GTT43A

Hardware Manual

Revision 1.5

PCB Revision: 3.0 or Higher

Revision History

Revision	Date	Description	Author
1.5	December 1st, 2016	Updated Specifications for 3.0 Release	Divino
1.4	June 30th, 2016	Changes made for the release of PCB Rev 3.0.3	Divino
1.3	July 22nd, 2014	Change to RS422 Pinout, Updated Dimensional Drawing and Header Locations image.	Martino
1.2	May 16th, 2014	Removed V3 Option	Martino
1.1	January 8th, 2014	Minor Details and Formatting	Clark
1.0	October 24th, 2013	Initial Release	Clark

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Figure 1: The GTT43A Display

1 Introduction

The Matrix Orbital GTT43A is a full colour TFT display with an integrated touch screen, crafted to become a crisp, controllable canvas for creativity. Utilizing an extended version of our widely used command library and industry standard communication protocols, the customizable GTT43A series contains an intelligent display that will quickly become the gorgeous face of your application.

2 Features

In addition to a beautiful full-colour TFT screen, seamless incorporation of a touch panel provides sleek user input while a small piezo speaker and vibratory motor can offer audio and tactile feedback for a completely interactive experience. Storage of fonts and bitmaps within the swappable onboard SD memory card allows for a co-ordinated appearance in any design.

The elegant simplicity of the familiar Matrix Orbital command structure now provides updates to the user and optional flow control for full two-way communication. Also new are animations, full-colour graphs, automated display initialization, and field upgradeability.

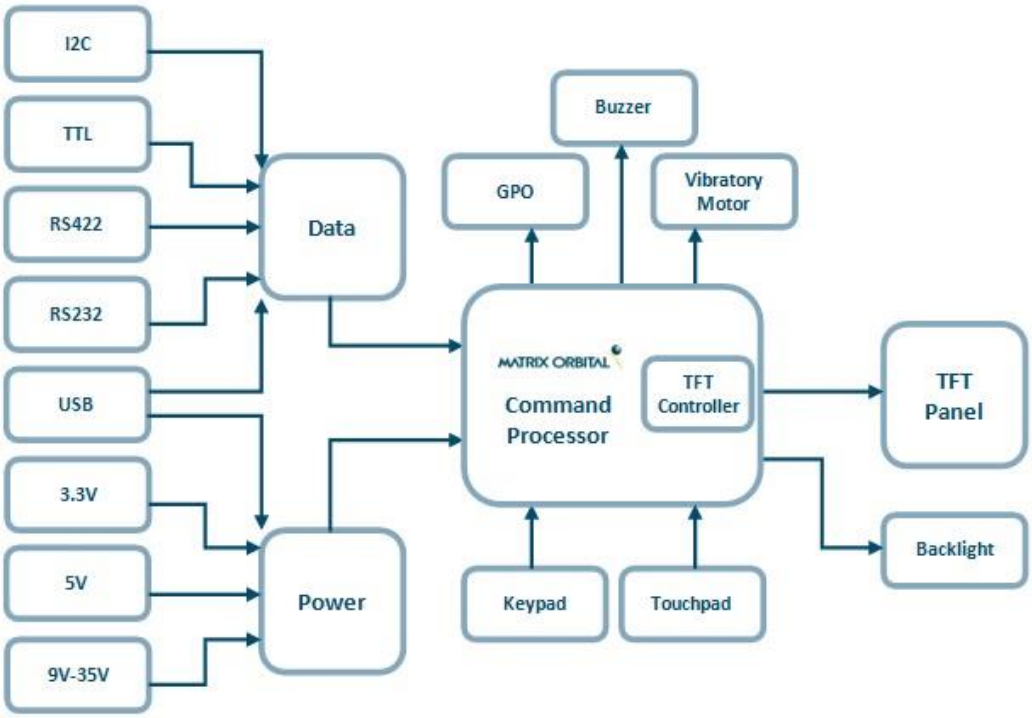

Figure 2: Functional Diagram

Available flow controlled RS232 and TTL interfaces, as well as an I^2C protocol provide versatile communication schemes, while USB and RS422 versions ensure that any controller can have a beautiful user interface. Scorching fast communication speeds, up to 256kbps in serial modes and 400kHz in I2C, ensure important information is relayed on time.

3 Ordering

The innovative GTT43A, with all of the features mentioned above, is available in various voltage and communication options to provide a sleek touch of creativity to any project.

3.1 Ordering Part Numbering Scheme

Table 1: Part Numbering Scheme

GTT	43	A	-TPR	-BLS	-B0	-H1	-CU	-V5
1	2	3	4	5	6	7	8	9

3.2 Options

Table 2: Display Options

#	Designator	Options
1	Product Type	GTT: Graphic TFT Display
2	Display Size	43: 4.3"
3	Screen Type	A: A Type
4	Touch	-TPN: No touch panel -TPR: Resistive touch panel -TPC: Capacitive touch panel
5	Backlight	-BLS: Brightness < 300 Nit -BLM: 300 Nit < Brightness < 600 Nit -BLH: 600 Nit < Brightness < 1000 Nit -BLD: Brightness > 1000 Nit
6	Bezel	-B0: None
7	Headers	-H0: No Connectors -H1: Standard Connectors -H2: Locking Connectors -H3: Right Angle, Locking Connectors -H4: Terminal Blocks
8	Protocol	-CS: RS232 Model -CT: TTL Model -CU: USB Model -C4: RS422 Model -CE: Ethernet Model -CC: CAN Model -CI: I2C Model
9	Voltage	-V5: 5.0V Input Voltage -VPT: Regulated 9V-35V Input Voltage

***Note:** All options may not be available, please consult www.matrixorbital.com for a list of purchasable products.

3.3 Recommended Parts

Serial Communication

Figure 3: ESCCPC5V

The most common cable choice for the any GTT display, the Extended Communication/ Power Cable offers a simple connection to the unit with familiar interfaces. A DB9 and floppy power header provide all necessary input to communicate to and power your display.

I2C Communication

Figure 4: BBC

For a more flexible interface to the GTT, especially with the I^2C protocol, a Breadboard Cable may be used. This provides a simple four wire connection that is popular among developers for its ease of use in a breadboard environment.

USB Communication

Figure 5: EXTMUSB3FT

The External Mini-B USB Cable is recommended for USB communication. It will connect to the Mini-B style header on the unit and provide a connection to a regular A style USB connector, commonly found on a PC.

Power

Figure 6: PCS

The standard power cable can be used to apply power to the GTT, either in conjunction with the ESCCPC5V cable, or via a direct connection to the Alternate Power Header. It connects to a standard PC power supply.

Mass Storage

Figure 7: EXTMUSB3FT

An External Mini-B USB Cable may also be used to access data within the onboard SD card when removing the card itself is not possible. This connection also provides power to the GTT and can be more convenient than moving the SD card from one location to another.

4 Hardware

4.1 Available Headers

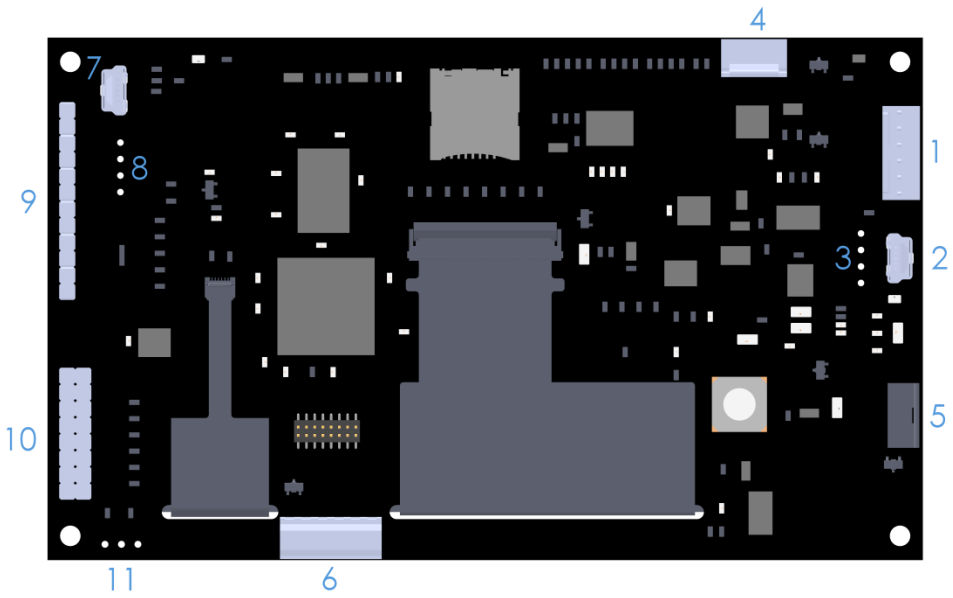

Figure 8: GTT43A Header Locations

Table 3: List of Available Headers

#	Header	Standard Mate	Population
1	Extended Serial Communication & Power	ESCCPC5V, ISCCPC5V	RS232/TTL Models Only
2	USB Communication & Power	EXTPUSB6FT	USB Model Only
3	Alternate USB	None Offered	Custom Only
4	I2C Communication & Power	BBC	All Models
5	Alternate Power	PCS	USB Model Only
6	RS422 Communication & Power	16-30 AWG Wire	RS422 Model Only
7	Mass Storage	EXTPUSB6FT	All Models
8	Alternate Mass Storage	None Offered	Custom Only
9	Keypad	KPP4x4	All Models
10	GPO	None Offered	All Models
11	Mass Storage Selector	Jumper	All Models

4.2 Extended Serial Communication/Power Header

The communication/power header provides an interface for the two most common GTT43A protocols: RS232 and TTL. With the ability to connect to a PC serial port or microcontroller and optional hardware flow control, this is the most versatile header available on the GTT43A.

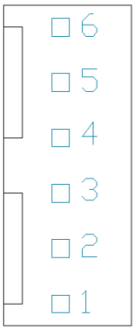

Figure 9: Extended Communication/Power Header

Table 4: Extended Communication/Power Pinout

Pin	Function
6	RTS
5	CTS
4	Gnd
3	Tx
2	Rx
1	Vcc

Voltage is applied through pins one and four of the header, please reference electrical specifications before applying power. Pins two and three are reserved for serial transmission using either RS-232/TTL levels, depending on what model has been ordered. Finally, pins five and six are used for optional hardware flow control. The Serial Molex 22-04-1061 style header used can be mated to a number of connectors, including a 22-01-1062.

4.3 Mini-B USB Communication Connector

USB protocol offers an easy connection to any host computer. The simple and widely available protocol can be accessed using the familiar Mini-B USB connector to fulfill both communication and power needs.

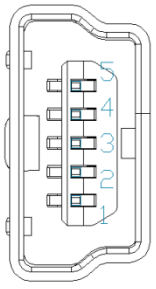

Figure 10: Mini USB Connector

Table 5: Mini USB Pinout

Pin	Function
1	Vcc
2	D-
3	D+
5	Gnd

The USB model can be connected to virtually any USB host using the appropriate cable, and additional power may be supplied through the alternate power header if necessary. Most commonly used with a PC, this connection creates a virtual com port that offers a simple power solution with a familiar communication scheme.

4.1 Alternate Power Connector

The Alternate Power Connector provides the ability to power the GTT43A using an alternate cable*. This feature can supply additional power to the GTT that your USB connection alone cannot provide, especially when peripherals such as the piezo buzzer, motor and GPOs are used.

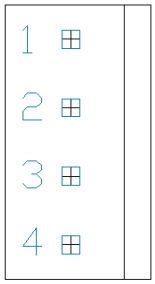

Figure 11: Alternate Power Connector

Table 6: Alternate Power Pinout

Pin	Function
1	5V
2	Gnd
3	Gnd
4	NC**

The standard Tyco 171825-4 style header is particularly useful for connecting to an unmodified floppy power cable, a 171822-4 for example, from a PC power supply for a simple bench power solution.

***Note:** Do Not power the GTT43A using both USB and Alternate Power connections. When using the Alternate Power connector move the 0 ohm resistor at R83 to R29. If you have any questions, please Contact a friendly Matrix Orbital support representative.

****Note:** When using a –VPT model, it may be desirable to input power to the GTT using the floppy power cable 12V connection. Please Contact a friendly Matrix Orbital support representative for modification details.

Alternate USB Communication Header

Some advanced applications may prefer the straight four pin connection offered through the optional Alternate USB Header. The Alternate USB Header may be added to the USB model for an added charge as part of a custom order. Please use the Contact section to reach Sales for additional details.

Drivers

The latest drivers are available for download in a zipped file format at www.matrixorbital.ca/drivers. To install or update the drivers installed on your PC, locate the GTT43A in your device manager, right click its' icon, select Update Driver Software, and manually point to the unzipped driver file.

4.2 I²C Communication/Power Header

A dedicated I²C header is available on all GTT43A models and provides the most basic protocol connection to the unit.

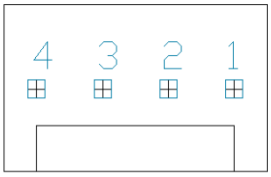

Figure 12: I²C Communication/Power Header

Table 7: I²C Communication/Power Pinout

Pin	Function
1	Vcc
2	SCL
3	SDA
4	Gnd

Voltage is applied through pins one and four of the header, please reference the electrical specifications before applying power. Pins two and three are reserved for I²C clock and data signals respectively, both of which should be pulled up to five volts using a resistance between one and ten kilohms. The Tyco 640456-4-LF style header used can be mated to a number of connectors, including Molex 22-01-3047.

4.3 RS422 Header

RS422 communication provides an industrial alternative to the standard RS232 communication protocol. Rather than single receive and transmit lines, the RS422 model uses a differential pair for each receive and transmit signals to reduce degradation and increase transmission lengths.

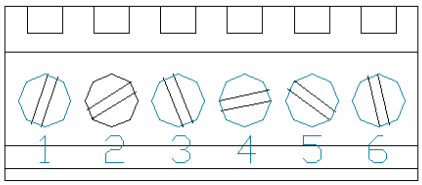

Figure 13: RS422 Header

Table 8: RS422 Pinout

Pin	Function
1	Vcc
2	Tx (A)
3	Inv Tx (B)
4	*Inv Rx (Z)
5	*Rx (Y)
6	Gnd

The six pin RS422 Header offers a power and ground connections at either end, and two differential pair communication lines in the middle. Regular and inverted lines, labelled A/B and Z/Y, are provided for receive and transmit signals. The standard Tyco 282834-6 style header populated is best mated to a sized 16 to 30 on the American Wire Gauge connections that are secured via the header screws.

***Note:** Changes made in PCB Rev. 2.2, prior to Rev. 2.2 Pin 4 was Rx (Y) and Pin 5 was Inv Rx (Z).

4.4 Mass Storage Mini-B USB Header

The GTT43A comes with a secondary Mini-B USB connector to access the SD memory card as a mass storage device for easier access to the files contained on the card.

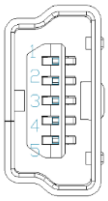

Figure 14: Mass Storage USB Connector

Table 9: Mass Storage USB Pinout

Pin	Function
1	Vcc
2	D-
3	D+
5	Gnd

The mass storage selector must be placed on the pins labelled “A” to use this function, please refer to the Mass Storage Mode section for further information.

Alternate USB Mass Storage Header

Some advanced applications may prefer the straight four pin connection offered through the optional Alternate Mass Storage Header. The Alternate Mass Storage Header may be added to the GTT43A as part of a custom order. Please use the Contact section to reach Sales for additional details.

Mass Storage Mode

Placing a jumper on the USB mass storage selector labelled “A”, the unit will appear to any PC as a mass storage device when powered, giving you access to the contents of the SD memory card directly.

When connected to the GTT Designer Tool, users will be able to place their GTT display in Mass Storage Mode using a software switch found in Designer Tools. The software switch allows users to switch between Mass Storage, and normal operating modes without having to manually reboot and reposition their jumpers.

Please note, the speed of data transfers in mass storage mode is limited, and is only intended to be used in situations where an external SD memory card reader is not available.

SD Memory Card

The SD Memory Card is used to store all user fonts, bitmaps, 9-slices, animations and start-up settings. The start-up settings are stored in a binary file called AUTOEXEC. This file contains a simple stream of characters stored just as they would be if they were sent to the display at runtime, this will store all the commands to change the initial settings for your application. Start-up settings are stored in this location alone; therefore, simply removing the AUTOEXEC file will restore the display to factory defaults.

Please refer to the Protocol Manual at http://www.matrixorbital.ca/manuals/GTT Series/ for a complete list of available commands executable not only at start up but runtime as well.

4.5 General Purpose Outputs

A unique feature of the GTT43A is the ability to control relays* and other external devices using either one of six General Purpose Outputs.

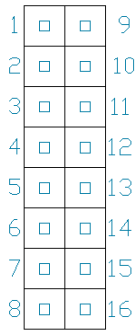

Figure 15: GPO Header

Table 10: GPO Pinout

Pin	Function	Pin	Function
1	Gnd	8	Gnd
2	GPO 1	9	Gnd
3	GPO 2	10	Gnd
4	GPO 3	11	Gnd
5	GPO 4	12	Gnd
6	GPO 5	13	Gnd
7	GPO 6	14	Gnd
8	Vcc	16	Gnd

Each can source up to 15mA of current at five volts when on, or sink 15mA at zero volts when off. The two row, fourteen pin header can be interfaced to a number of female connectors to provide control to any peripheral devices required.

4.6 Keypad Header

To facilitate user input, the GTT43A provides a Keypad Connector which allows a matrix style keypad of up to twenty-five keys to be directly connected to the display module. Key presses are generated when a short is detected between a row and a column. When a key press is generated, a character specific to that key press is automatically sent on the Tx communication line. If the display module is running in I²C mode, the key press will remain in the buffer until it is accessed using the display read address.

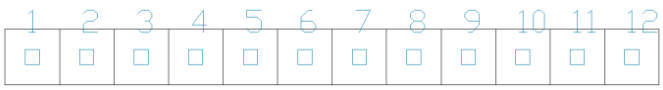

Figure 16: Keypad Header

Table 11: Keypad Pinout

Pin	Function	Pin	Function
1	Gnd	7	Column 1
2	Row 1	8	Column 2
3	Row 2	9	Column 3
4	Row 3	10	Column 4
5	Row 4	11	Column 5
6	Row 5	12	Gnd/Vcc**

The character that is associated with each key press may be altered using the “Assign Key Codes” command. The straight twelve pin header of the Keypad Interface Connector will interface to a variety of different devices including the Matrix Orbital KPP4x4 keypad.

***Note:** If connecting a relay, be sure that it is fully clamped using a diode and capacitor in order to absorb any electro-motive force (EMF) which will be generated.

****Note:** The Ground / +5V pin is toggled by the jumper to the right of the keypad connector. Jump pads 1 & 2 for +5V or 2 & 3 for GND.

5 Troubleshooting

5.1 Power

To function correctly, the GTT43A must be supplied with the appropriate power. If the power LED near the top right corner of the board is not illuminated, power is not applied correctly. Try the tips below.

- GTT devices have specific power requirements. Ensure the correct voltage and sufficient current are available to your device by consulting the Power Consumption table.
- Check the power cable which you are using for continuity. If you don't have an ohm meter, try using a different power cable, if this does not help try a different power supply.
- Check the power connector in use on your display. If the connector has become loose or you are unable to resolve the issue, please use the Contact section to reach a friendly Matrix Orbital support representative.

5.2 Display

If your display is powered successfully with an AUTOEXEC file present, the Matrix Orbital logo or user specified screen should display briefly on start up. If this is not the case, check out these tips.

- If any start-up issues are encountered, it is recommended that you remove the AUTOEXEC file from the SD card to allow the unit to start with factory defaults.

5.3 Communication

When communication of either text or commands is interrupted, try the steps below.

- First, check the communication cable for continuity. If you don't have an ohm meter, try using a different communication cable. If you are using a PC try using a different Com Port.
- In USB protocol, ensure that a connection is made to the header labelled USB, not Mass Storage and check that the mode selection jumper is not placed on the “A” side.
- In serial protocol, ensure that the host system and display module are both communicating on the same baud rate. The default baud rate for the display module is 115,200 bps.
- Match Rx from the display to the transmit pin from your host and the Tx pin to receive.
- If you are communicating to the display via I²C* please ensure that the data is being sent to the correct address. The default slave address is decimal 80 (0x50 hex).
- In I²C mode, connect SDA to the data line of your controller and SCL to the clock output.

5.4 Factory Defaults

If the settings of your display become altered in a way that dramatically impacts usability, the default settings can be restored simply by removing the AUTOEXEC file in the memory card’s root directory. This will remove the start screen and reset the baud rate to 115,200. If the Matrix Orbital start screen is desired, default files are available at www.matrixorbital.ca/manuals/GTT_Series/GTT_Example_Files.

***Note:** I²C communication will always require pull up resistors on SCL and SDA of one to ten kilohms.

6 Appendix

6.1 Dimensional Drawing

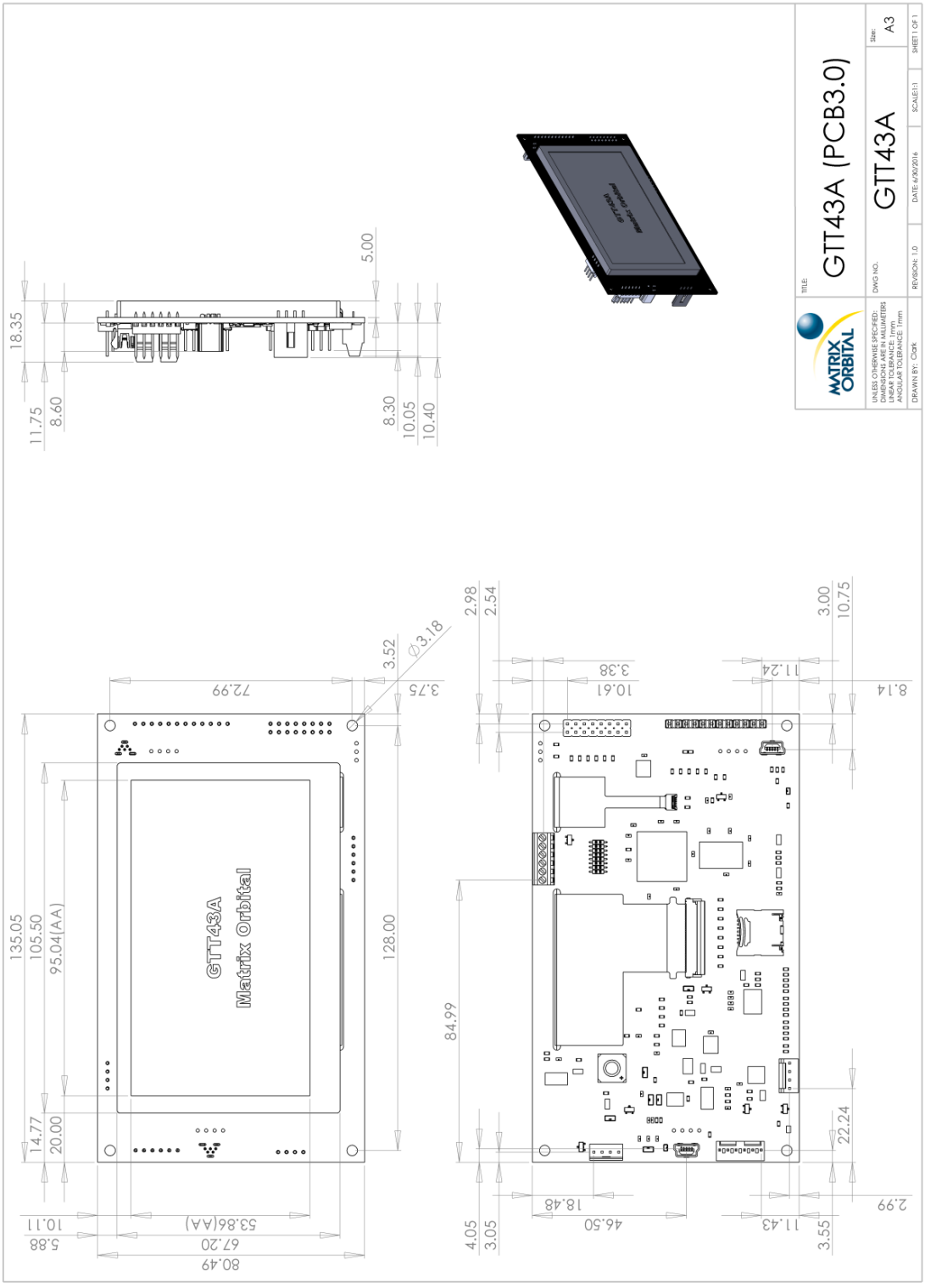

Figure 17: GTT43A Drawing

6.2 Power Consumption

Table 12: Required Supply Voltage

Parameter	Min	Typ	Max	Unit	Remarks
Supply Voltage	4.75	5.0	5.25	V	Standard Voltage (V5)
	9.0	12.0	35.0	V	Wide Voltage (VPT)

Table 13: Operating Current Draw

Parameter	Min	Typ	Max	Unit	Remarks
Logic	-	275	-	mA	Backlight Off
Backlight	0	105	190	mA	Off, Mid, Max
Piezo	-	80	-	mA	Burst
Motor	-	190	-	mA	Burst
GPO	-	-	15	mA	Each

6.3 Environmental

Table 14: Environmental Specifications

Operating Temperature	-20°C to +70°C
Storage Temperature	-30°C to +80°C
Operating Relative Humidity*	95% (T < 40°C) 85% (40°C < T < 50°C)

***Note:** No condensation at any temperature

6.4 Touch Specifications

Table 15: Resistive Touch Screen Attributes

Hardness	3.0	H
Active Area	96.70 x 55.50	mm
Transparency	80%	
Required Force	1.177	N

Table 16: Capacitive Touch Screen Attributes

Hardness	6.0	H
Active Area	96.04 x 54.86	mm
Transparency	86%	

6.5 Optical Characteristics

Table 17: Optical Characteristics

Module Size	135.1 x 80.5 x 17.1	mm
Viewing Area	98.70 x 57.50	mm
Active Area	93.04 x 53.86	mm
Pixel Pattern	480 x RGB x 272	
Dot Pitch	0.198 x 0.198	mm
Luminance	472	NIts
Viewing Angle	70° Up ,Left, Right 50° Down	
Contrast Ratio	500:1	

6.6 ESD Performance

Table 18: ESD Resistance Data

Component	Value	Unit	Remarks
Serial Translator (RS232, RS422)	±15	kV	Human Body Model
	±15	kV	Air Gap (IEC 1000-4-2)
	±8	kV	Contact (IEC 1000-4-2)
Controller (I^2C, TTL)	±4	kV	Human Body Model

6.7 Electrical Characteristics

Absolute Maximum Ratings

Table 19: GTT43A Limiting Values

Parameter	Min	Max	Unit	Remarks
Supply Voltage	-0.5	6	V	Standard Voltage (V5) Option
	-0.5	35	V	Extended Wide Voltage (VPT) Option
RS232 Pins	-25	25	V	Input Signals
	-13.2	13.2	V	Output Signals
RS422 Pins	-13	13	V	Inverting and Non, Input and Output Signals
I2C/TTL pins	-0.5	3.6	V	SCL, SDA, Input and Output Signals
USB Pins	-0.5	3.8	V	Input and Output Signals

Communication Characteristics

Table 20: RS232 Interface Characteristics

Parameter	Min	Typ	Max	Unit
Input Threshold Low	0.6	1.2	-	V
Input Threshold High	-	1.5	2.4	V
Output Voltage Swing	±5.0	±5.4	-	V
Input Resistance	3	5	7	kΩ
Output Resistance	300	10M	-	Ω
Output Short Circuit Current	-	±35	±60	mA

Table 21: USB Interface Characteristics

Parameter	Min	Typ	Max	Unit
Static Output High	2.8	-	3.6	V
Static Output Low	-	-	0.3	V
Input Differential Threshold	0.2	-	-	V
Common Mode Output Voltage	0.8	-	2.5	V
Driver Output Impedance	26	29	44	Ω

Table 22: I^2C Interface Characteristics

Parameter	Min	Typ	Max	Unit
Input Threshold Low	-	0	1.0	V
Input Threshold High	2.3	3.3	3.6	V
Output Voltage Low	-	0	0.4	V
Output Short Circuit Current	-	-	±50	mA

Table 23: TTL Interface Characteristics

Parameter	Min	Typ	Max	nit
Input Threshold Low	-	0	1.0	V
Input Threshold High	2.3	3.3	3.6	V
Output Voltage Low	-	0	0.4	V
Output Voltage High	2.9	3	3.3	V
Output Short Circuit Current	-	-	±50	mA

Table 24: RS422 Interface Characteristics

Parameter	Min	Typ	Max	Unit	Remarks
Input Voltage (A and B)	-7.0	-	12.0	V	
Input Differential Threshold	-200	-125	-50	mV	-7V < Vin < +12V
Differential Driver Output	2	-	3.3	V	RL = 100Ω
Common Mode Output Voltage	-	1.65	3	V	
Input Resistance	96	-	-	kΩ	-7V < Vin < +12V
Driver Short Circuit Current Limit	-	-	250	mA	
Receiver Output Short Circuit Current	-	-	95	mA	

6.8 Defect Criteria

Display Specifications

Table 25: Display Defect Criteria

Item/LCD size	Criteria
Color bad dot-bright dot(R,G,B)	1
Two adjacent bright points	0
Three or more adjacent points	0
Total points for bright dot faults	1
Bad dot – Dark dot	2
Two adjacent dark points	1
Three or more adjacent point	0
Total points for dark dot faults	3

Appearance Specifications

Table 26: Screen and Touch Defect Criteria

Defect*	Condition	Criteria
Dot defect	D ≤ 0.1mm	Allowed
	0.1mm < D ≤ 0.2mm	4
	0.2mm < D ≤ 0.3mm	0
	0.3mm < D ≤ 0.5mm	0
	D > 0.5mm	0
Line defect	W ≤ 0.05mm	Allowed
	L ≤ 5mm, 0.05mm < W ≤ 0.1mm	4
	L > 5mm, W > 0.1mm	0

***Note:** Defects must occur in Active Area

7 Definitions

9-Slice: Graphic format used to scale bitmaps, usually rectangular, without distorting their geometry. Nine regions define the object center, four corners, and four sides for accurate up or down scaling.

ASCII: American standard code for information interchange used to give standardized numeric codes to alphanumeric characters.

BPS: Bits per second, a measure of transmission speed.

GUI: Graphical user interface.

Hexadecimal: A base 16 number system utilizing symbols 0 through F to represent the values 0-15.

I^2C: Inter-integrated circuit protocol uses clock and data lines to communicate short distances at slow speeds from a master to up to 128 addressable slave devices. A display is a slave device.

LSB: Least significant bit or byte in a transmission, the rightmost when read.

MSB: Most significant bit or byte in a transmission, the leftmost when read.

RS232: Recommended standard 232, a common serial protocol. Logic levels can be as high as +/-30V, a high level is negative, a low is positive.

RS422: Recommended standard 422, a more robust differential pair serial protocol.

SDA: Serial data line used to transfer data in I^2C protocol. This open drain line should be pulled high through a resistor. Nominal values are between 1K and 10K Ω.

SCL: Serial clock line used to designate data bits in I^2C protocol. This open drain line should be pulled high through a resistor. Nominal values are between 1K and 10K Ω.

TTL: Transistor-transistor logic applied to serial protocol. Low level is 0V while high logic is 5V.

USB: Universal Serial Bus protocol widely used in PCs.

8 Contact

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LifeElectronics
Живое партнерство

ООО «ЛайфЭлектроникс» **“LifeElectronics” LLC**

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

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