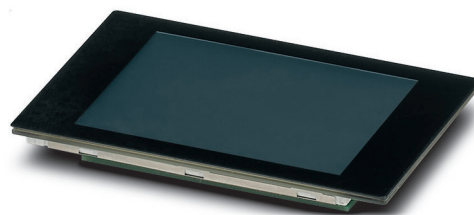


DCT T 2,4 QVGA S RTOUCH

**Industrial-grade touch display for control cabinet
and field applications**



Data sheet
109921_en_01

© PHOENIX CONTACT 2021-03-12

1 Description

The touch display is suitable for stationary or mobile electronics housing applications.

- 2.4 inch screen size
- High-contrast TFT touch display
- Can be used in temperature ranges from -20°C to +70°C
- Available built-in for ICS, ME-IO, and UCS series electronics housings
- Resistive touch technology, can be operated with finger, stylus, and when wearing gloves

Table of contents

1	Description	1
2	Ordering data	2
3	Technical data	3
3.1	General data	3
3.2	Maximum electrical values.....	4
3.3	Electrical properties (operation).....	4
3.4	LED backlight	5
3.5	Electrical values	5
4	Optical characteristics	6
5	Display.....	7
6	Reliability test	7
7	Software	8
8	Dimensional drawings	9
9	Installation	10



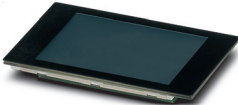
Make sure you always use the latest documentation. It can be downloaded at phoenixcontact.net/product/1132710.



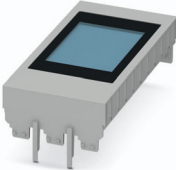
This document is valid for the products listed in Section “Ordering data” on page 2.

2 Ordering data

Touch display

Description		Type	Order No.	Pcs./Pkt.
 2.4 inch touch display		DCT T 2,4 QVGA S RTOUCH	1132710	5

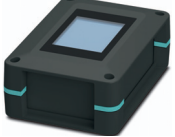
Already integrated in ME-IO 56,4 series housing

Description		Type	Order No.	Pcs./Pkt.
 ME-IO series housing cover, overall width: 56.4, 10 units, with integrated 2.4 inch touch display, 6 pcs.		ME-IO 56,4 C 10U D2,4-TRG 7035	1209364	6
ME-IO series housing cover, overall width: 56.4, 10 units, with integrated 2.4 inch touch display, 1 pcs.		ME-IO 56,4 C 10U D2,4-TRG 7035-VPE1	1225275	1

Already integrated in ICS50 series housing

Description		Type	Order No.	Pcs./Pkt.
 ICS series upper housing part, overall width: 50 mm, with integrated 2.4 inch touch display, height: 100 mm, 10 pcs.		ICS50-C100X12-D2,4-TRG-7035	1077656	10
ICS series upper housing part, overall width: 50 mm, with integrated 2.4 inch touch display, height: 100 mm, 1 pcs.		ICS50-C100X12-D2,4-TRG-7035-VPE1	1226370	1

Already integrated in UCS 125-87 series housing

Description		Type	Order No.	Pcs./Pkt.
 UCS series electronics housing, length: 125 mm, width: 87 mm, depth: 47 mm, adhesive pads, with integrated 2.4 inch touch display, light gray		UCS 125-87-F-GD-D2,4-TRG 7035	1246286	1
 UCS series electronics housing, length: 125 mm, width: 87 mm, depth: 47 mm, adhesive pads, with integrated 2.4 inch touch display, black		UCS 125-87-F-GD-D2,4-TRG 9005	1246287	1

3 Technical data

3.1 General data

Display data

Touch display	6.1 cm / 2.4"
Touch technology	Resistive (RTP)
Panel technology	TFT, transmissive
Screen resolution	320 x 240 pixels (QVGA)
Backlight	LED, white
Dot pitch	0.153 mm x 0.153 mm
Controller	ST7789V
Interface	4-wire SPI half duplex
Weight	26 g (without electronics housing)

Dimensions

Dimensions of the cover lens (W x H x D)	74.4 mm x 47.4 mm x 7.0 mm
Viewing area (W x H)	50.16 mm x 37.72 mm
Active area (W x H)	48.96 mm x 36.72 mm

Ambient conditions

Ambient temperature (operation)	-20°C ... +70°C
Ambient temperature (storage)	-30°C ... +80°C



The background color may vary slightly depending on the ambient temperature. This procedure can be reversed.



NOTE: Electrostatic discharge

Electrostatic discharge can damage or destroy components. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.

3.2 Maximum electrical values



In this specification, all voltages are in reference to ground (GND).

Permanent damage will be caused to the device if the maximum values are exceeded. Furthermore, this device may not function properly at the maximum values.

These are only load values:

Description		Min.	Max.
Logic power supply	V_{CC}	-0.3 V	3.6 V
Input voltage	V_I	-0.3 V	$V_{CC} + 0.5$ V

3.3 Electrical properties (operation)



Correct operation of the device is only ensured in accordance with the specifications provided in the table.

At an ambient temperature of +25°C

Condition		Min.	Typ.	Max.
Logic power supply				
V_{CC}		2.6 V	2.8 V	3.3 V
Input voltage				
V_{IH}	High level	$0.8 \times V_{CC}$	–	$1 \times V_{CC}$
V_{IL}	Low level	GND	–	$0.2 \times V_{CC}$
Logic current consumption				
I_{CC}	$V_{CC} = 2.8$ V	–	7 mA	15 mA

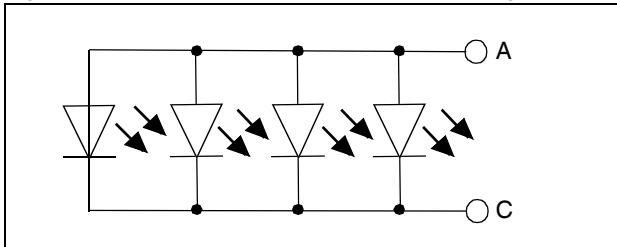
3.4 LED backlight

Electrical data

At an ambient temperature of +25°C

Description	Typical
Conducting-state voltage V_{AC}	3.0 V
Conducting-state current I_{AC}	60 mA

Figure 1 Connection scheme for LED backlight

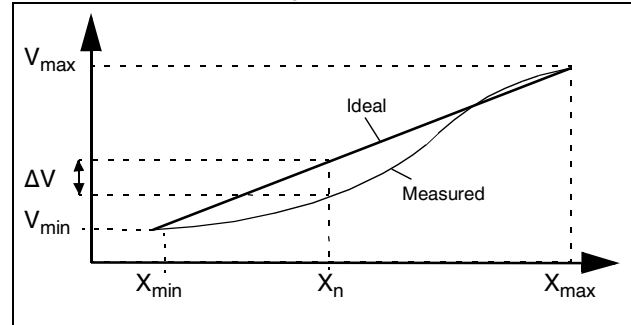


3.5 Electrical values

At an ambient temperature of +25°C

Condition	Min.	Max.
Non-linearity	–	3.3%
Surface resistivity		
ITO-coated film, Anti-Newton Ring	300 Ω	1000 Ω
ITO-coated glass	100 Ω	600 Ω

Definition of non-linearity



$$\text{Non-linearity}_{\max} = \frac{\Delta V}{V_{\max} - V_{\min}} \times 100\%$$

$$\Delta V = \max \left| (V_{\text{measured}})_{X_n} - (V_{\text{ideal}})_{X_n} \right|$$

4 Optical characteristics

At an ambient temperature of +25°C

Description	Condition	Typical
Viewing angle Θ ($Cr \geq 10$)	$\varphi = 0^\circ$	65°
	$\varphi = 180^\circ$	55°
	$\varphi = 90^\circ$	65°
	$\varphi = 270^\circ$	65°
Contrast ratio Cr	Min. 300, typ. 500	
Response time T_f, T_r	—	10 ms
Surface luminance L_i at $I_{AC} = 60 \text{ mA}$	—	180 cd/m^2

Figure 2 Definition of the viewing angle $\Theta(\varphi)$

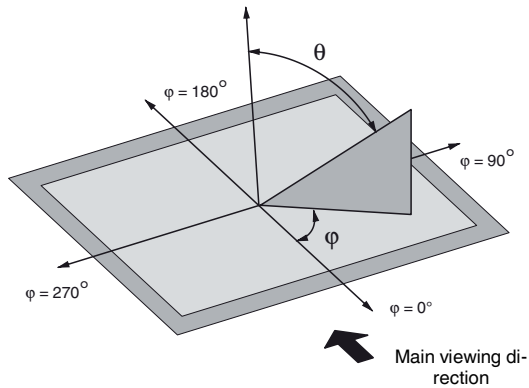


Figure 3 Definition of the contrast ratio Cr (positive type)

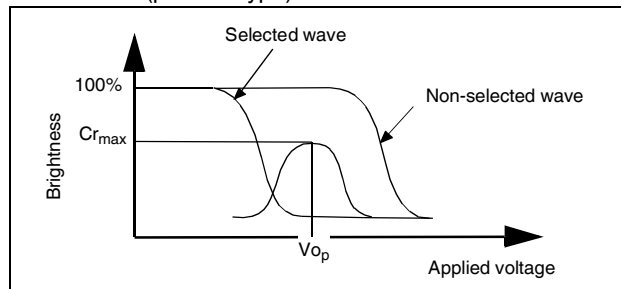


Figure 4 Definition of the contrast ratio Cr (negative type)

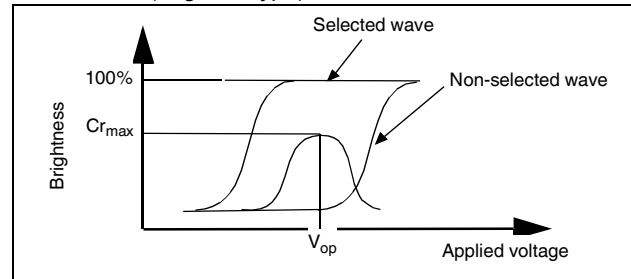


Figure 5 Definition of the response time T_r, T_f (positive type)

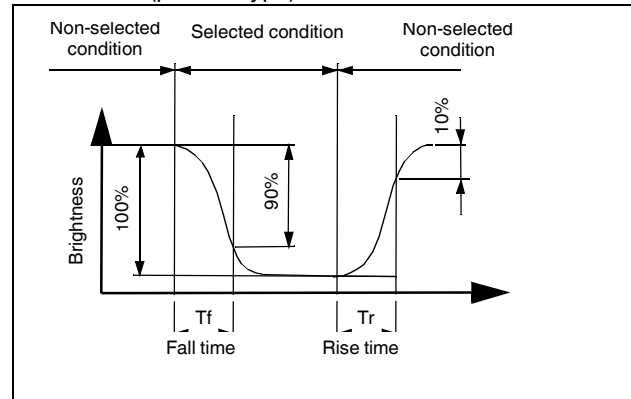
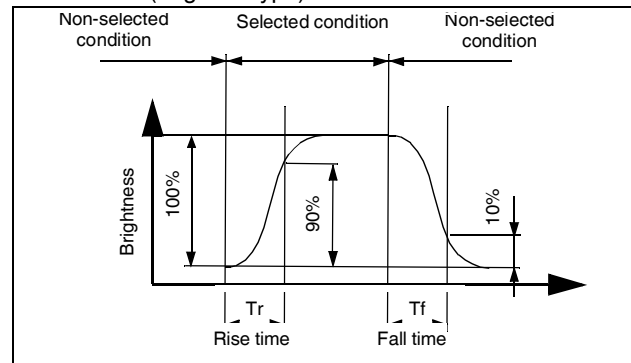
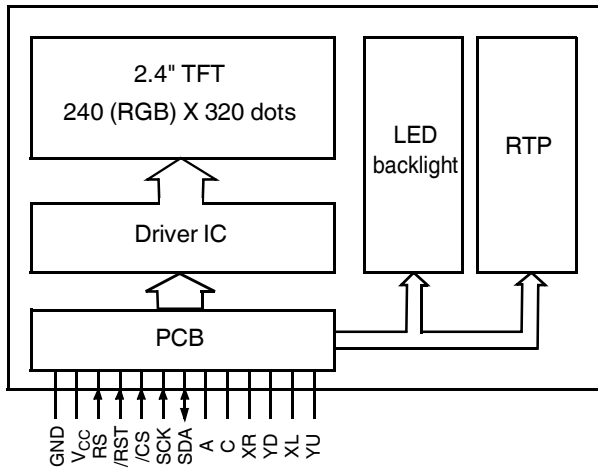


Figure 6 Definition of the response time T_r, T_f (negative type)



5 Display

Figure 7 Block diagram with connecting contacts



Description of the LCD interface

Connection method: FPC connector, 14-pos.
(FH12-14S-05SH), pitch: 0.5 mm

Symbol	Pin	IO	Function
YU	1	–	Resistive touch display
XL	2	–	
YD	3	–	
XR	4	–	
GND	5	PWR	Ground
V _{CC}	6	PWR	Logic power supply
/CS	7	I	Chip selection
/RST	8	I	Reset input
RS	9	I	Register selection: “L” ≙ command data “H” ≙ parameter data
SCL	10	I	Serial clock
SDA	11	I	Serial data
NC	12	I/O	Not connected
A	13	PWR	LED backlight, anode
C	14	PWR	LED backlight, cathode

6 Reliability test

Test conditions

No.	Task	Condition	
1.	Ambient temperature (storage), maximum	+80°C	96 h
2.	Ambient temperature (storage), minimum	-30°C	96 h
3.	Humidity (storage)	90% RH (+60°C)	96 h
4.	Ambient temperature (operation), maximum	+70°C	96 h
5.	Ambient temperature (operation), minimum	-20°C	96 h
6.	Vibration	Duration: 2 h; 10 Hz ... 150 Hz; Acceleration 100 m/s ²	
7.	Thermal shock	5 cycles (1 cycle = 30 min at -30°C, 30 min at +80°C)	



After the reliability test, only the function is confirmed. The image properties will only be achieved again after a sufficiently long rest period of at least two hours at room temperature.

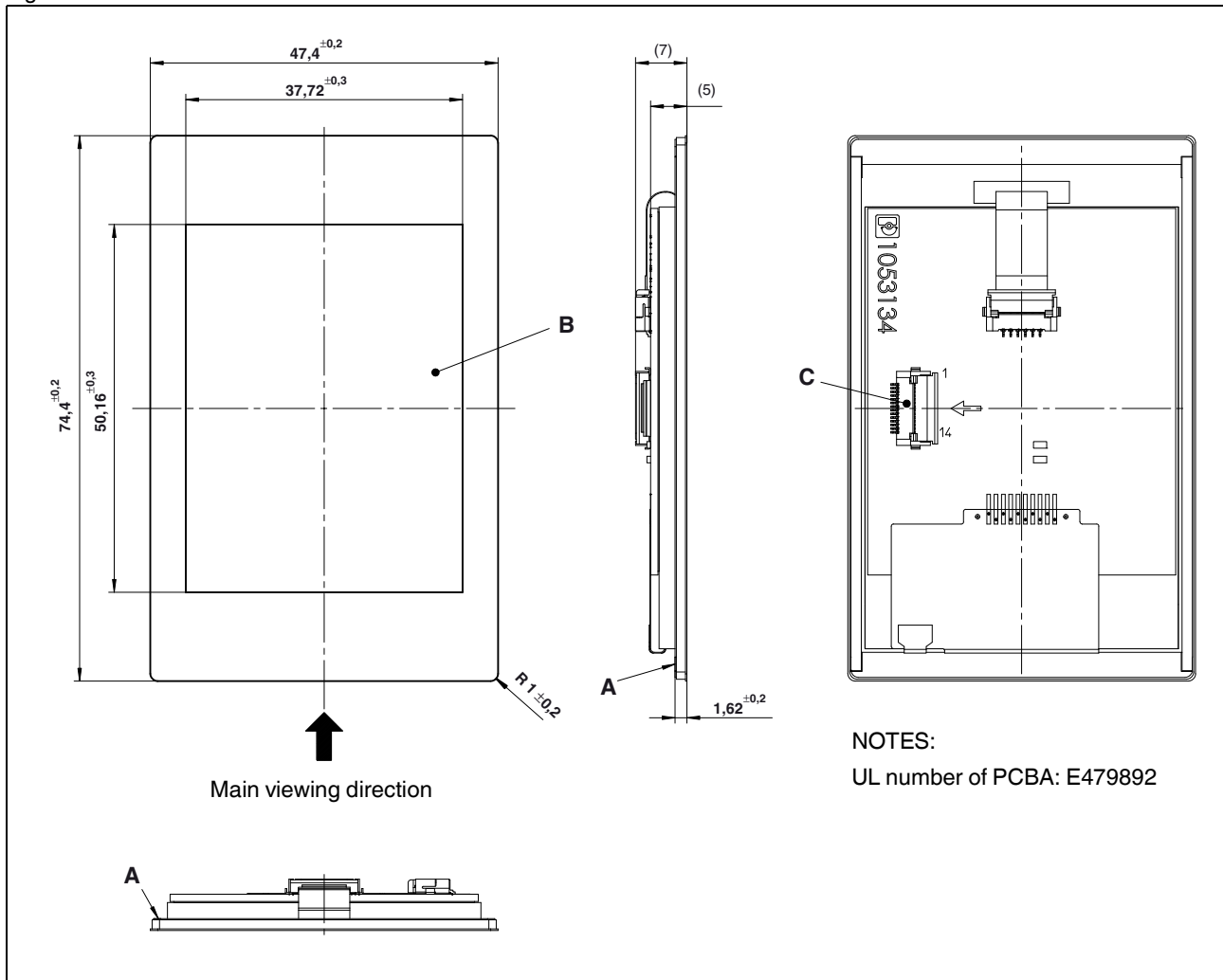
7 Software

The TFT must be initialized via SPI prior to use. For detailed information on the register and timing features, refer to specification IC ST7789V. Use the following parameters for initialization.

Register	Parameter	Register	Parameter
Reset cycle		0xe1	0xd0
Delay = 120 ms			0x00
0x36	0x00		0x05
0x3a	0x05		0x0d
0xb2	0x0c		0x0c
	0x0c		0x2d
	0x00		0x44
	0x33		0x40
	0x33		0x0e
0xb7	0x35		0x1c
0xbb	0x2b		0x18
0xc0	0x2c		0x16
0xc2	0x01		0x19
0xc3	0x11	0xe7	0x10
0xc04	0x20	0x11	–
0xc6	0x0f	Delay = 120 ms	
0xd0	0xa4	0x29	
	0xa1	Delay = 120 ms	
0xe0	0xd0		
	0x00		
	0x05		
	0x0e		
	0x0d		
	0x37		
	0x43		
	0x47		
	0x09		
	0x15		
	0x12		
	0x16		
	0x19		
	0x11		

8 Dimensional drawings

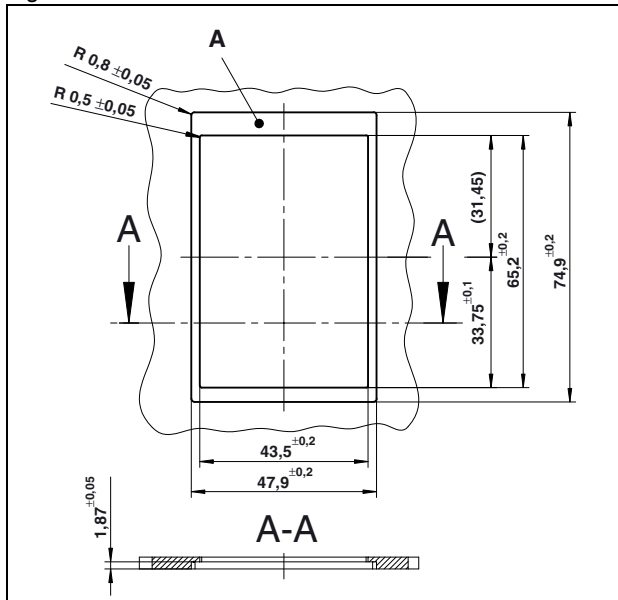
Figure 8 Dimensions



Item	Description
A	Adhesive tape
B	Visible area
C	LCD interface, connection method: FPC connector, 14-pos. (FH12-14S-05SH)

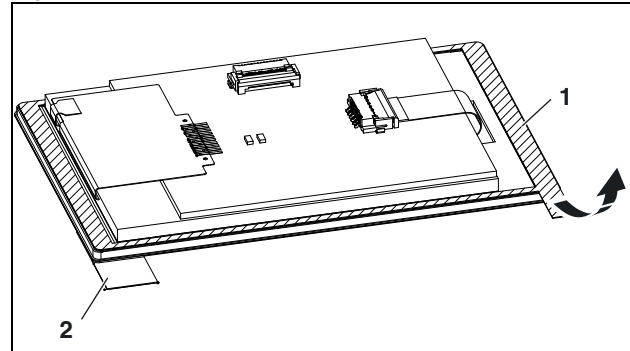
9 Installation

Figure 9 Recommended installation dimensions



Item	Description
A	Adhesive surface

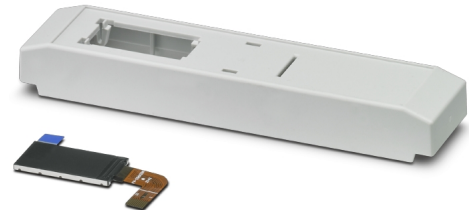
Figure 10 Adhesive surface



- Remove the foil (1) from the adhesive surface. Leave the protective foil (2) on the display.
- Place the display in the mounting cutout and press on the adhesive joint.

ICS25-C100(122)X12-DKP-7035

Upper housing part with industrial-grade display for control cabinet applications



Data sheet
109941_en_00

© PHOENIX CONTACT 2021-02-26

1 Description

The display is suitable for stationary ICS series electronics housing applications.

Use the display and a membrane keypad to implement display and operating solutions with a screen size of 0.96 inches.

- High-contrast TFT color display
- Can be used in temperature ranges from -20°C to +70°C
- Integrated in ICS series electronics housings
- Membrane keypad that is tailored to the upper housing part and display

Table of contents

1	Description	1
2	Ordering data	2
3	Technical data	2
3.1	General data	2
3.2	Maximum electrical values.....	3
3.3	Electrical properties (operation).....	3
3.4	LED backlight	3
4	Optical characteristics	4
5	Display.....	5
6	Timing properties.....	5
7	Reliability test	5
8	Software	6
9	Dimensional drawings	9
10	Mounting the display and membrane keypad	10

 Make sure you always use the latest documentation. It can be downloaded at phoenixcontact.net/product/1215685.

 This document is valid for the products listed in Section “Ordering data” on page 2.

2 Ordering data

Display

Description	Type	Order No.	Pcs./Pkt.
Upper housing part with 0.96 inch display , for ICS25 series housings, height: 100 mm, depth: 12 mm, color: similar to RAL 7035 (light gray)	ICS25-C100X12-DKP-7035	1215686	10
Upper housing part with 0.96 inch display , for ICS25 series housings, height: 122 mm, depth: 12 mm, color: similar to RAL 7035 (light gray)	ICS25-C122X12-DKP-7035	1215685	10

Accessories

Description	Type	Order No.	Pcs./Pkt.
Membrane keypad for ICS25-C100X12-DKP-7035	KP ICS25X100 K4 C3 P5	1215683	10
Membrane keypad for ICS25-C122X12-DKP-7035	KP ICS25X122 K4 C3 P5	1215684	10

3 Technical data

3.1 General data

Display data	
Display	2.44 cm / 0.96"
Panel technology	IPS-TFT
Screen resolution	80 x 160 pixels
Backlight	LED, white
Dot pitch	0.135 mm x 0.1356 mm
Controller	ST7735S
Interface	4-wire SPI half duplex
Weight	33 g
Dimensions	
Dimensions of the module (W x H x D)	13.5 mm x 27.95 mm x 1.5 mm
Active area (W x H)	10.8 mm x 21.7 mm
Ambient conditions	
Ambient temperature (operation)	-20°C ... +70°C
Ambient temperature (storage)	-30°C ... +80°C

 The background color may vary slightly depending on the ambient temperature. This procedure can be reversed.



NOTE: Electrostatic discharge

Electrostatic discharge can damage or destroy components. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.

3.2 Maximum electrical values



In this specification, all voltages are in reference to ground (GND).

Permanent damage will be caused to the device if the maximum values are exceeded. Furthermore, this device may not function properly at the maximum values.

These are only load values:

Description		Min.	Max.
Logic power supply	V_{CC}	-0.3 V	4.6 V
Input voltage	V_I	-0.3 V	$V_{CC} + 0.3$ V

3.3 Electrical properties (operation)



Correct operation of the device is only ensured in accordance with the specifications provided in the table.

At an ambient temperature of +25°C

Condition		Min.	Typ.	Max.
Logic power supply				
V_{CC}		2.5 V	2.8 V	3.3 V
Input voltage				
V_{IH}	High level	$0.8 \times V_{CC}$	–	$1 \times V_{CC}$
V_{IL}	Low level	GND	–	$0.2 \times V_{CC}$
Logic current consumption				
I_{CC}	$V_{CC} = 2.8$ V	–	2 mA	3 mA

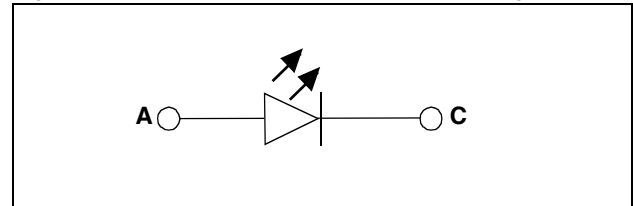
3.4 LED backlight

Electrical data

At an ambient temperature of +25°C

Description	
Conducting-state voltage V_{AC}	2.7 V ... 3.3 V, typical 3.0 V
Conducting-state current I_{AC}	15 mA ... 30 mA, typical 20 mA

Figure 1 Connection scheme for LED backlight



4 Optical characteristics

At an ambient temperature of +25°C

Description	Condition	Typical
Viewing angle Θ ($Cr \geq 10$)	$\varphi = 0^\circ$	80°
	$\varphi = 180^\circ$	80°
	$\varphi = 90^\circ$	80°
	$\varphi = 270^\circ$	80°
Contrast ratio Cr	—	800
Response time T_f, T_r	Maximum 40 ms Typical 30 ms	
Surface luminance L_i , at $I_{AC} = 20 \text{ mA}$	Minimum 350 cd/m^2 Typical 400 cd/m^2	

Figure 2 Definition of the viewing angle $\Theta(\varphi)$

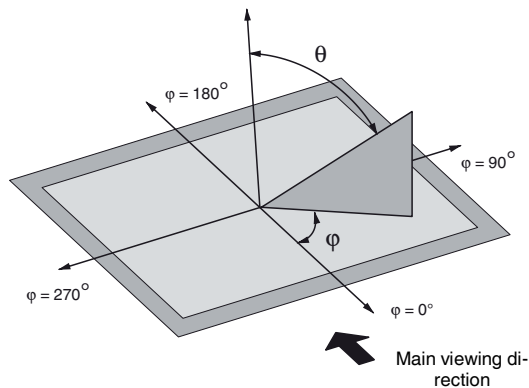


Figure 3 Definition of the contrast ratio Cr (positive type)

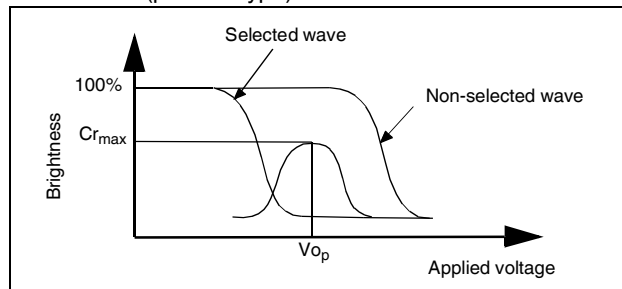


Figure 4 Definition of the contrast ratio Cr (negative type)

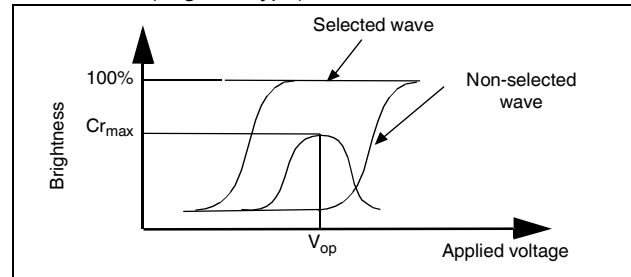


Figure 5 Definition of the response time T_r, T_f (positive type)

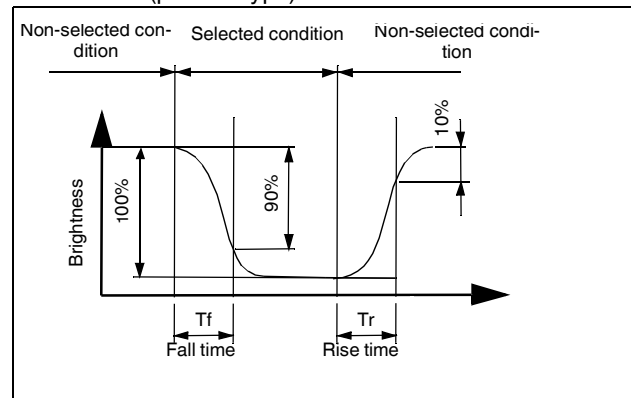
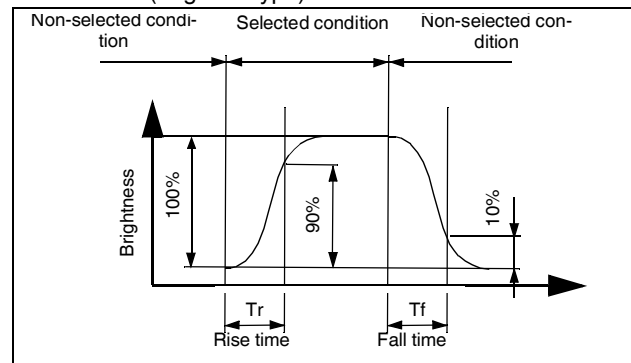
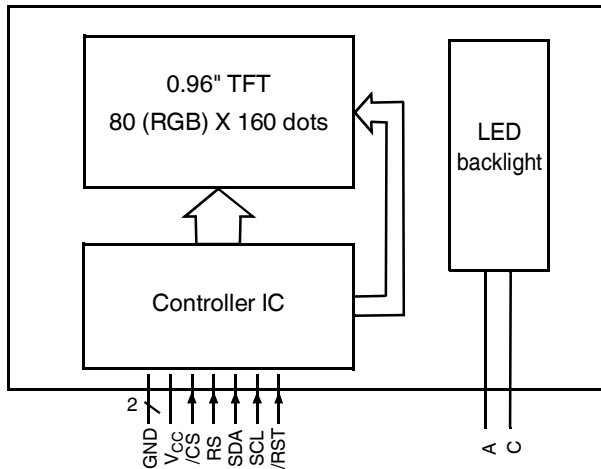


Figure 6 Definition of the response time T_r, T_f (negative type)



5 Display

Figure 7 Block diagram with connecting contacts



Description of the LCD interface

Connection method: FPC connector, 10-pos., pitch: 0.5 mm
(FPC UL number: E497910)

Symbol	Pin	I/O	Function
GND	1	PWR	Ground
SCL	2	I	Serial clock
/RST	3	I	Reset input
/CS	4	I	Chip selection
SDA	5	I	Serial data
RS	6	I	Register selection: "L" ≙ command data "H" ≙ parameter data
V _{CC}	7	PWR	Logic power supply
GND	8	PWR	Ground
C	9	PWR	LED backlight, cathode
A	10	PWR	LED backlight, anode

6 Timing properties

i Observe the specifications for the HX8347I controller block.

7 Reliability test

Test conditions

No.	Task	Condition	
1.	Ambient temperature (storage), maximum	+80°C	96 h
2.	Ambient temperature (storage), minimum	-30°C	96 h
3.	Humidity (storage)	90% RH (+60°C)	96 h
4.	Ambient temperature (operation), maximum	+70°C	96 h
5.	Ambient temperature (operation), minimum	-20°C	96 h
6.	Vibration	Duration: 2 h; 10 Hz ... 150 Hz; Acceleration 100 m/s ²	
7.	Thermal shock	5 cycles (1 cycle = 30 min at -30°C, 30 min at +80°C)	

i After the reliability test, only the function is confirmed. The image properties will only be achieved again after a sufficiently long rest period of at least two hours at room temperature.

8 Software

The TFT/LCM must be initialized prior to use. For detailed information on the register and timing features, refer to specification IC ST7789V.

Recommended initialization:

```
Init_TFT( void ) {
    RESET=1;    // set reset pin to high
    Delay(10);  // delay 10ms
    RESET=0;    // set reset pin to low
    Delay(10);  // delay 10ms
    RESET=0;    // set reset pin to high
    Delay(120); // delay 120ms

    SPI_Tx_Command(0x11); // Sleep out
    Delay(120); // delay 120ms
    SPI_Tx_Command(0xB1); // set frame rate in normal mode
    SPI_Tx_Parameter(0x05);
    SPI_Tx_Parameter(0x3C);
    SPI_Tx_Parameter(0x3C);

    SPI_Tx_Command(0xB2); // set frame rate in idle mode
    SPI_Tx_Parameter(0x05);
    SPI_Tx_Parameter(0x3C);
    SPI_Tx_Parameter(0x3C);

    SPI_Tx_Command(0xB3); // set frame rate in partial mode
    SPI_Tx_Parameter(0x05);
    SPI_Tx_Parameter(0x3C);
    SPI_Tx_Parameter(0x3C);
    SPI_Tx_Parameter(0x05);
    SPI_Tx_Parameter(0x3C);
    SPI_Tx_Parameter(0x3C);

    SPI_Tx_Command(0xB4); // set display inversion options
    SPI_Tx_Parameter(0x03);
    SPI_Tx_Parameter(0x02);

    SPI_Tx_Command(0xC0); // set power control 1
    SPI_Tx_Parameter(0xA4);
    SPI_Tx_Parameter(0x04);
    SPI_Tx_Parameter(0x84);

    SPI_Tx_Command(0xC1); // set power control 2
    SPI_Tx_Parameter(0x05);

    SPI_Tx_Command(0xC2); // set power control 3
    SPI_Tx_Parameter(0x0D);
    SPI_Tx_Parameter(0x00);

    SPI_Tx_Command(0xC3); // set power control 4
    SPI_Tx_Parameter(0x8D);
    SPI_Tx_Parameter(0x6A);

    SPI_Tx_Command(0xC4); // set power control 5
    SPI_Tx_Parameter(0x8D);
    SPI_Tx_Parameter(0xEE);
}
```



```
SPI_Tx_Command(0xC5); // set power VCOM
SPI_Tx_Parameter(0x1D);

SPI_Tx_Command(0xE0); // set positive gamma
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x0E);
SPI_Tx_Parameter(0x08);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x10);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x02);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x09);
SPI_Tx_Parameter(0x0F);
SPI_Tx_Parameter(0x25);
SPI_Tx_Parameter(0x36);
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0x08);
SPI_Tx_Parameter(0x04);
SPI_Tx_Parameter(0x10);

SPI_Tx_Command(0xE1); // set negative gamma
SPI_Tx_Parameter(0x0A);
SPI_Tx_Parameter(0x0D);
SPI_Tx_Parameter(0x08);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x0F);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x02);
SPI_Tx_Parameter(0x07);
SPI_Tx_Parameter(0x09);
SPI_Tx_Parameter(0x0F);
SPI_Tx_Parameter(0x25);
SPI_Tx_Parameter(0x35);
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0x09);
SPI_Tx_Parameter(0x04);
SPI_Tx_Parameter(0x10);

SPI_Tx_Command(0xFC); // set frequency for gate pump
SPI_Tx_Parameter(0x80);

SPI_Tx_Command(0x2A); // set column address (full colums)
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0x1A);
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0x69);

SPI_Tx_Command(0x2B); // set page address (full pages)
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0x01);
SPI_Tx_Parameter(0x00);
SPI_Tx_Parameter(0xA0);

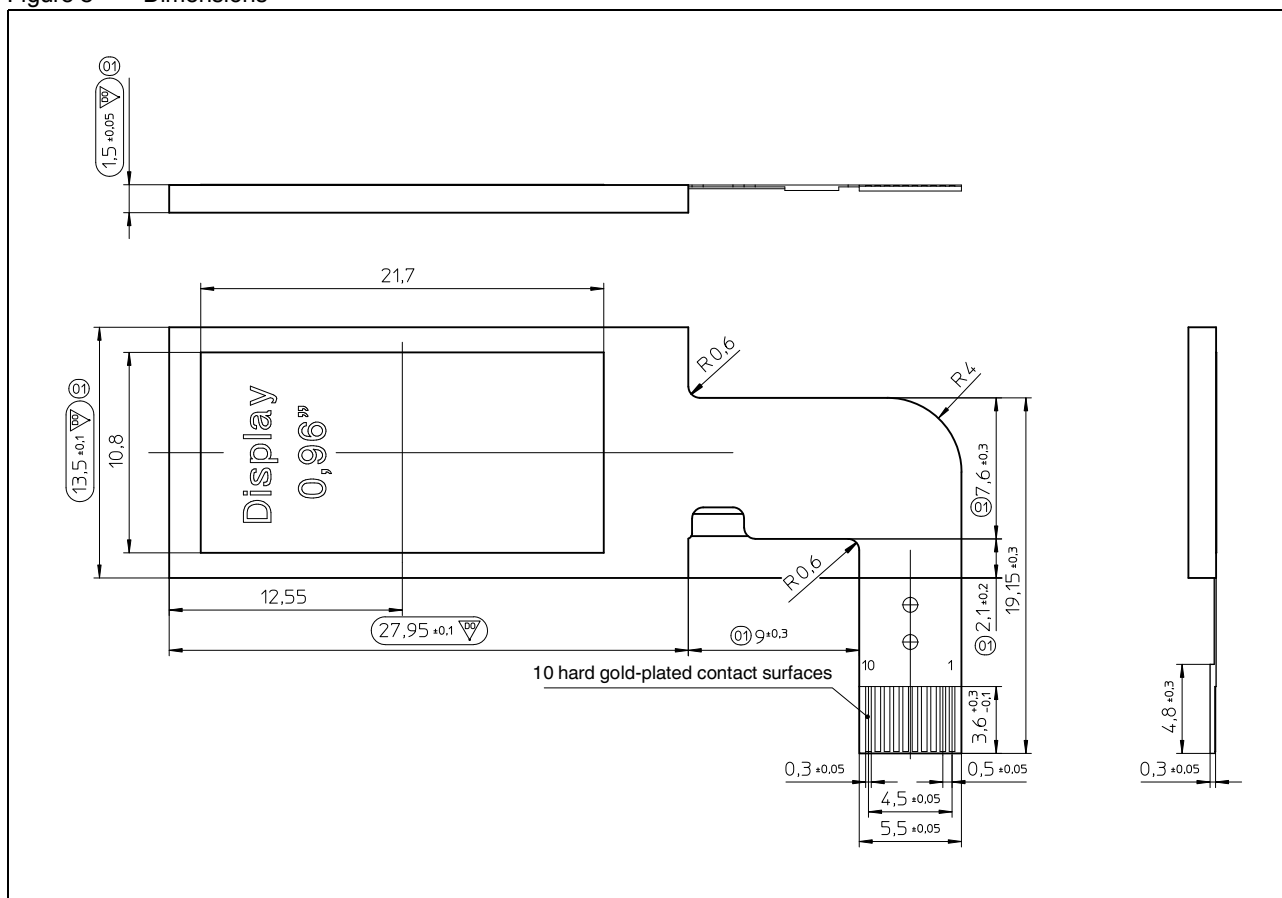
SPI_Tx_Command(0xF0);
SPI_Tx_Parameter(0x11);

SPI_Tx_Command(0xD6);
SPI_Tx_Parameter(0xCB);
```

```
SPI_Tx_Command(0x3A);  
SPI_Tx_Parameter(0x05);  
  
SPI_Tx_Command(0x36); // set interface pixel format  
SPI_Tx_Parameter(0x08);  
  
SPI_Tx_Command(0x21); // set display inversion on  
  
SPI_Tx_Command(0x29); // turn display on  
}
```

9 Dimensional drawings

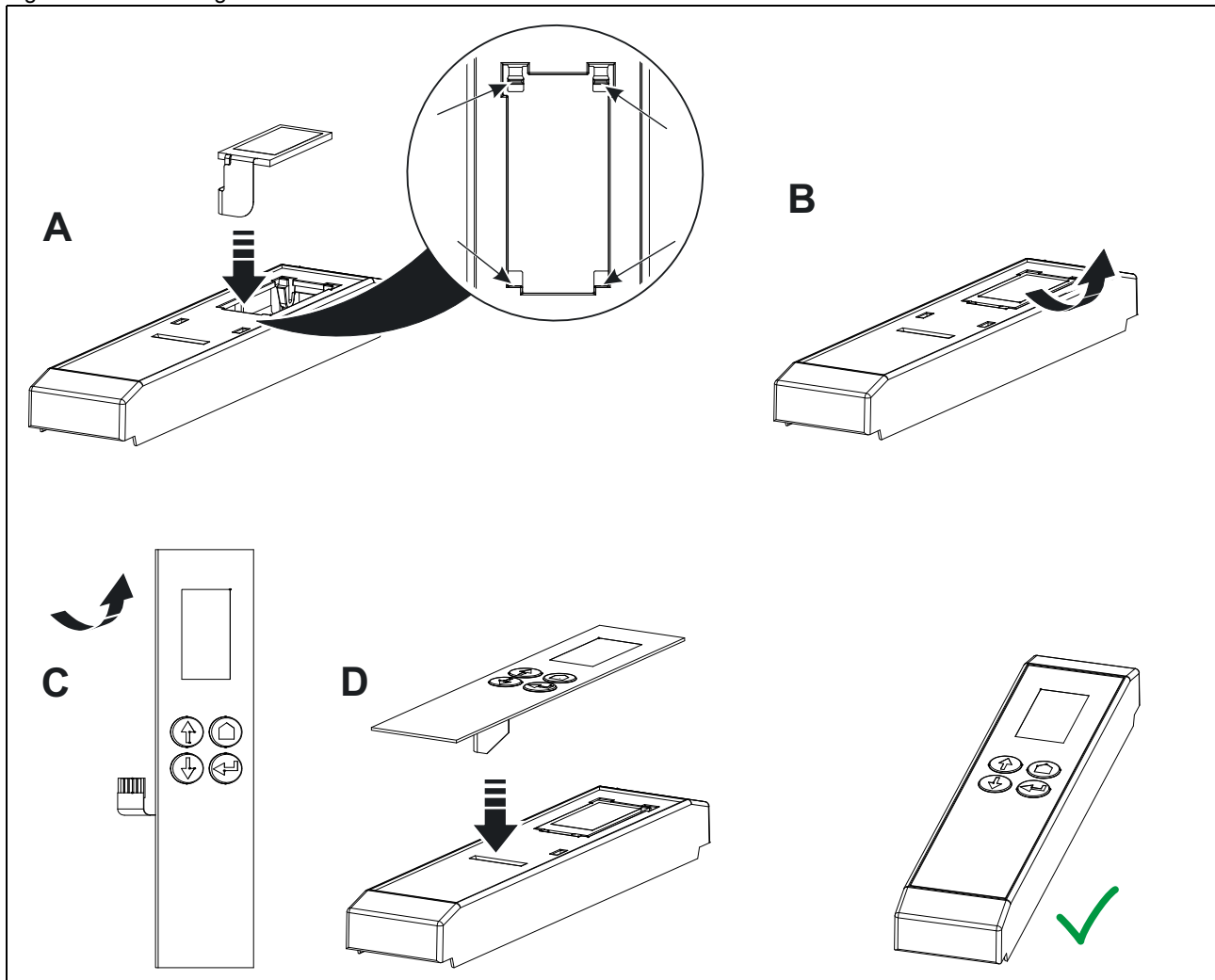
Figure 8 Dimensions



Pin	Symbol
1	GND
2	SCL
3	/RST
4	/CS
5	SDA
6	RS
7	V _{CC}
8	GND
9	C
10	A

10 Mounting the display and membrane keypad

Figure 9 Mounting



Mounting

- Feed the flat-ribbon cable from the display through the cutout on the upper housing part (A). Pay attention to the seating and contact surfaces of the display.
 - Insert the display from above.
 - Remove the foil from the display (B).
 - Remove the foil from the back of the membrane keypad (C). The foil is designed for easy removal. The foil is interrupted on the left side at the height of the opening for the display.
 - Feed the flat-ribbon cable of the membrane keypad through the slot on the upper housing part (D).
 - Adhere the membrane keypad so that it is centered in the recessed area of the upper housing part.  Attach the long side of the membrane keypad. Make sure that the display remains in position.
- ⚠ NOTE:** The flat-ribbon cable must not become deformed. Make sure that it is not bent.