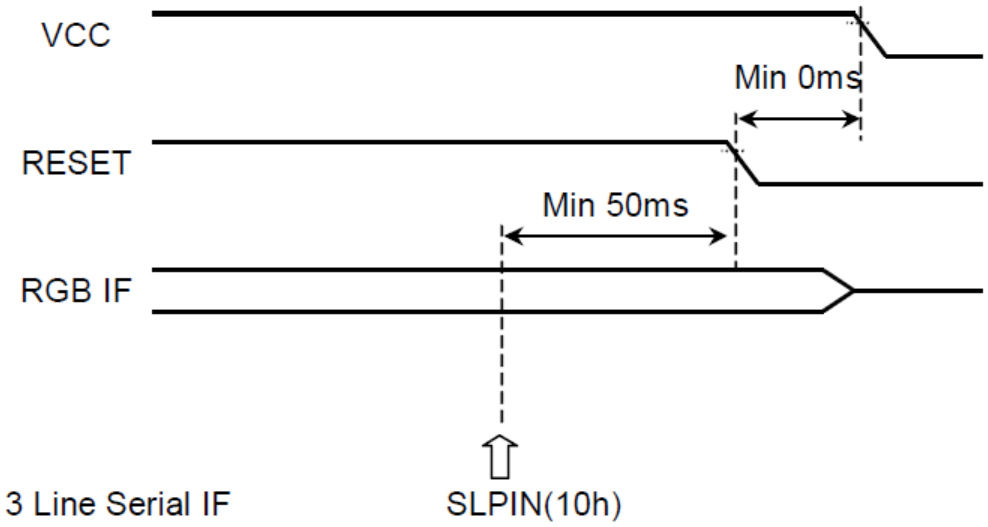
Note 2: Logic high and low levels of input signals are specified as 0.3 x VDD for low state and 0.7 x VDD for high state.

5.2.3 Power On / Off Sequence (over operating temperature range)

Power on sequence



Power off sequence



5.2.4 Input signal – grayscale exposition

	Gray scale		Data signal																	
	Color	Level	R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic color	Black	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	100%	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green	100%	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	100%	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	100%	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	100%	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	
	Yellow	100%	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	100%	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	↓				↓						↓						↓		
	↓	↓				↓						↓						↓		
	brighter	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	↓	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	darker	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	↑	↓				↓						↓						↓		
	↓	↓				↓						↓						↓		
	brighter	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
	↓	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	↑	↓				↓						↓						↓		
	↓	↓				↓						↓						↓		
	brighter	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	↓	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Blue	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Each primary color (red, green & blue) can be graded in 64 gray scales from a 6-bit data signal. In total the 18-bit data signal enables 262144 number of colors (0: low ; 1: high).

5.3 Adjustment

The supplier has to tell which adjustments are stored in the EEPROM (e.g. gamma voltage, VCOM, …)

5.4 LED backlight

5.4.1 Structure

LED supplier Nichia
LED type NSSW123B
Qty. of LEDs 16
Brightness binning: PA 6/7/8

Connector to LED chains anode and cathode of each chain should be lead out separately and not connected together (8 pin Pokayoke connector as described in 4.1.2)

LED type and count have to be selected according to brightness requirement on display surface.

5.4.2 Interface characteristics

Parameter	*Symbol*	*Min.*	*Typ.*	*Max.*	*Unit*	*Remarks*
Number of LED chains	N_L	-	4	-	-	Note 5.7
Voltage per chain	V_L	-	tbd	24	Vrms	T_A=+25℃
Forward Voltage per LED	V_F	tbd	3.1	tbd	V	LED V_F binning
Current per chain	I_L	tbd	tbd	80	mArms	
Power consumption	P_L	-	-	2.0	W	T_A=+25℃
Max. voltage difference between LED chains	ΔV_{LED_chain}			2	V	

Note1: alternating placement of LEDs of each chain

5.4.3 Lifetime

Parameter	*Symbol*	*Min.*	*Typ.*	*Max.*	*Unit*	*Remarks*
life time continuous	-	20000	-	-	hours	TA=+25℃ Note 5.7
life time continuous	-	5000	-	-	hours	T_A=+85℃ Note 5.7

Note 5.7: End-of-life criteria: backlight brightness < 50% of initial brightness (T_A=+25℃)

5.4.4 Luminance derating (t.b.d. EID)

thermal characteristics has to be specified

- maximum brightness as function of ambient temperature
- maximum brightness as function of hour at max. operating temperature

6 Quality Requirements

6.1 General Quality Requirements

The "General Quality Requirements" of CONTINENTAL are defined in the GQA document (*Reference 2*).
This document is already negotiated with the supplier or has to be negotiated with new suppliers.
It is the baseline for this specification.

If there are any discrepancies between the GQA and parts of this module specification, the module specification is valid.

This module specification defines the quality requirements for the whole module, display including touchpanel.
Deviations to the GQAS were discussed, agreed and signed with the display supplier (*Reference 18*).

Also the "General Quality and Approval Standard for Displays – Testing", *Reference 3b* and the "General Quality and Approval Standard for Displays – Production", *Reference 3c* is mandatory for this project.

6.2 Quality and Reliability Requirements

Concerning Quality and Reliability requirements, the "GQAS for LC Displays for Automotive Use" defines the standard requirements for CONTINENTAL (*Reference 3a*).

It defines general test conditions and test plans for optical, mechanical and electrical requirements. Also reliability and EMC issues are covered.

If there are any discrepancies between the GQAS and parts of this module specification, this module specification is valid.

In addition, the "GQAS for PPM-level of LCD/VFD components" (*Reference 4*) defines the quality levels, which have to be reached by the supplier.

6.2.1 Additional Reliability Test Requirements

No.	*Test Items*	*Test Conditions*	*Requirement/Remark*
1.1	Low Temperature Operating	-40℃ / 240 h	
2.1	Ball impact test	acc. to EID test description Weight 0,5kg / 1,0kg / 1,5kg Length 0,43 m	EID test description (*Reference 16*) No scatter of glass or liquid crystal, no splinter of glass.
3.1	Chemical requirements (resistance to chemical agents)	a) Procedure according to VW 80101 Chapter 6 Resistance to • interior cleaner / dashboard spray ($T_{amb.}$ = 70°) • Refreshment containing coffeine and sugar ($T_{amb.}$ = 70°) • commercial glass cleaner($T_{amb.}$=25°) • sweat (acc. to DIN EN ISO 105-E04) has to be guaranteed. No changes, which affect the performance or the appearance of the DUT may occur. 50 ml of the reagent is applied with cotton cloth (30 x 30 cm). Storage time afterwards 48 h. b) Skin creams & cosmetics according to Volkswagen PV 3964 (Surfaces in the Vehicle Interior) • Hand cream: Kamill Classic • Sun cream: Delial Plus, factor 30	Critical part is polarizer.
4.1	ESD Test (FPC contact area)	1500 Ohm, 100 pF (HBM model) 1,5 kV discharge to every pin 3 times discharge to every pin of the fpcs	acc. to MIL STD 883D
5.1	UV Resistance Test	In addition to the GQAS (*Reference 3*) UV Resistance requirements a surface peel test has to be performed with the following conditions: Used tape: "Tesa 4972 or equivalent" for peel test (as alternative of protection foil) Peeling condition : (1). Test position Peeling test may not be performed at the area within 10 mm from the edge but may be performed at center area. (2). tape -attached area : 2cm x 5cm (3). peel speed : It should take more than 2 sec. to peel off the above area	acc. to Epson proposal 9.July 2008

6.3 EMC Requirements

Concerning EMC Requirements, first of all, chapter 5 of the "GQAS for LC Displays for Automotive Use" defines the basic requirements for CONTINENTAL (*Reference 3a*). In addition, the EMC testplan defined in document "Summary of EMC Tests and Requirements for System Modules" (*Reference 6*) is valid for this module.

Finally, also this document includes hints and requirements concerning EMC issues, which are additionally valid.

If there are any discrepancies between chapter 5 of the GQAS, the EMC testplan and this module specification, first of all, the module specification and the EMC testplan are valid. Parts, which are not covered by these two documents, are covered in the GQAS, chapter 5.

The final EMC release is dependent on an in-car-measurement at the customer.

6.4 Pixel Errors, Blemishes, Cosmetic Anomalies Inspection

For Blemishes, Cosmetic Anomalies and any other optical defect – except deviations given in this chapter – please refer to the GQAS for LCDs in Automotive Use (*Reference 3a*).

6.4.1 Pixel Error Specification

Inspection conditions:	(visual inspection)
Viewing distance:	35 cm
Ambient illumination:	100-150 lux
Ambient temperature:	20..25°C
Light source condition:	based on specification
Viewing Angle:	0°
Zone:	Active area

Possible Defects:

a) Bright dot: Dot appears bright in display at black picture position
b) Black dots: Dot appears black in display at white, red, green or blue picture position
c) Scratches on color filter (< 1/2 dot : no count)
d) Scratches on Cr mask (< 50 µm : no count)

Item		***R***	***G***	***B***	***Total***	***Test Pattern***	***Remark***
Dot Defect	Bright Defect	0	0	0	0	Black, R, G, B	no ND filters allowed
	Dark Defect	3	3	3	3	White, R, G, B	
	Total				3		Bright & Black dots
Joined dots	Bright				0	Black, R, G, B	defect of two neighboring dots no ND filters allowed
	Black				0	White, R, G, B	
Line Defect		0				White, Black, Red, Green, Blue	
Cluster Defect		0				White, Black, Red, Green, Blue	defect of three or more neighboring dots

Defect Interval: Minimum distance for two dot defects: 10 mm

6.4.2 Cosmetic criteria

Touch panel and complete module (L5F30817) apply to GQAS Ver.A for cosmetic criteria only.
Dot defect is GQAS Ver. B.
The intermediate module (L5F30817 without touch panel) applies to GQAS Ver.B.

To take the scattering effect of the touchpanel into account, extended judgement criterias are defined, if the failure occurs within the TFT-module, between the polarizer and LCD-cell and within the LCD-cell itself. The deviating cosmetic criteria specification for these defects is given below for circular and linear ones.

The total number of defects is NOT influenced by this.

Item	*Diameter [mm]*	*Judgement*	*Remark*
Circular Defects			
	D <= 0,15		Note 7.1
	D <= 0,10	disregard	Note 7.2, acc. to GQAS
	0,15 < D < 0,20		Note 7.1
	0,10 < D < 0,15	N <= 4	Note 7.2, acc. to GQAS
	0,20 < D < 0,25		Note 7.1
	0,15 < D < 0,20	N <= 2	Note 7.2, acc. to GQAS
	0,25 < D		Note 7.1
	0,20 < D	not allowed	Note 7.2, acc. to GQAS
Linear Defects			
	W < 0,015		Note 7.1
L <= 3	W < 0,015	disregard	Note 7.2, acc. to GQAS
	0,015 < W < 0,065		Note 7.1
L <= 3	0,015 < W < 0,05	N <= 6	Note 7.2, acc. to GQAS
	0,065 < W		Note 7.1
L <= 3	0,05 < W	not allowed	Note 7.2, acc. to GQAS
L > 3		not allowed	

Note 7.1 valid for defects within TFT-module, between polarizer and LCD-cell and within LCD-cell
Note 7.2 valid for all defects, which are not mentioned in note 7.1

TP Glass chipped

In deviation to the GQAS (chapter 1.1.1, page 4), the following description is valid:

GQAS	*Component Spec*
(a) At contact surfaces: >25% of contact : not allowed	(a) At contact surfaces: >25% of contact : not allowed
(b) Between contact surfaces>40% of contact pad length : not allowed	(b) Between contact surfaces>40% of contact pad length : not allowed
(c) Others : depth>50% of total glass thickness : not allowed	(c) Others : depth>50% of total glass thickness : not allowed
Remarks: -	Remarks: - Within any limitation of a, b and c no limit on number as well as corners - Convexity : Lateral exceeding must be within outer dimensions allowance - Damage of the sealing frame is not allowed.

6.5 Environmental friendly design

The European directive for the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) has to be observed, in particular lead free soldering is required.

7 Appendix

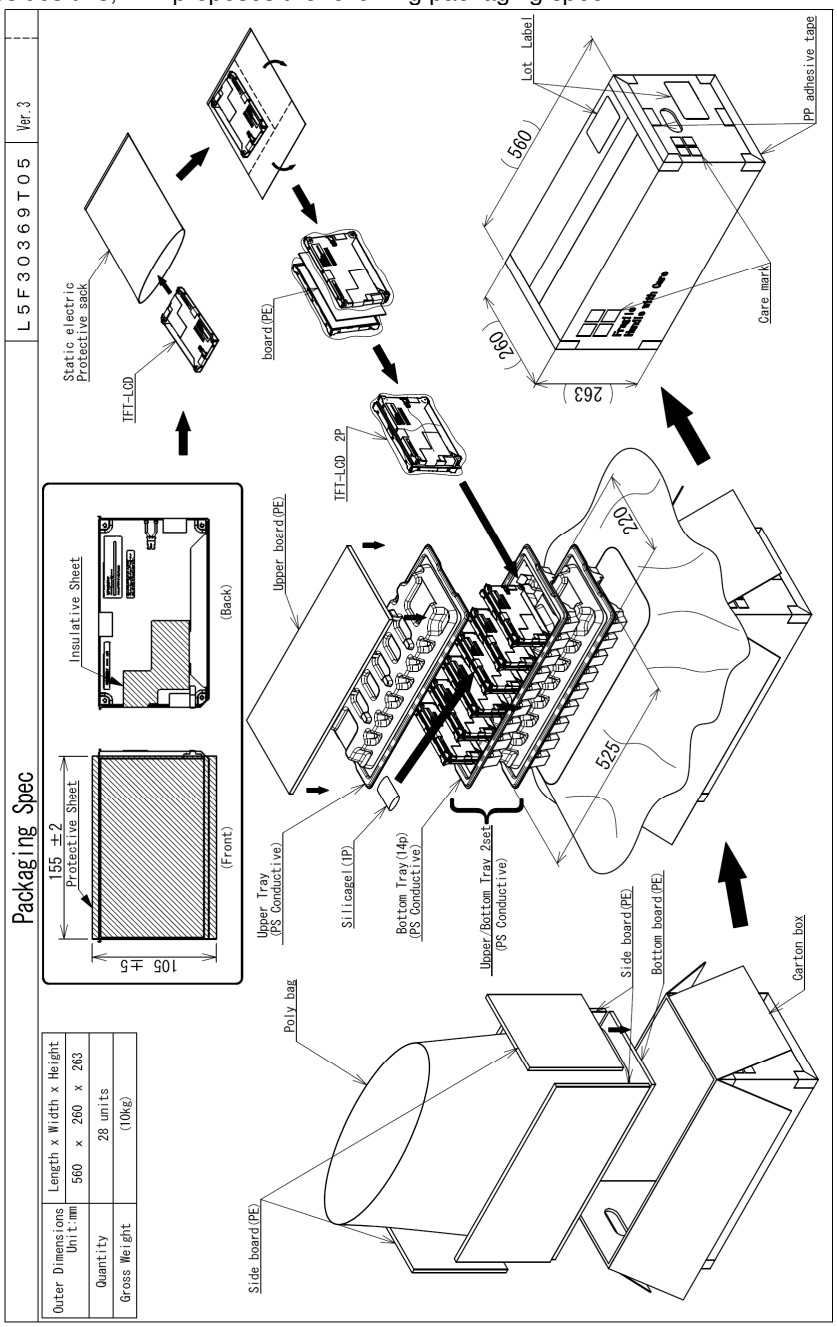
7.1 Sample Definition

Level	*Status*	*Description*	*Remark*
A Sample	Evaluation Sample	evaluation sample Panel Hard Tool, FPC+B/L Soft tool assembled with touchpanel	not required by CONTINENTAL
B Sample	Improved Evaluation Sample final Hardware	improved evaluation sample Panel Hard Tool, FPC+B/L Soft tool	not required by CONTINENTAL
C Sample	Qualified Samples	complete specification is fulfilled all parts by hard tooling qualified parts 100% according to specification	t.b.d.
PPAP Sample		complete specification is fulfilled parts by tooling qualified parts 100% PPAP documentation	t.b.d.

7.2 Packaging and Labeling

7.2.1 Packaging

The product has to be labeled and packed according to the standard CONTINENTAL packaging and labeling requirements. Besides this, EID proposes the following packaging spec.



7.2.2 Barcode

A barcode label has to be applied on the backside of each display.

All labels should be placed on the right half of the display (seen from backside). This is the half, where the CCFL cable is connected.

Barcode Specification:

Parameter	*Description*	*Remark*
Barcode Format	Datamatrix (ECC200) 16 x 16 pixels, numeric, 24 figures	
Barcode Size	7,5 x 7,5 mm	
Edge size (label)	26 x 11 mm	
Quality of Printing	laser printing or thermotransfer printing	
Position of plaintext	at the right side of the label	
Character Size	sufficient readability must be guaranteed	

Barcode Content:
XXXXXXXXCSSSSSSSS

Parameter	*Description*	*Remark*
(A2C)XXXXXXXX	last 8 figures of CONTINENTAL A2C part number	
C	change index (can be used for fully compatible changes to avoid change of part number)	
SSSSSSSS	serial number, 8 figures	

7.3 IMDS Data Handling Procedure

IMDS Note:
- Material Information must be entered and maintained in the International Material Data System (IMDS)
- IMDS input is the supplier's responsibility and is a requirement for every ISIR.
- The IMDS Material Data ID Number is to be declared in the ISIR

7.4 Abbreviations and Definitions

Shorthand	*Description*
AG	Anti glare
AR	Anti reflection
BU I	Business Unit Interior and Infotainment
CIE	International Commission on Illumination
CM	Complete Module
DUT	device under test
EMC	Electromagnetic Compatibility
EMV	= EMC
ESD	Electrostatic Disturbances
FPC	flat printed cable
GQA	General Quality Agreement
GQAS	General Quality & Approval Standard
HLL	high luminance level
IS	Infotainment Solutions
LCD	Liquid Crystal Display
PCB	Printed Circuit Board
PWM	Pulse width modulation
RH	Relative Humidity
RNS	Radio Navigation System
SLL	standard luminance level
SM	Submodule
SPE	specification
t.b.d. or tbd	to be defined
TCP	Tape Carrier Package
TFT	Thin Film Transistor
T_{OB}	upper limit of operating temperature
T_{RT}	room temperature
VESA	Video Electronics Standard Association
VGA	Video Graphics Adapter
WVGA	Wide VGA

7.5 References

Ref	Name	Doc / A2C No	Version or Date	Author
1				
2	General Quality Agreement for Automotive Suppliers	A2C00022907AAA	Latest version	S.Weinlein
3a	General Quality and Approval Standard for LC Displays for Automotive Use	A2C00028201 Vers.C	01.10.2006	R.Specht
3b	General Quality and Approval Standard for Displays - Testing	A2C00044808AAA Vers.A	01.10.2006	R.Specht
3c	General Quality and Approval Standard for Displays - Production	A2C00044807AAA Vers.A	01.10.2006	R.Specht
4	General Quality and Approval Standard for PPM-level of VFD/LCD components	A2C00030465AAA	Latest agreed version	R.Specht, W.Merkl
5	General Quality and Approval Standard for declarable materials	A2C00023889AAA	Latest agreed version	R.Münch
6	EMC approbation of system modules EE summary of EMC tests and requirements	P730006FCDa01	10.09.2007	CONTINENTAL
7	Touchpanel Spec	40450753_SPE_000_AA_TP065_RGGCP_010_complete.pdf	2010-09-17	S.Immel
8	QFN, Qualification requirements for new parts	QFNenglish08.04.20041	08.03.2004	C.Arnao
9	Packaging specification for purchased series parts Europe	SN55228-1	01.05.2004 1a	A.Jung
10	Display Module Drawing	40454882_DRW_000_AA_ P079252-11-00_Outline.pdf	2010-09-21	SONY
11	ARD QV Umwelterprobung	40097508		R.Scherl
12	AVX Connector 6288	AVX_6288_Connector.pdf		AVX