

Component Specification

- LCD panel
- LCD passive-matrix module
- LCD active-matrix assembly

Basic requirements and definitions are described in the general specification

A2C00028201
 P730006F39
 A2C00022907
 A2C00030465
 A2C00023889
 SN 60740
 SN 55228-1
 SN 55228-2

GQAS for LCDs for Automotive use
General Specification of EMC for Automotive Use
General Quality Agreement
GQAS for ppm-Level
GQAS for Declarable Materials
Identification of LC Displays
Packaging specification for purchased series parts – Europe
Requirements on marking of goods and accompanying information for purchased series parts

Additional and alternative requirements are described in this document. In case of differences between these specifications the Component Specification is mandatory.
 In case of differences between Continental Automotive drawing and this Component Specification, the drawing is obligatory.

Supplier's Field: <i>mandatory for the supplier to fill out</i>	
<input type="checkbox"/> accepted with vendor addendum	<input type="checkbox"/> accepted without vendor addendum
Supplier Name Signature (s) by Supplier Date / Name / Position	_____ _____ _____ <i>in printed letters</i>
Ordering code: Marking: Component name: Component family: Manufacturing plant:	_____ _____ _____ _____ _____

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Designed by		Date 2008-07-21	Department RD CD HW
Released by		Date 2012-01-10	Department RD
		Designation Specification for Liquid Crystal Displays for Automotive use 12.3" TFT (digital, transmissive, LED Backlight, TN)	Status
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Changes

Rev.	Modifications	Page	Date	File	Name
AA	Initial Work		2008-09-24		
AB	Update		2008-12-01		
AC	Update Reliability requirements, change LED type		2009-07-27 2009-10-06		
AD	Update		2009-11-16		
AE	40pin Connector type, typ values at 0°C, max. reflection, min Luminance, luminance distribution, vibration test conditions, test conditions for dry heat operating	8, 9, 12, 30, 31	2009-12-02 2009-12-09		
AF	Update requirements solar radiation, black homogeneity, vibration test	9, 30, 31	2010-01-18		
	Update environmental requirements, burn in test	28, 29, 30, 31, 33	2010-02-25		
	Update environmental requirements	30, 31	2010-03-10		
AG	Update requirements grey to grey level, Pin No 26, timing specification, thermistor, limit of damp heat test	9, 10, 15, 17, 22, 31	2012-01-10		

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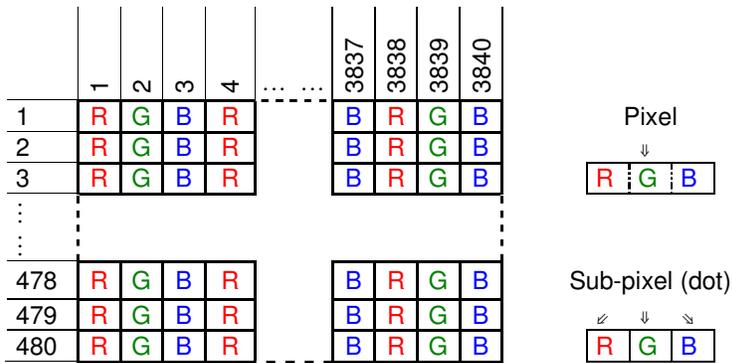
1 General characteristics

1.1 Features

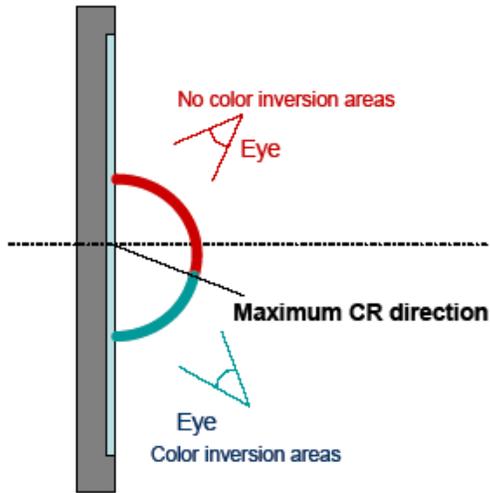
Parameter	Specification	Units	Remarks
Display technology	High Contrast TN full color, transmissive, normally white, a-Si TFT active matrix, COG drivers		
Screen size	12.3	inch	Diagonal
Aspect ratio	8 : 3	-	
Active area	293.76 x 110.16	mm	horizontal x vertical
Display resolution	1280 x RGB x 480	Pixels	horizontal x vertical
Pixel configuration	RGB vertical stripe	-	Note 1-1 Pixel configuration Note 1-1
Dot pitch	0.0765 x 0.2295	mm	horizontal x vertical
Pixel pitch	0.2295 x 0.2295	mm	horizontal x vertical
Gray-scale inversion direction & maximum contrast ratio	6 o'clock		Note 1-2
Luminance	750	cd/m ²	min. perpendicular @+25 °C
Contrast ratio	400:1		min. perpendicular @+25 °C
Input Video Signal	digital RGB		each color 6 bit
Front surface treatment	Anti-glare (AG)		Reflection < 4,5%
Light source	white LED		
Operating temperature	-40 ... +95	°C	Note 1-3
Storage temperature	-40 ... +95	°C	
Outline dimension	320.0(W) x 130.0(H) x 12.94(D)	mm	according Continental drawing
Weight	600	g	Typical

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Note 1-1 Pixel configuration



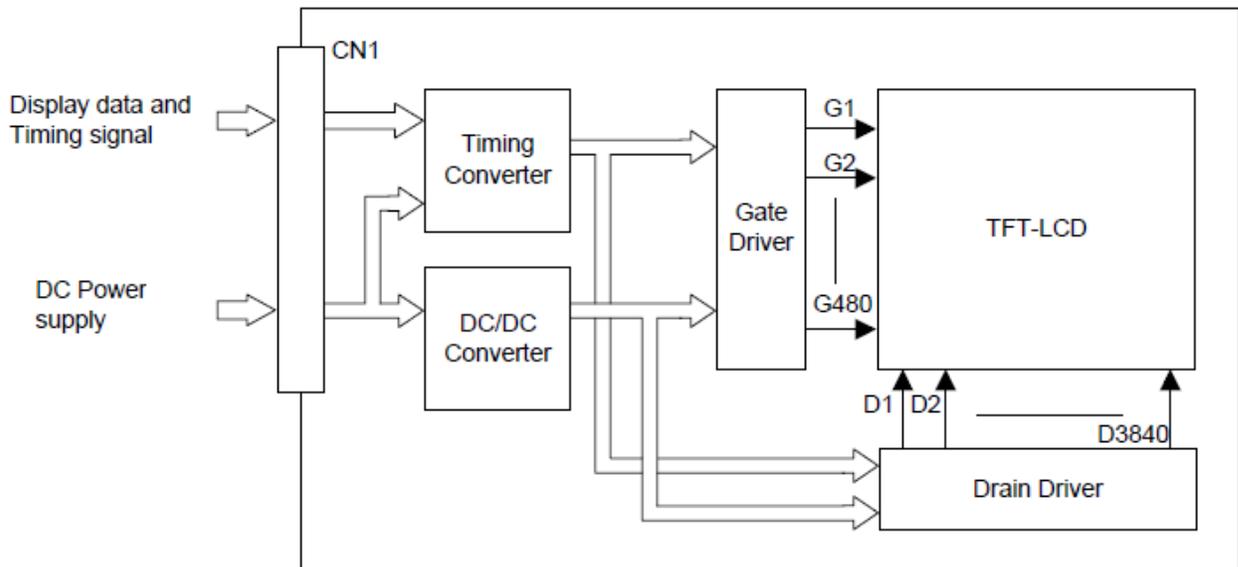
Note 1-2 Maximum contrast direction, color inversion and viewing direction



Note 1-3 Operating temperature range on panel surface

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1.2 Block diagram

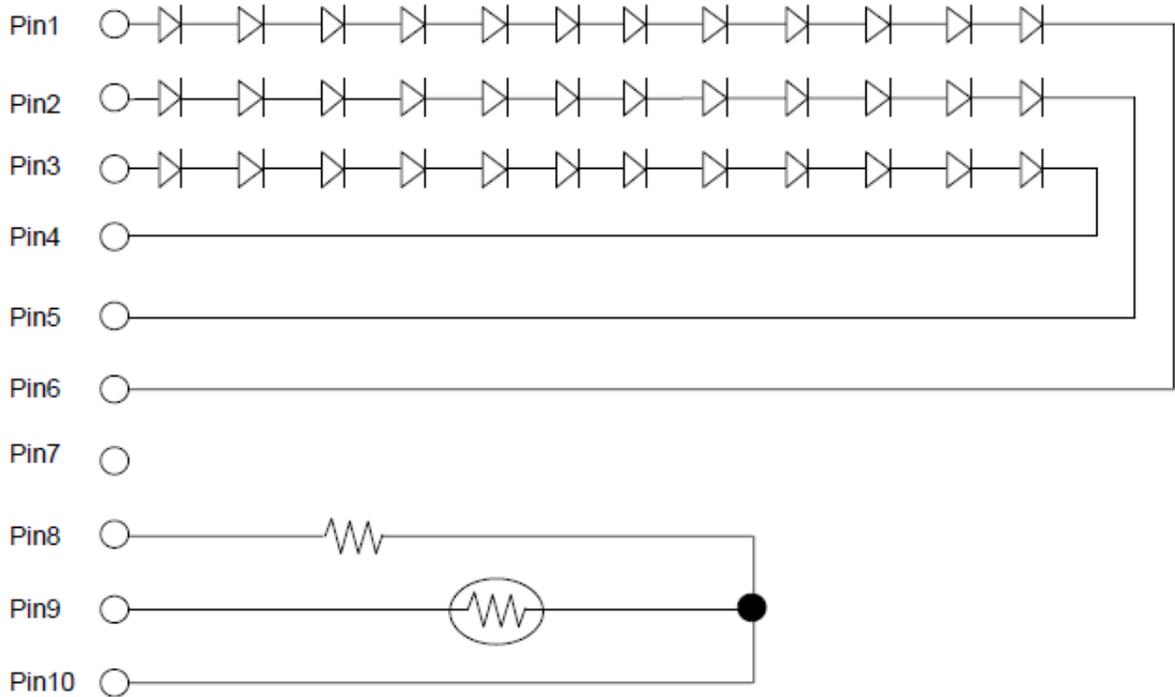


The shown block diagram gives an overview of the requested TFT panel (dotted line) and it's application circuit.

Backlight and display have to be packaged with housing (metal housing is required).

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Backlight Unit



1.3 Absolute maximum ratings

Parameter		Symbol	Extrem Ratings		Unit	Remarks
			Min.	Max.		
Data signal voltage			-0.3	$V_{DD1}+0.3$	V	Note 1-4
Power supply	+3,3V (Logic)	V_{DD1}	-0.3	+4.0	V	
Operating temperature	on panel surface	T_{op}	-40	+95	°C	Note 1-5
	ambient temperature	T_A	-40	+85	°C	Note 1-5
Storage temperature	ambient temperature	T_{STG}	-40	+95	°C	

Note 1-4

digital RGB interface: CLK, R0~5, G0~5, B0~5, ENAB, Reset

Note 1-5

Operating temperature between -40°C to -31°C and +86 to +95°C does not require a correct image on LCD, but no damage of the display function will occur. Optical performance reduced above +85°C.

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1.4 Connectors & LED Flex Cable

Connection	Name	Comment	Pins	Connector Type
Data signals, power supplies and Reset	CN1	FPC / FFC Connector (1.0mm pitch / AU plating)	40	Iriso 9664S-40F-GFN1
LED power supply and temperature sensor	FPC	FPC cable, length 80 mm (1.0mm pitch / AU plating)	10	

1.5 Dimensions

The supplier has to provide a sketch with the following content:

- outline dimension
- active area dimension and position referred to outline
- polarizer dimension and position referred to active area
- position and height of drivers
- position, height and length of foils
- thickness of panel
- recommended mounting zones or areas
- heat sink areas

The tolerances for all dimensions have to be shown.

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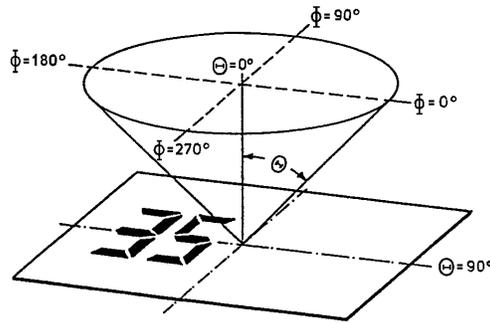
2 Optical characteristics

T_A = 25°C @ white LEDs

Parameter		Symbol	Conditions	MIN	TYP	MAX	Unit	Remarks
Viewing angle Θ		$\Phi_{0^\circ}/\Phi_{180^\circ}$	CR \geq 100	15/15	25/25		°	Note 2-1
		$\Phi_{90^\circ}/\Phi_{270^\circ}$	CR \geq 100	10/10	20/20		°	
Contrast ratio		CR	T _A = 25°C perpendicular	400	800		-	
Contrast ratio against temperature		Δ CR	T _A = -30°C perpendicular		30		%	Note 2-2
		Δ CR	T _A = -20°C perpendicular		15		%	
		Δ CR	T _A = 60°C perpendicular		10		%	
		Δ CR	T _A = 80°C perpendicular		30		%	
Response time Rise: grey x→y Fall: grey y→x	Rise	t _R	T _A = 25°C perpendicular		15	30	ms	Note 2-3
	Fall	t _F			5	20	ms	
	Rise	t _R	T _A = 0°C perpendicular		30	60	ms	
		t _F			10	40	ms	
	Rise	t _R	T _A = -20°C perpendicular		100	150	ms	
		t _F			70	100	ms	
	Rise	t _R	T _A = -30°C perpendicular		300	400	ms	
		t _F			100	250	ms	
Luminance		L	R=G=B=L63 (center)	750	1000	-	cd/m ²	
			R=G=B=L0 (center)			(1.875)	cd/m ²	Based on 750cd/m ² (R=B=L63)
Luminance homogeneity		U	R=G=B=L63 (center)	75	85	-	%	
White chromaticity		x	max brightness	0.26	0.30	0.34	-	
		y	max brightness	0.29	0.33	0.37	-	
Red chromaticity		x	max brightness	0.58	0.61	0.64	-	
		y	max brightness	0.32	0.35	0.38	-	
Green chromaticity		x	max brightness	0.29	0.33	0.37	-	
		y	max brightness	0.56	0.60	0.64	-	
Blue chromaticity		x	max brightness	0.11	0.14	0.17	-	
		y	max brightness	0.07	0.10	0.13	-	
Color gamut of NTSC					59		%	
surface reflection		-			4,5	6	%	Note 2-4
Gamma		-		1.8	2.2	2.6		

Note 2-1 Definition of viewing angle range

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Θ: Angle of between observed position and Normal. ($0^\circ \leq \Theta \leq 90^\circ$)
 Φ: Angle of between observed position and X-axis. ($0^\circ \leq \Phi \leq 360^\circ$)

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.

Note 2-2 Contrast ratio against temperature

ΔCR defines the allowed contrast reduction at the defined temperature based on the CR at room temperature. For example: $\Delta CR = (CR@25^\circ C - CR@-30^\circ C) / CR@25^\circ C \times 100\%$

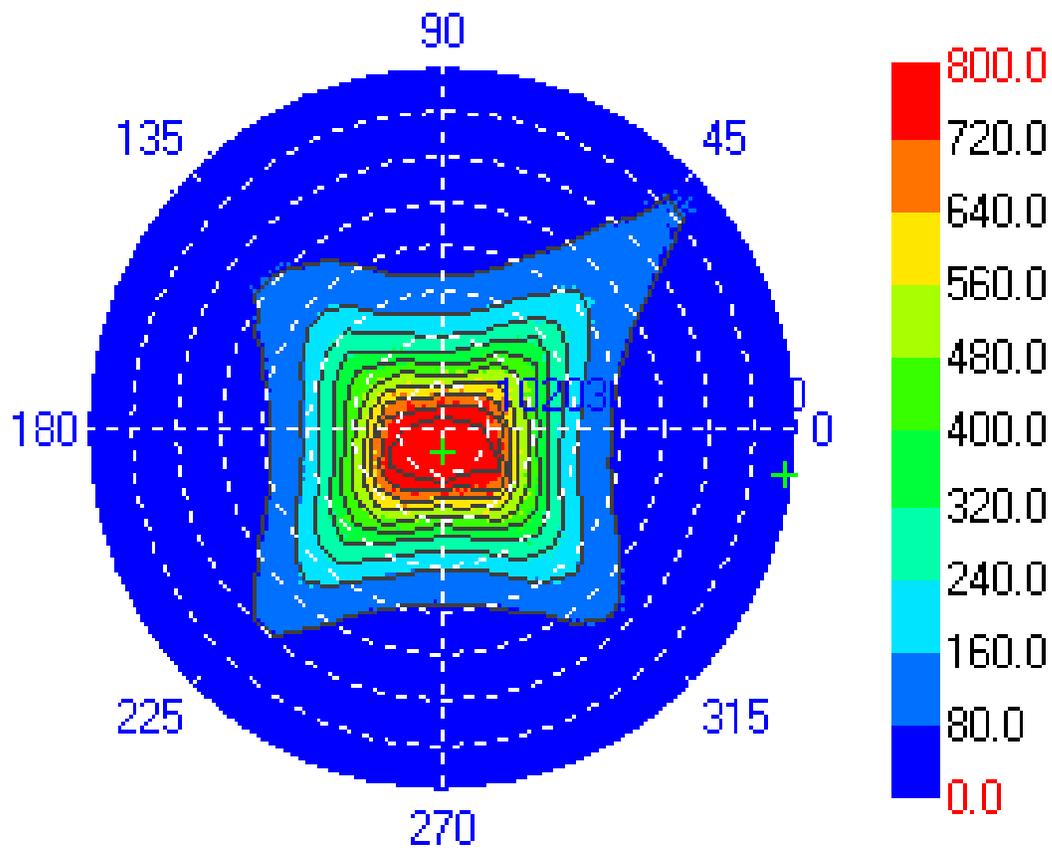
Note 2-3 Response time (grey to grey)

The response time has to be valid for switching from any grey levels x, y(0...63) to another. For measurement the grey level 55 to 63 can be used.

Note 2-4 Glare suppression of the LCD glass via polarizer with antiglare surface. Optional it should be possible to add an antireflective film with optically active layers. The layers must be touchable, tempered and resistant to common cleaning agents

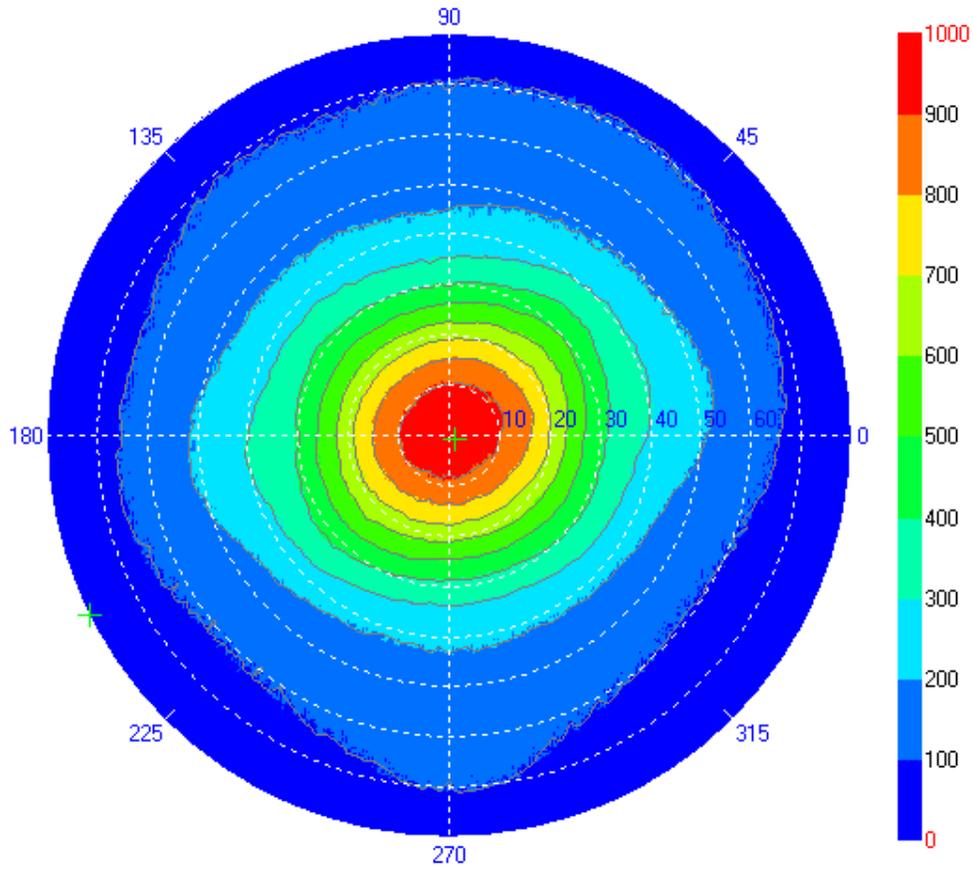
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2.1 Iso-Contrast diagram



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2.2 Iso-Luminance distribution:



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3 Electrical characteristics

3.1 Recommended operating conditions

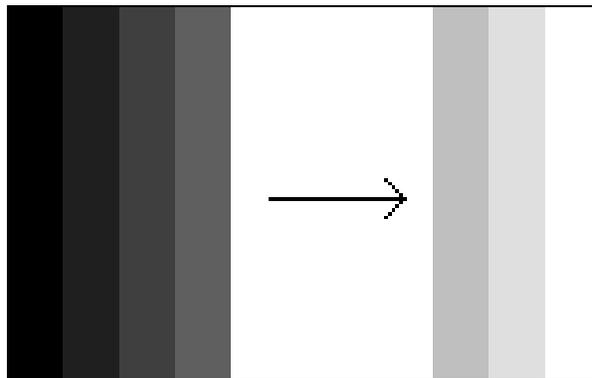
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks	
CLK Signal	high	V_{IH}	$V_{DD} \times 0.7$	-	V_{DD}	V	Note 3-1	
		I_{IH}	-10.0	-	10.0	μA		
	low	V_{IL}	V_{SS}	-	$V_{DD} \times 0.3$	V		
		I_{IL}	-10.0	-	10.0	μA		
Other Digital Signals	high	V_{IH}	$V_{DD} \times 0.7$	-	V_{DD}	V	Note 3-1	
		I_{IH}	22	-	160	μA		
	low	V_{IL}	V_{SS}	-	$V_{DD} \times 0.3$	V		
		I_{IL}	-10.0	-	10.0	μA		
Power supply	+3,3V	V_{DD}	$V_{SS}=0V$	3,0	3,3	3,6	V	Note 3-2
		I_{DD}		-	950	1100	mA	Note 3-3
Permissive input ripple	V_{RF}	$V_{DD1}=3.3V$	-	-	200	mV_{PP}		

Note 3-1 $V_{DD1} = 3.3V$; signals: CLK, R0~5, G0~5, B0~5, ENAB, Reset

Note 3-2 V_{DD} fuse

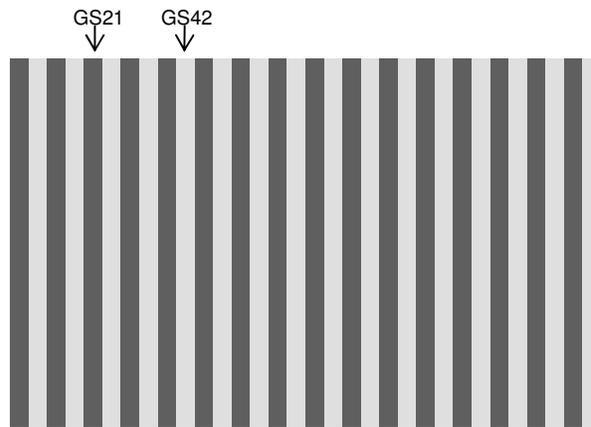
Type: JAA2402162NA011 (1,6A)
 Supplier: MATSUO Electric CO., LTD

Note 3-3 Typical current situation: 16-gray-bar pattern; at recommended operating timing conditions (GS0 → GS63)



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



3.2 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)

3.2.1 Timing controller

Timing and modulation requirements:

- at least +/- 5% jitter for all signals (CLK, ENAB, RGB, ...) are possible over the complete operation range

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3.3 Interface

3.3.1 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, ...)

3.3.2 Data Interface (CN1)

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	Note
1	VSS	Ground	
2	DCLK	Dot Clock	
3	VSS	Ground	
4	R0	Red data	
5	R1	Red data	
6	R2	Red data	
7	R3	Red data	
8	R4	Red data	
9	R5	Red data	
10	VSS	Ground	
11	G0	Green data	
12	G1	Green data	
13	G2	Green data	
14	G3	Green data	
15	G4	Green data	
16	G5	Green data	
17	VSS	Ground	
18	B0	Blue data	
19	B1	Blue data	
20	B2	Blue data	
21	B3	Blue data	
22	B4	Blue data	
23	B5	Blue data	
24	VSS	Ground	
25	NC	NC	Note 3-4
26	DataEn/ENAB (DTMG)	Data Enable (Displaytiming)	
27	NC	NC	Note 3-4
28	VSS	Ground	
29	NC	NC	Note 3-4
30	NC	NC	Note 3-4
31	NC	NC	Note 3-4
32	NC	NC	Note 3-4
33	VSS	Ground	
34	VSS	Ground	

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Pin No.	Symbol	Description	Note
35	Reset	Reset of timing controller	
36	VDD	Power Supply (+3.3V)	
37	VDD	Power Supply (+3.3V)	
38	VDD	Power Supply (+3.3V)	
39	VSS	Ground	
40	VSS	Ground	

Note 3-4 Do not connect any signal to NC terminals

3.3.3 Backlight Unit

Pin No.	Symbol	Description	Note
1	VLA1	Anode1	
2	VLA2	Anode2	
3	VLA3	Anode3	
4	VLC3	Cathod3	
5	VLC2	Cathod2	
6	VLC1	Cathod1	
7	NC	NC	Note 3-4
8	R_BR	Resistor Code for LED brightness ranks	
9	NTC	Negative Thermistor	
10	GND	Ground (NTC & R_BR)	

3.3.4 Input signal fault

If ENAB (DTMG) signal is missing the module has to show black screen.
If Clock signal is missing and continuously, the module will make the picture sticking.

3.3.5 Display driver

Block diagram

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

Characteristics

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

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3.4 Timing

The display has to **switch automatically** between the frequencies of **50Hz an 60Hz** and inverted (PAL and NTSC).

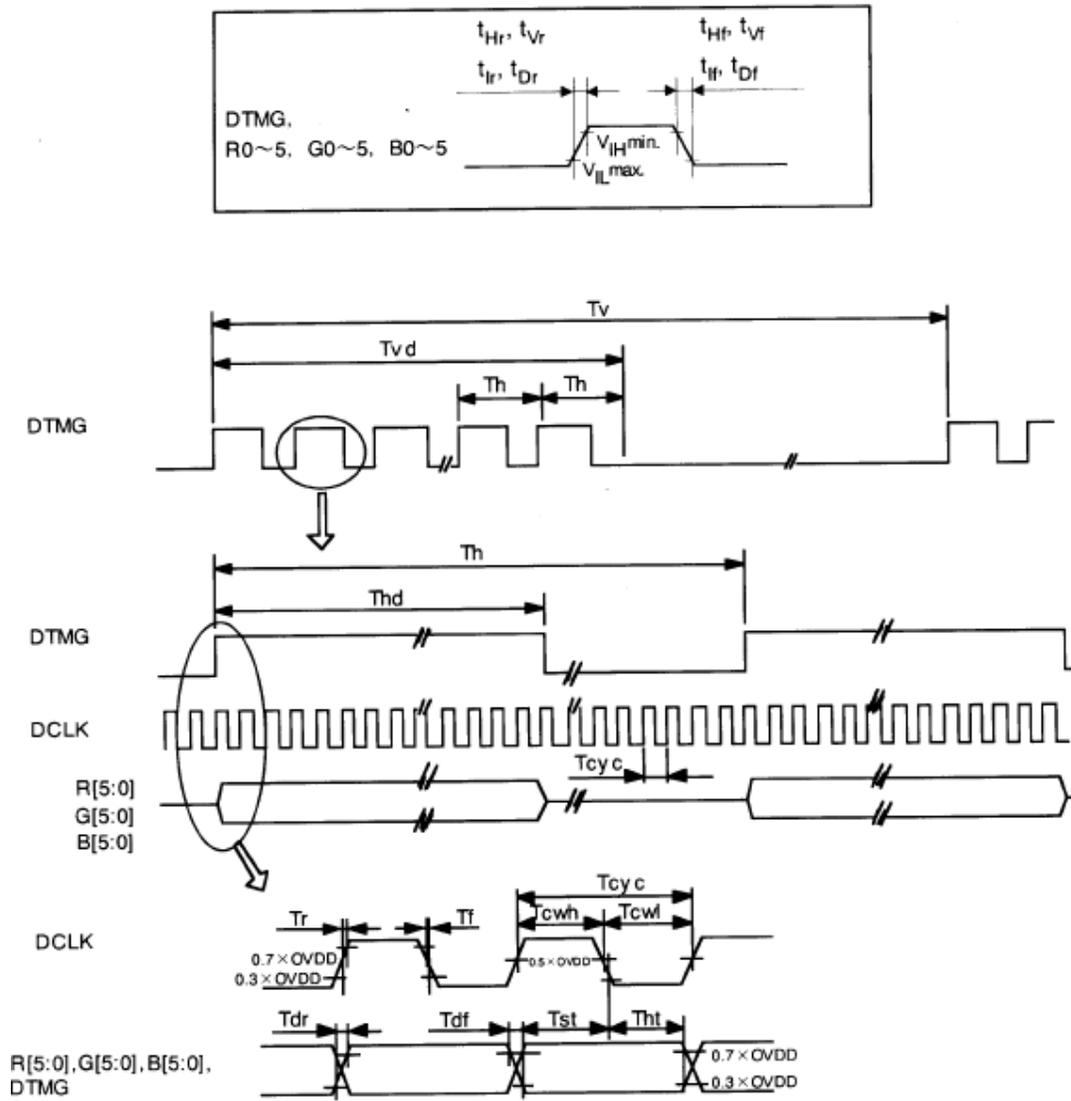
The frequency switching between 50Hz and 60Hz must not be visible. No image interferences and image interruptions are accepted. At both timings (50Hz and 60Hz) the same clock frequency has to be used. The switching between the frame frequencies has to be realized by changing the line quantity (vertical back/front porch) and / or the clock quantity per line (horizontal back / front porch).

3.4.1 Timing specification

Item	Symbol	Standard value (Note 1)			Unit	Remarks
		min.	typ	max.		
Clock	Frequency	$1/t_{CYC}$	34	37	40	MHz
	High width	t_{wch}	8			ns
	Low width	t_{wcl}	8			ns
	Rise time	t_R			4	ns
	Fall time	t_F			4	ns
	DUTY ratio	t_{wcl}/wch	45	50	55	%
Data	Setup time	t_{st}	4			ns
	Hold time	t_{ht}	4			ns
	Rise time	t_{dR}			4	ns
	Fall time	t_{df}			4	ns
	Horizontal cycle time	t_h	1300	1325	1860	t_{CYC}
	Horizontal active width	t_{hd}	1280	1280	1280	t_{CYC}
	Vertical cycle time	t_v	482	483	690	t_h
	Vertical active width	t_{vd}	480	480	480	t_h

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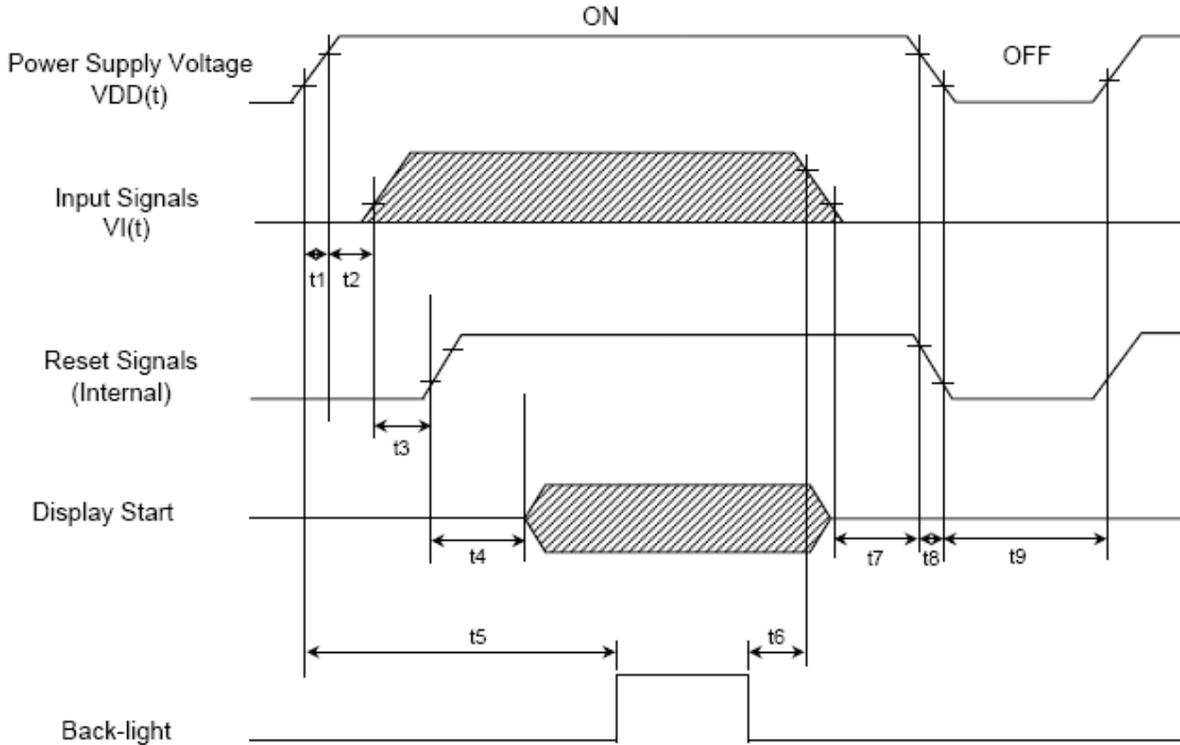
3.4.2 Input signal waveform



※ This module synchronizes with only DTMG and doesn't require inputting Vsync and Hsync signals. During Blanking period, DTMG should be "Low" level.

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3.4.3 Power On/Off sequences



POWER ON

- t1 ≤ 15ms
- 0ms < t2 ≤ 45ms
- 0ms < t3 ≤ 45ms
- t4 (max) = 60ms
- t5 (min) = 100ms

POWER OFF

- t6 (max) = 5ms
- 0ms < t7 ≤ 45ms
- 0ms < t8 ≤ 20ms
- t9 (min) = 500ms

- Note) 1) Set $0V \leq VI(t) \leq VDD(t)$.
 Here, VI (t), VDD (t) indicate the transitional state of VI, VDD when power supply is turned ON or OFF.
- 2) Do not keep interface signal high-impedance when power on.

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3.4.4 Input signal – greyscale 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	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 262.144 number of colors (0: low ; 1: high).

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3.5 Adjustment

No Adjustment by Continental need concerning Gamma and VCom.

Brightness Control requested, depending on Heat Management Concept to keep specified Temperature limits. T-con adjustment will be done by Hitachi

3.6 LED backlight

3.6.1 Structure

LED supplier Nichia
 LED type NSSW123BT
 Number of chains 3
 Number of LEDs 12

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

3.6.2 Interface characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
voltage per chain	V_L	-	38,4	43,2	V_{rms}	$T_A=+25^{\circ}C$
current per chain	I_L	-	80	90	mA_{rms}	
power consumption	P_L	-	9,22	10,37	W	$T_A=+25^{\circ}C$
Max. voltage difference between LED chains	ΔV_{LED_chain}			4,8	V	

3.6.3 Backlight lifetime

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Backlight life time continuous	-	20.000	-	-	hours	$T_A=+25^{\circ}C$ @ 100% PWM Note 3-5
Backlight life time continuous	-	30.000	-	-	hours	$T_A=+25^{\circ}C$ @ 80% PWM Note 3-5

Note 3-5 End-of-life criteria:
 LED brightness < 50% of initial brightness ($T_A=+25^{\circ}C$)

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3.6.4 Start-up characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
brightness	L_{low}	-	80	-	%	Note 3-6

Note 3-6 starting temperature -30 °C
 warm-up time 1 minute
 reference brightness stable brightness at 100% PWM and 25 °C

3.6.5 Luminance derating

For ambient temperatures higher than +85 °C, the backlight intensity can be derated. Up to +85 °C the backlight intensity must be maximum brightness level.

thermal characteristics has to be specified

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

3.7 Thermistor

The NTC has to be thermally connected to the Panel to measure the temperature of it.

Type: NCP15XV103J0SRC (Murata)

$R_{25} = 10k\Omega \pm 5\%$

Thermal characteristics have to be specified - NTC characteristic (temperature curve and position of NTC)

3.8 Brightness Resistor (R_BR)

Resistor values for different LED brightness groups (Tolerance 5%)

The supplier has to select the three possible brightness groups and resistor values

Brightness group 1: 680 Ohm
 Brightness group 2: 1.000 Ohm
 Brightness group 3: 1.500 Ohm

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3.9 EMC Requirements

Continental has to fulfill the requirements of the commercial vehicle customer specifications (Daimler, IVECO, MAN, VOLVO, RENAULT, SCANIA, PACCAR ...).

The supplier of the display module has to make sure, that the display module performs in a way that these requirements can be fulfilled.

3.9.1 EMC Optimization

The supplier of the display has to plan

- component EMC test and optimization in the supplier EMC lab, documented in a EMC Qualification Report.
- system EMC tests and optimization together with Continental in the Continental EMC lab
- vehicle EMC tests and optimization together with Continental and the customer in the customer EMC lab

3.9.2 EMC Qualifications

According to any qualification the supplier of the display must provide a EMC Qualification Report during all development stages.

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EMC measurements

Category	Measurement	Stand. ref. Eur.& Inter.	Applicable	Functional Class.	Test condition / severity	Remarks
Radiated Emission	Narrow-band free field, st.-al. Sys.Mod.	CISPR 25	yes	5		
	Broad-band free field, st.-al. Sys.Mod.	CISPR 25	yes	5		
	Narrow-band stripline, st.-al. Sys.Mod.	none	no			
	Broad-band stripline, st.-al. Sys.Mod.	none	no			
	Narrow-band free field, emb. Sys.Mod.	CISPR 25	yes	n.a.	40 dB μ V/m@0.15-30 MHz; 40 lin.to 12 dB μ V/m@30-70 MHz; 12 dB μ V/m@70-300 MHz; 5 dB μ V/m@300-500 MHz; 5 lin. to 20 dB μ V/m@0.5-1 GHz; 20 dB μ V/m@1-2 GHz.	19 dB μ V @ 270 MHz
	Broad-band free field, emb. Sys.Mod.	CISPR 25	no			
	Narrow-band stripline, emb. Sys.Mod.	none	yes	n.a.	40 linear to 25 dB μ V/m@30-70 MHz; 15 dB μ V/m@70-300 MHz; 10 dB μ V/m@300-500 MHz; 10 linear to 20 dB μ V/m@500-1000 MHz.	
	Broad-band stripline, emb. Sys.Mod.	none	no			
Conducted Emission	Narrow-band on power-supply leads	CISPR 25	no			
	Broad-band on power-supply leads	CISPR 25	no			
	Narrow-band on data/control lines	CISPR 25	no			
	Broad-band on data/control lines	CISPR 25	no			
	EM self-pollution to AM receiver	none	yes	n.a.	Differential current $\leq 10 \mu$ A on all in- and output lines for AM receiver bands.	
Radiated Immunity	Magnetic fields	ISO 11452-8	no	FSC A	Test level II	
	Free field	ISO 11452-2	no			
	TEM Cell	ISO 11452-3	no			
	BCI	ISO 11452-4	no	FSC A	at 200mA CW +80%AM 0,1 MHz - 400 MHz	
	Stripline	ISO 11452-5	no	FSC A	at 200 V/m CW +80%AM 0,1MHz - 400MHz	
	GSM-like signals (audible interference)	ISO 11452-2	no	FSC A	ALSE (Absorber Line Chamber, radiation with antenna) according ISO 11452-2 at 100 V/m CW +80% AM 80MHz - 2GHz	
	GSM-like signals (malfunction)	ISO 11452-2	no	FSC A	ALSE (Absorber Line Chamber, radiation with antenna) according ISO 11452-2 at 100 V/m CW +80% AM 80MHz - 2GHz	
	Overall radiated immunity		yes		To be done in the final application	
Conducted Immunity	AF ripple, functionality	ISO 16750-2	no			
	AF ripple, audible interference	none	no			
	Transients, Pulse 1	ISO 7637-2	no			
	Transients, Pulse 2a	ISO 7637-2	no			
	Transients, Pulse 2b	ISO 7637-2	no			
	Transients, Pulse 3a	ISO 7637-2	no			
	Transients, Pulse 3b	ISO 7637-2	no			
	Transients, Pulse 4	ISO 7637-2	no			
	Transients, Pulse 5 (Load Dump)	ISO 7637-2	no			
	Engine start voltage with ripple	ISO 16750-2	no			
Supply micro cuts	none	no				

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Category	Measurement	Stand. ref. Eur.& Inter.	Applicable	Functional Class.	Test condition / severity	Remarks
	El. transient on data/control lines	ISO 7637-3	no			
	ESD accessible parts	IEC 61000-4-2	yes	Class B	+/- 15 kV air discharge on panel and panel surface. Test has to be done on the "Reference design" (ISO10605)	
	ESD, package and handling	IEC 61000-4-2	no			
	Large ESD current through Sys. Mod.	IEC 61000-4-2	no			
	Parts, ESD accessible w. a h.h. key	IEC 61000-4-2	no			
	ESD during prod. and serv. (hbm)	MIL-STD-833E	yes	a.t. Class A	Contact discharge +/- 2 kV. System Module not connected to power	
	LF Common Mode Rejection Ratio	none	no			

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4 Special Requirements

4.1 Mechanical Strength

The glass of the LCD must withstand to a pressure generated by a force of 19N on a circular area with a diameter of 15 mm without damage.

4.2 Display Appearance

4.2.1 Major defects

A major defect is a defect that is likely to result in failure or to reduce materially the usability of the product in the vehicle.

All parts which do not agree with the specification.

1. Function defect
Abnormal operation including distinct RGB line defects and white line defect.
2. Vertical stripes
3. Horizontal stripes
4. Afterimage (>10sec)
(After displaying the same pattern for 5 seconds, Afterimage which disappears within 10 seconds is not defect)
5. Flickering (easily visible)
6. RGB Timing
7. Wrong Color
8. Less Brightness / Ununiformity
9. Lamp Kick off Voltage
10. No Backlight / defect Lamp
11. Broken glass
12. Abnormal (higher) current consumption
13. Wrong mechanical dimensions (drawing)

4.2.2 Minor defects (cosmetically defects)

A minor defect either is a defect that is not likely to reduce materially the usability of the product in the vehicle or is a departure from an established ideal situation but which has little bearing on the effective use or operation of the product.

1. Dot defect (tracing required)
2. Extraneous substances
3. Scratches
4. Dents
5. Linked/joined black dots (tracing required)

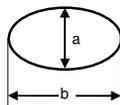
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4.2.3 Classification of Minor Defects

Extraneous Substances, Scratches, Dents

Items to be inspected		Inspection standards (acceptable level)	Remarks
Extraneous	Black spots	Black spots which appear when B/L or frontal lighting is operating $0.1 \leq D \leq 0.3$ Neglect $D > 0.3$ N = 1	Note 4-1
Substances	Lint	Module operating (black picture position) $0,10 \leq L \leq 1$ N ≤ 2	Note 4-2
Scratches		Scratches on the polarizer ($w < 300\mu\text{m}$) $L \leq 2$ N ≤ 2 $2 < L < 3$ N = 1 $L > 3$ N = 0	Note 4-2 Note 4-3
Dents		Dent on the polarizer $0.1 \leq D \leq 0.3$ Neglect $0.3 > D$ N = 1	Note 4-1 Note 4-3

Note 4-1 Average diameter: D (mm)



$$D = \frac{a+b}{2}$$

Note 4-2 Length: L (mm)
L = longest point



Note 4-3 The inspection shall be conducted by using a single fluorescent lamp for illumination, and the distance between the module and the eyes of the inspector shall be 35 cm or more.

4.2.4 Dot Defects

Inspection conditions: (visual inspection)

- Viewing distance: 60 cm
- Ambient illumination: 200 lux
- Ambient temperature: 20..25 °C
- Light source condition: based on component specification
- Viewing Angle: viewing angle range

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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

Number of Dot Defects:

- a) R,G,B Bright dots
No Filter for Inspection is allowed

R,G,B dots	Zone total	Condition
Green	0 MAX	
Red	0 MAX	
Blue	0 MAX	

Total : R + G + B ≤ 0

- b) dark dot at RGB pattern

Dark dots	Zone total	Condition
White pattern (W)	3 MAX	

- c) Total number of defects

Total	Zone total	Condition
Bright dots & black dots	3 MAX	

Defect Interval:

n/a

Linked / Joined Dots:

No joint dot defect is allowed.

4.3 Image sticking (burn-in)

Inspection conditions: (visual inspection)

- Viewing distance: 35 cm
- Ambient illumination: 100-150 lux
- Ambient temperature: 70 °C
- Light source condition: based on specification
- Viewing Angle: 0°
- Zone: Active area
- Picture Pattern: any application pattern => middle grey pattern
- Sequence time: 4h

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Criteria:

The display must not show image-sticking for switching to any picture pattern (e.g. full screen gray pattern or HMI application screen).

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5 Extent of testing

This section gives further details for the minimum extent of testing and documentation. Additional the supplier has to present all critical parameters and characteristics (according supplier's rating).

Dimensional check and appearance check according "Special Requirements" & standard A2C00028201.

5.1 Quality relevant Tests and Inspections

All qualifications and tests have to be done in accordance with General Quality & Approval Standard (GQAS) A2C00028201

5.2 Deviations of test conditions

Unlike mentioned at point 5.1 in the GQAS (A2C00028201), the following tests have to be done at different parameters.

Test	Test parameter in GQAS	Test parameter for this device																					
Dry heat operating	+85 °C, 200h	+85 °C, 500h																					
Dry heat storage	+85 °C, 500h	+85 °C, 500h , +95 °, 2h																					
Low Temp. Operation	-40 °C, 100h	-40 °C, 24 h																					
Damp Heat	IEC 60068-2-78	40 °C/95% r.h./21 days																					
Solar radiation	DIN 75220-D-OUT-T	60W/m ² (300 – 400nm), 63 °C, 168h																					
Mech. shock	IEC 60068-2-27 Ea	-> 50g, 6 ms; 2*10*3 = 60 shocks (half sinusoidal) 2= amplitude (+/-), 10 = shocks, 3= orientation (x,y,z)																					
Vibration	IEC 60068-2-6 Fc	4.1 Vibration inside cab , code A, B and D: <table border="1"> <thead> <tr> <th>Frequency</th> <th colspan="2">PSD</th> </tr> <tr> <th>(Hz)</th> <th>(m/s²)²/Hz</th> <th>g²/Hz</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>28,9</td> <td>0,3</td> </tr> <tr> <td>30</td> <td>0,24</td> <td>0,0025</td> </tr> <tr> <td>450</td> <td>0,007</td> <td>0,00007</td> </tr> <tr> <td>720</td> <td>0,048</td> <td>0,0005</td> </tr> <tr> <td>2000</td> <td>0,014</td> <td>0,00015</td> </tr> </tbody> </table> 3 * 48 h	Frequency	PSD		(Hz)	(m/s ²) ² /Hz	g ² /Hz	10	28,9	0,3	30	0,24	0,0025	450	0,007	0,00007	720	0,048	0,0005	2000	0,014	0,00015
Frequency	PSD																						
(Hz)	(m/s ²) ² /Hz	g ² /Hz																					
10	28,9	0,3																					
30	0,24	0,0025																					
450	0,007	0,00007																					
720	0,048	0,0005																					
2000	0,014	0,00015																					

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		<p>4.1.2 Sinus vibration:</p> <table border="1"> <thead> <tr> <th rowspan="2">Frequency (Hz)</th> <th colspan="2">Acceleration</th> </tr> <tr> <th>m/s²</th> <th>g</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>30</td> <td>3,06</td> </tr> <tr> <td>15</td> <td>30</td> <td>3,06</td> </tr> <tr> <td>23</td> <td>10</td> <td>1,02</td> </tr> <tr> <td>1250</td> <td>20</td> <td>2,04</td> </tr> <tr> <td>2000</td> <td>28</td> <td>2,85</td> </tr> </tbody> </table> <p>3*24 h total time: 216 h in X, Y an Z direction sinus and random test have to be done with the identical module</p>	Frequency (Hz)	Acceleration		m/s ²	g	10	30	3,06	15	30	3,06	23	10	1,02	1250	20	2,04	2000	28	2,85
Frequency (Hz)	Acceleration																					
	m/s ²	g																				
10	30	3,06																				
15	30	3,06																				
23	10	1,02																				
1250	20	2,04																				
2000	28	2,85																				

5.3 Additional tests

The additional tests have to be done by supplier

Test	Additional tests
Damp Heat	IEC 60068-2-38 (upper limit for rel humidity 100% ramp up cycle @ zone a,d, lower lever 70% ramp down cycle @ zone c,f)
Damp Heat	IEC 60068-2-30 (test procedure with 55 °C)

Criteria:

without any fatal defect after test

5.4 Material choice

The proposed substitutes of chemical substances regarding as critical from a health and environmental point of view are specified in Volvo’s white list (STD 100-0004). No chemical substances according to Volvo’s black list (STD 100-0002) and/or GADSL-P (Global Automotive Declarable Substances list) are to be used, neither in the product nor in the production process. Chemical substances according to Volvo’s grey list (STD 100-0003) and/or GADSL-D (Global Automotive Declarable Substances list) are to be avoided or to be used extremely sparsely; written approval from Volvo is required before usage.

No Cr6+ (chromium 6), Pb (Lead), Hg (mercury) and Cd (cadmium) compounds allowed for any new or modified part, in compliance with End Of Life Vehicle, EC-Directive requirements in Annex II.

Radioactivity level must be less than or equal to the natural radioactivity level for all products delivered.

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Silicone shall not be used in any components or manufacturing processes. If the material cannot be avoided, possible solutions shall always be discussed between the supplier and V3P.

Waterborne surface treatments shall be used

Parts intended for cab interior mounting shall be free from Bromide Flame Retardants (BFR).

5.4.1 Supplier substances reporting

All parts with occurrences of prohibited or reportable substances from Volvo’s black list (STD 100-0002), GADSL-P (Global Automotive Declarable Substances list) or Volvo’s grey list (STD 100-0003) must be reported with a Material Data Sheet (MDS) from International Material Data Sheet (IMDS).

Substances Absence Certificate: For parts not containing substances from Volvo’s black list (STD 100-0002), GADSL-P (Global Automotive Declarable Substances list) or Volvo’s grey list (STD 100-0003) and/or GADSL-D (Global Automotive Declarable Substances list), the supplier is requested to formally commit on the absence of hazardous substances. This supplier declaration will be registered in a Volvo database (Listed Substances absence certificate).

Supplier Substances reporting is mandatory at each Technical Release

An accepted MDS or a Supplier Absence Certificate will be one of the conditions for PPAP acceptance. The detailed process fro PPAP acceptance will be communicated by Purchaser.

5.5 Fire resistance

All possible malfunctions, short-circuits, or breakdown of electrical components within the component itself shall not cause fire (see definition below).

The material shall fulfil the requirements in ISO 3795.

An independent test laboratory shall carry out the fire resistance test. Optionally, the fire resistance may be documented by a material certificate. In both cases, the test laboratory shall be accredited to ISO3795.

The material may not burn or propagate a flame across its surface at a rate in excess of 80 mm/min.

The document has to be accessible in time for PPAP.

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5.5.1 Definition of fire

Fire is an incident, which is considered to occur when one or several of the following items have been fulfilled.

When a material or a component has been heated or overheated so that flames and/or smoke are generated.

When copper wires in electrical cables have been separated from their protective sleeves or insulation jackets as a result of internal overheating.

When a material has been heated so much that it glows and/or creates large quantities of smoke.

5.6 Fire resistance

Test according to STD 104-0001 which conforms to FMVSS 302 and ISO 3795.

Optionally, the fire resistance may be documented by a material certificate from a laboratory accredited to ISO 3795.

5.7 Functional testing (2 parts)

Electrical characteristics

- Current ISH (typ. & max.)
- NTC characteristics @ -40 °C, -30 °C, 0 °C, +25 °C, +60 °C, +85 °C

Optical characteristics

- Viewing angle characteristics
- Contrast ratio perpendicular
- Iso-contrast and Iso-brightness diagram
- Response time @ -30 °C, -20 °C, 0 °C, +20 °C
- Luminance perpendicular
- Luminance homogeneity (black and white scene)
- cold brightness starting-up
- color coordinates

5.8 Reliability

Tests have to be performed in PPAP

according general standard A2C00028201:

- 2 parts after dry heat (operating 200h)
- 3 parts after dry heat (storage 500h)
- 5 parts after humidity resistance (500h)
- 3 parts after resistance to cold (100h)
- 4 parts after change of temperature (10x)
- 3 parts after resistance to UV-radiation

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- 2 parts after shock
- 2 parts after vibration
- 3 parts after ESD 2kV (contact discharge)
- 3 parts after ESD 15kV (air discharge)
- documentation lifetime testing LED @ +85 °C

Criteria:

without any fatal defect after test

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6 Review team

This spec was reviewed by the following persons within Continental.

Name	Department	eMail
	RD PS	
	RD CD HW	
	RD PS	

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