TC55149S CONTROLLER

USER MANUAL

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TOUCH SCREEN LCD MODULE HANDLING PRECAUTIONS

The following precautions will guide you in handling of our product correctly:

1. Liquid crystal display devices:
   1.1. The liquid crystal display device panel used in the liquid crystal display module is made of plate glass. Avoid any strong mechanical shock on LCD and touch screen. Should the glass break, handle it with care.
   1.2. The polarizer adhering to the surface of the LCD is made of a soft material. Guard against scratching it.
   1.3. Wash your hands or clothes if you touch liquid crystal!

2. Avoid Static electricity!
   2.1. When working with the module, use your naked or gloved hand and wear non-conductive work suit to prevent generating static electricity by friction. ESD ground straps should be utilized.
   2.2. Be sure to ground any electrical appliances you may be using, such as soldering iron, cutting pliers, tweezers, etc.
   2.3. Floors, doors, and work tables must be grounded to discharge electricity.

3. When the LCD module alone must be stored for long periods of time:
   3.1. Protect the modules from high temperature and humidity.
   3.2. Keep the modules out of direct sunlight or direct exposure to ultraviolet rays.
   3.3. Protect the modules from excessive external forces.

4. Use the module with a power supply that is equipped with an over current protector circuit, since the module is not provided with this protective feature.

5. Do not ingest the LCD fluid itself should it leak out of a damaged LCD module. Should hands or clothing come in contact with LCD fluid, wash immediately with soap.

6. Conductivity is not guaranteed for models that use metal holders where solder connections between the metal holder and the PCB are not used.

7. Do not stack up modules since they can be damaged by components on neighboring modules.

8. Do not place heavy objects on top of the product. This could cause glass breakage.

9. Do not scratch LCD or touch screen!

10. In order to maintain module reliability, do not touch or hold by the connector area.

11. Avoid any bending, pulling, or other excessive force on flexible cables, which can result in broken connections.

PREFACE

About This Manual

This user's manual describes the function and operation of the TC55149S controller Firmware rev 1.0 and higher. This manual will help you quickly set up the touch screen controller evaluation board and its accompanying software, so that you can rapidly test and evaluate their usefulness for your application.

If You Need an Assistance

If you have any questions about this evaluation board, feel free to e−mail TVI Electronics Support Team at support@tvielectronics.com. Include the product name in the subject heading.

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Notice to Users

When a system failure may cause serious consequences, protecting life and property against such consequences with a backup system or safety device is essential. The user agrees that protection against consequences resulting from system failure is the user's responsibility. This device is not approved for life-support or medical systems.

DOCUMENT CONVENTIONS

The following icons are used as necessary to distinguish elements of text.

NOTE. Notes emphasize additional information that may be useful to the reader.

CAUTION. Describes a situation or practice that requires operator awareness or action in order to avoid undesirable consequences.

MANDATORY ACTION. Gives directions that, if not observed, could result in loss of data or in damage to equipment.

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EXAMPLES

1. FUNCTIONS AND STRUCTURE

1.1. GENERAL

The TC55149S is an intelligent LCD controller with an integrated touch screen control that supports Kyocera Display (former Optrex) T-55149 240x400 TFT Transflective Graphic LCDs. This controller allows user to individually control each display pixel. This independent pixel control allows user displaying both text and graphics simultaneously. The TC55149S utilizes AT32UC3B0256 microcontroller and external 64Mbit serial flash. The device can be used as an "intelligent" LCD controller or as stand-alone controller. There is enough of flash and RAM memory in the controller on board to incorporate additional graphical commands or to customize the firmware for particular tasks.

1.2. FEATURES

1.2.1. Serial (RS-232 or USB) communication interface with seven programmable baud rates

The serial parameters for communication between the TC55149S controller and the host are as follows:
Baud Rate: 9600, 14400, 19200, 28800, 38400, 57600 or 115200 bps (default)
Parity: None
Data Bits: 8
Stop Bits: 1

1.2.2. 64Mbit external flash memory

TC55149S has 64Mbit of flash memory for fonts, bitmaps and images storage. The external flash memory is capable to save up to 43 (240x400) screen images. A utility program allows user to save 240x400 pixels *.bmp, *.jpg and *.gif patterns to memory.

1.2.3. Voltage regulator

The TC55149S has a built-in voltage regulator with input 5-15 VDC, connector J8 or J7 optional. 3.3V power may be applied to J10 eliminating the need for an onboard voltage regulator.

1.2.4. Touch screen controller

The TC55149S controller utilizes the AD7147 CapTouch™ controller and allows touch screen to operate as a multi-touch keypad by sending pressed keypad ids to host microprocessor or PC. The touch screen is divided into 12 rectangles.

1.2.5. *Draw line/rectangle/circle*

The TC55149S controller simplifies drawing of horizontal, vertical and skew lines, pixels and shapes, such as rectangles and circles.

1.2.6. *Fonts*

The TC55149S controller supports 3 user-selectable fonts and 1 system font. The imported font size should not exceed the maximum character size, which is 48 pixels high. Use TVI Electronics utility program to convert and save computer fonts to the controller flash memory.

1.2.7. *180° screen rotation*

The TC55149S controller allows 180° screen rotation. A screen rotation is saved in the controller's memory and will default after power on.

1.2.8. *Portrait / landscape screen orientation*

The TC55149S controller allows portrait / landscape screen orientation. A screen orientation is saved in the controller's memory and will default after power on.

1.2.9. *Firmware update*

The TC55149S controller's firmware can be updated through the USB port.

1.3. POWER REQUIREMENTS

Power to the TC55149S is derived from the external power supply through J7, J8, J10 or J11 connectors. Voltages of 5-15VDC must be supplied through J7 or J8 connectors. Since it is regulated on the TC55149S, this input voltage does not need to be regulated as long as it falls within this range. Voltage of 3.3VDC must be supplied through J10 and should be regulated. Powering up the controller from J7 or J8 will require installation of a jumper on J12. Powering up the controller from J11 (USB) will require installation of two jumpers on J12. Powering up the controller from J10 (3.3VDC) will require installation of a jumper on J12. See Table 3-2.

Do not reverse the polarity on the power inputs. Doing so will permanently damage the controller board and void the warranty.

Do not install J12 "USB" jumper if using external power from J7 or J8 connectors. Doing so will permanently damage the controller board and/or PC and void the warranty.

2. GETTING STARTED

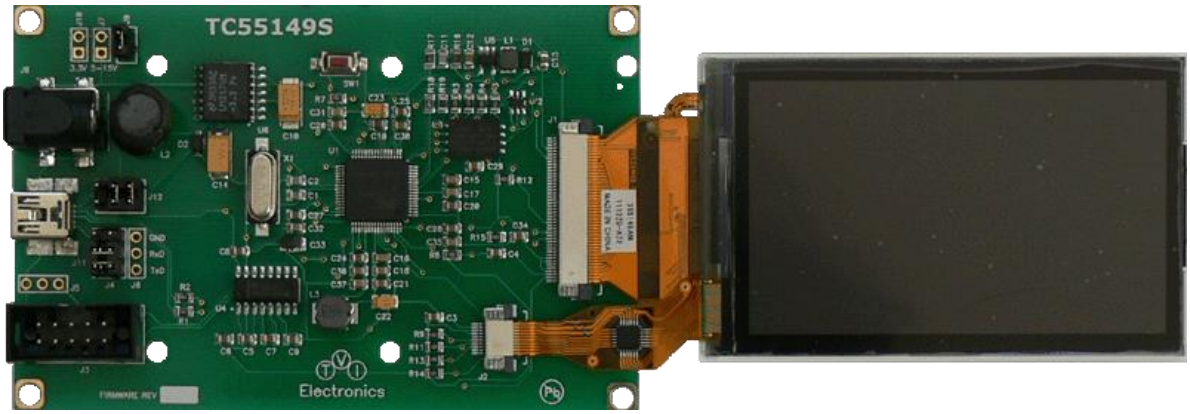
This chapter guides you through the hardware connection, powering up the TC55149S controller and setting up the software for initial testing.

2.1. HARDWARE CONNECTION

Carefully open the LCD connector latch J1 by pulling the brown latch upwards. Insert the flat data cable contacts side up into the connector being sure the cable is fully seated, push the latch back in being sure the cable is pushed all the way in.

If you have a touch screen carefully pull the latch on connector J2 out. Insert the touch screen cable into J2 being sure it is seated, push the latch back in.

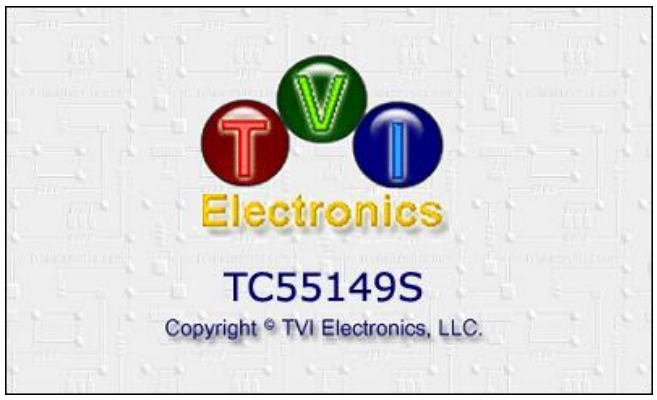
Figure 2-1: Hardware Connection



2.2. POWER UP

To power up the controller follow the instructions in paragraph 1.3. The controller will display a power up screen#1 each time it is powered up. The power up screen can be customized through the GUI Manager software. The factory default (0° rotation, landscape orientation) will show TVI Electronics logo and current controller firmware revision as shown on Default Power-Up Screen below.

Example 2-1: Default Power-Up Screen



2.3. QUICK START

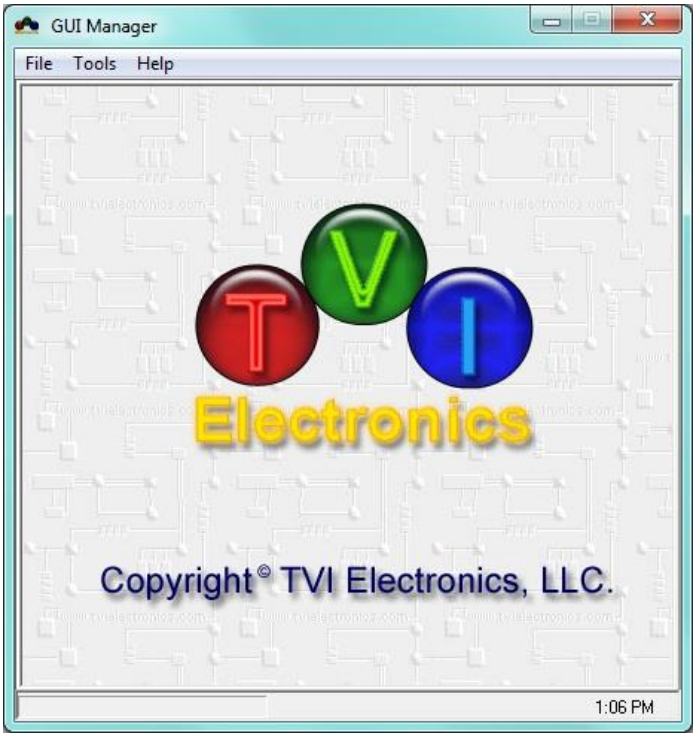
Install the GUI Manager software on your PC. A serial connection is required between the TC55149S controller board and PC in order to communicate with the controller.

You can use a USB to serial converter if your PC doesn't have a serial port or connect directly to a USB port.

Once the connection with the TC55149S controller is established launch the GUI Manager software on your PC. Bring up Communication utility (accessed from the "File" menu), select COM Port, Baud Rate (default 115200) and click "Connect" button. Now you may begin using the software to evaluate the TC55149S controller board.

For communication through the USB port, installation of the USB Communications Device Class (CDC) driver is required before you can start evaluating the TC55149S controller board.

Figure 2-2: Startup Screen



3.OPERATION

This chapter describes each function of the TC55149S LCD controller.

3.1. TC55149S CONTROLLER JUMPERS AND SWITCHES

Figure 3-1: TC55149S Controller Board Layout

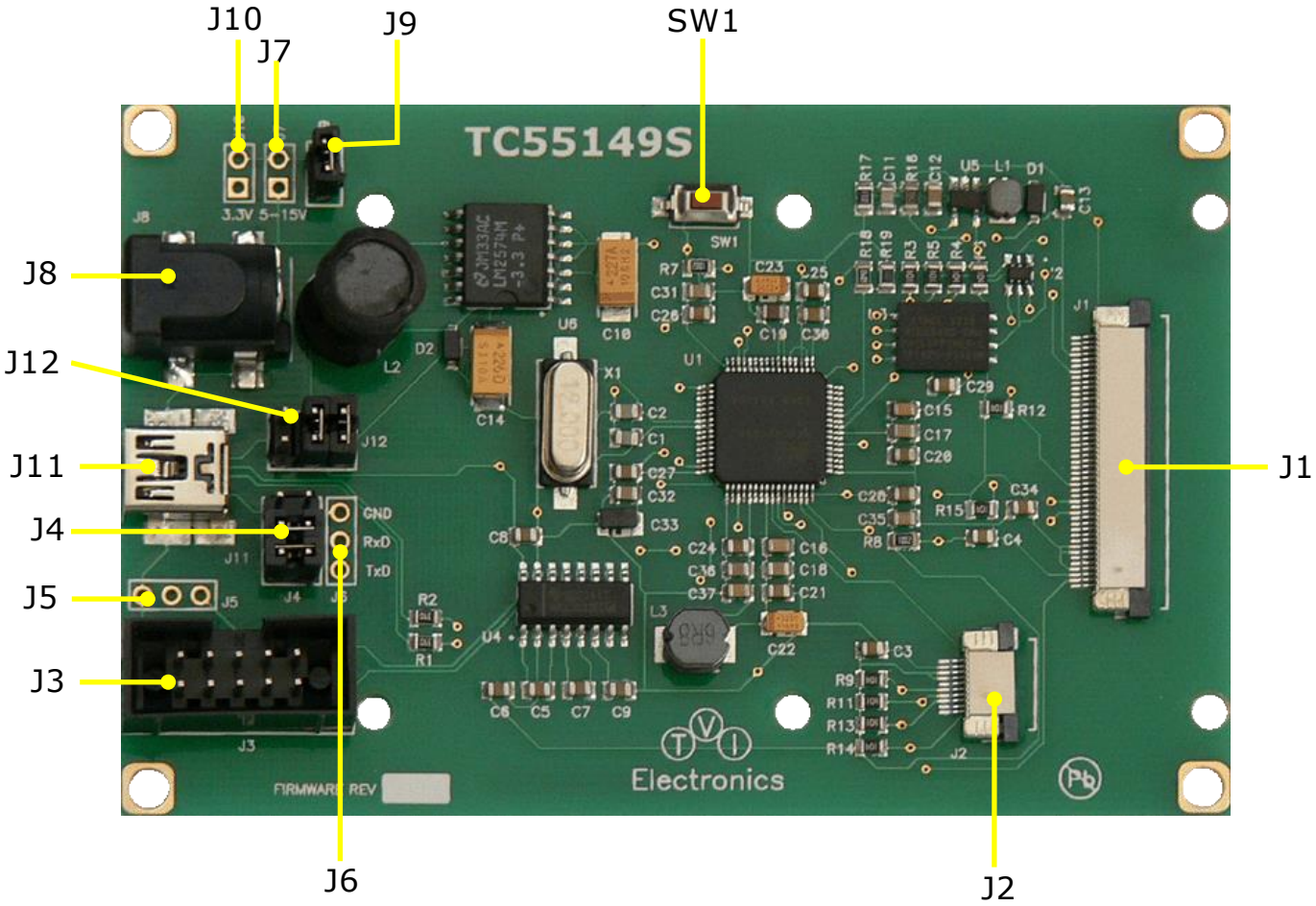


Figure 3-2: J4 Jumpers

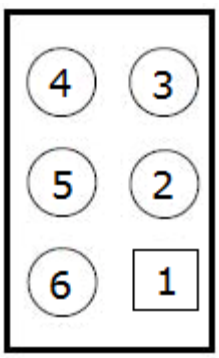


Figure 3-3: J12 Jumpers

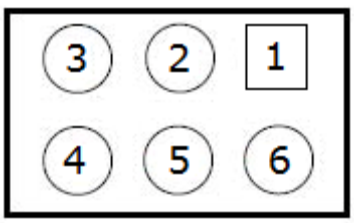


Figure 3-4: J9 Jumpers

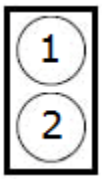


Figure 3-5: J5 Pin Out

Figure 3-6: J6 Pin Out

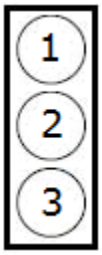


Figure 3-7: J7, J10 Pin Out

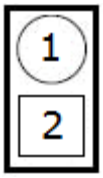


Table 3-1: J4 Jumper Descriptions

PIN #	PIN Name	Subsection
1,6	TxD	3.1.1
2,5	RxD	
3,4	GND	

Table 3-2: J12 Jumper Descriptions

PIN #	Function	Paragraph
1,6	USB Power	1.3
2,5	Unregulated Voltage	
3,4	3.3V Power	

Table 3-3: J9 Jumper Descriptions

PIN #	Function	Subsection
1,2	Default Baud Rate (115200bps)	3.1.2

Table 3-4: Headers

Reference Designator	Function
J5	RS232 Interface

Table 3-5: Connectors

Reference Designator	Function
J1	T-55149 LCD Interface
J2	Touch Screen Connector
J5	Optional RS232 Interface
J6	Optional Serial Communication
J7	Optional External 5–15 VDC Input
J8	External 5–15 VDC Input
J10	Optional External 3.3VDC Input
J11	USB Connector

Table 3-6: Switches

Reference Designator	Function	Subsection
SW1	Programming	3.1.3

Table 3-7: J5 Pin Descriptions

PIN Name	PIN #	Type	Description
GND	1	PWR	Power Ground
TD	2	DOUT	RS232 Transmitter Output. This pin should be connected to the host RS232 RD.
RD	3	DIN	RS232 Receiver Input. This pin should be connected to the host RS232 TD.

Table 3-8: J6 Pin Descriptions

PIN Name	PIN #	Type	Description
GND	1	PWR	Power Ground
RxD	2	DIN	UART Receiver Input. This pin should be connected to the host UART TxD.
TxD	3	DOUT	UART Transmitter Output. This pin should be connected to the host UART RxD.

Table 3-9: J7 Pin Descriptions

PIN Name	PIN #	Type	Tolerance	Description
GND	1	PWR	0V	Power Ground
V+	2	PWR	5-15V	+5-15V Power Input

Table 3-10: J10 Pin Descriptions

PIN Name	PIN #	Type	Tolerance	Description
GND	1	PWR	0V	Power Ground
V+	2	PWR	3.3V	3.3V Power Input

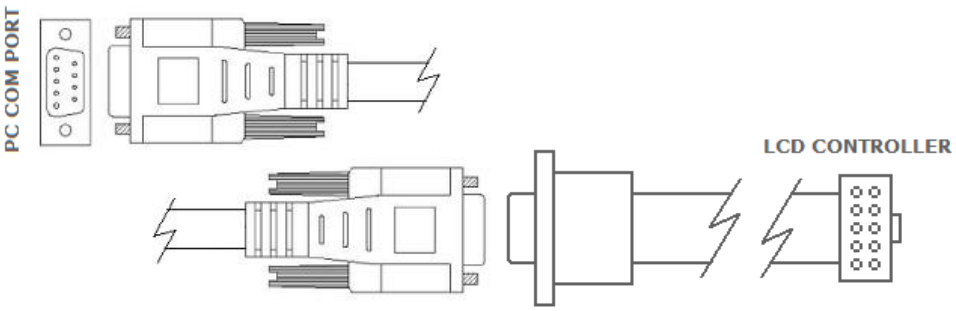
3.1.1. Serial Communication

RS232 communication through J3 header requires DB9MF serial cable and DB-9 to 10 Pin IDC adapter.

This requires installation of the jumpers on J4 Pins 1,6 and 2,5 (Factory Default).

J5 can be used as an optional RS232 connector.

Figure 3-8: PC to TC55149S Controller Connection



A serial TTL interface is supplied at J6, see Table 3-8. For TTL interface, remove jumpers from J4 Pins 2,5 and 3,4.

3.1.2. Baud Rate Settings

The TC55149S controller has seven programmable baud rates (default is 115200 bit/sec). A baud rate is set by a command and stored in the flash memory.

3.1.3. Firmware Update

TC55149S controller supports firmware updates. The firmware can be updated through the USB port.

3.2. TC55149S COMMANDS LIST

Upon power-up, the controller will display screen#1 and send code 0x21 (ASCII "!") to the host. The host controller will need to wait until it receives the 0x21 code before sending another command to the controller. This will prevent the host from jamming the interface and filling the command buffer and also keep the host and LCD controller in synch.

Table 3-11: Color Data Format

	DB7	**DB6**	**DB5**	**DB4**	**DB3**	**DB2**	**DB1**	**DB0**
Byte 1	G^2	G^1	G^0	B^4	B^3	B^2	B^1	B^0
Byte 2	R^4	R^3	R^2	R^1	R^0	G^5	G^4	G^3

Table 3-12: Coordinate Data Format (Landscape)

	DB7	**DB6**	**DB5**	**DB4**	**DB3**	**DB2**	**DB1**	**DB0**
Byte 1								X^8
Byte 2	X^7	X^6	X^5	X^4	X^3	X^2	X^1	X^0
Byte 3	Y^7	Y^6	Y^5	Y^4	Y^3	Y^2	Y^1	Y^0

Table 3-13: Coordinate Data Format (Portrait)

	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Byte 1	X^7	X^6	X^5	X^4	X^3	X^2	X^1	X^0
Byte 2								Y^8
Byte 3	Y^7	Y^6	Y^5	Y^4	Y^3	Y^2	Y^1	Y^0

Table 3-14: Touch Screen Controller Data Format

	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Byte 1	0	0	0	0	K^{12}	K^{11}	K^{10}	K^9
Byte 2	K^8	K^7	K^6	K^5	K^4	K^3	K^2	K^1
Byte 3	0	0	1	0	0	1	0	0

K – Key Status

K=1: Pressed K=0: Not Pressed

Load Screen Pattern

Description	Load picture from the flash memory
Command Syntax	0x4C 0x53 0x50 "screen ID" 0x0D
Response	0x21
Note	Screen ID = 0x01 – 0x2B

Write Text

Description	Write text on the screen with the selected font from current cursor position
Command Syntax	0x57 0x54 "color" "font" 0x0D "wait" "text" 0x0D
Response	0x21
Note	Color: 16 bit see Table 3-11 Font 1: 0x31, Font 2: 0x32, Font 3: 0x33, System font: 0x53 Wait: wait for the controller response with code 0x21 Text: ASCII string

Draw Pixel

Description	Change color of the specified pixel
Command Syntax	0x44 0x50 "coordinate" "color" 0x0D
Response	0x21
Note	Coordinate: for Landscape see Table 3-12, for Portrait see Table 3-13 Color: 16 bit, see Table 3-11

Set Cursor

Description	Set cursor to the specified XY location
Command Syntax	0x53 0x43 "coordinate" 0x0D
Response	0x21
Note	Coordinate: for Landscape see Table 3-12, for Portrait see Table 3-13

Draw Line

Description	Draw line with the selected color from one point to another
Command Syntax	0x44 0x4C “start coordinate” “end coordinate” “color” 0x0D
Response	0x21
Note	Coordinate: for Landscape see Table 3-12, for Portrait see Table 3-13 Color: 16 bit, see Table 3-11

Draw Rectangle

Description	Draw rectangle outline with the selected color from upper left corner to lower right corner
Command Syntax	0x44 0x52 “upper left coordinate” “lower right coordinate” “color” 0x0D
Response	0x21
Note	Coordinate: for Landscape see Table 3-12, for Portrait see Table 3-13 Color: 16 bit, see Table 3-11

Fill Rectangle

Description	Fill rectangle with the selected color from upper left corner to lower right corner
Command Syntax	0x46 0x52 “upper left coordinate” “lower right coordinate” “color” 0x0D
Response	0x21
Note	Coordinate: for Landscape see Table 3-12, for Portrait see Table 3-13 Color: 16 bit, see Table 3-11

Draw Circle

Description	Draw circle outline with the selected color from XY coordinate (central point) with radius
Command Syntax	0x44 0x43 "center coordinate" "radius" “color” 0x0D
Response	0x21
Note	Coordinate: for Landscape see Table 3-12, for Portrait see Table 3-13 Radius: 8 bit Color: 16 bit, see Table 3-11

Fill Circle

Description	Fill circle with the selected color from XY coordinate (central point) with radius
Command Syntax	0x46 0x43 "center coordinate" "radius" “color” 0x0D
Response	0x21
Note	Coordinate: for Landscape see Table 3-12, for Portrait see Table 3-13 Radius: 8 bit Color: 16 bit, see Table 3-11

Fill Screen

Description	Fill the entire screen with color
Command Syntax	0x46 0x53 "color" 0x0D
Response	0x21
Note	Color: 16 bit, see Table 3-11

Touch Screen Calibration

Description	Activate touch screen calibration routine
Command Syntax	0x54 0x43 0x0D
Response	0x21
Note	

Load Keypad

Description	Load built-in 3x4 (Portrait) or 4x3 (Landscape) Keypad
Command Syntax	0x4C 0x4B 0x0D
Response	0x21
Note	See Table 3-14

Keypad Enable

Description	Enable touch screen response in keypad mode
Command Syntax	0x4B 0x45 0x0D
Response	0x21
Note	See Table 3-14

Keypad Disable

Description	Disable touch screen response in keypad mode
Command Syntax	0x4B 0x44 0x0D
Response	0x21
Note	See Table 3-14

Back Light

Description	Turn the display backlight ON or OFF
Command Syntax	0x42 0x4C "on/off" 0x0D
Response	0x21
Note	On: 0x31, Off: 0x30

Screen Orientation

Description	Set screen orientation to landscape or portrait and screen rotation to 0° or 180°
Command Syntax	0x53 0x4F "settings" 0x0D
Response	
Note	Settings: Portrait 0° - 0x31, Portrait 180° - 0x32, Landscape 0° - 0x33, Landscape 180° - 0x34

Change Baud Rate

Description	Set the specified baud rate
Command Syntax	0x43 0x42 "baud rate" 0x0D
Response	
Note	Baud rate: 9600 – 0x30, 14400 – 0x31, 19200 – 0x32, 28800 – 0x33, 38400 – 0x34, 57600 – 0x35, 115200 – 0x36

Power Save

Description	Turn the display backlight and LCD ON or OFF
Command Syntax	0x50 0x53 “on/off” 0x0D
Response	0x21
Note	On: 0x31, Off: 0x30

4.ELECTRICAL SPECIFICATIONS

This chapter contains the TC55149S controller board electrical specifications.

4.1. MODULE POWER CONSUMPTION

All measurements are done with T-55149GD030J-MLW-AMN LCD connected to the TC55149S controller.

Table 4-1: Electrical Specifications

Parameter	Condition	Min.	Typ.	Max.	Units
Input Current	3.3V Supply*		350	360	mA
	3.3V Supply Back Light OFF*		47		
	3.3V Supply Power Save*		39		
	5V Supply		380	390	
	5V Supply Back Light OFF		50		
	5V Supply Power Save		43		
	12V Supply		160	170	
	12V Supply Back Light OFF		22		
	12V Supply Power Save		19		

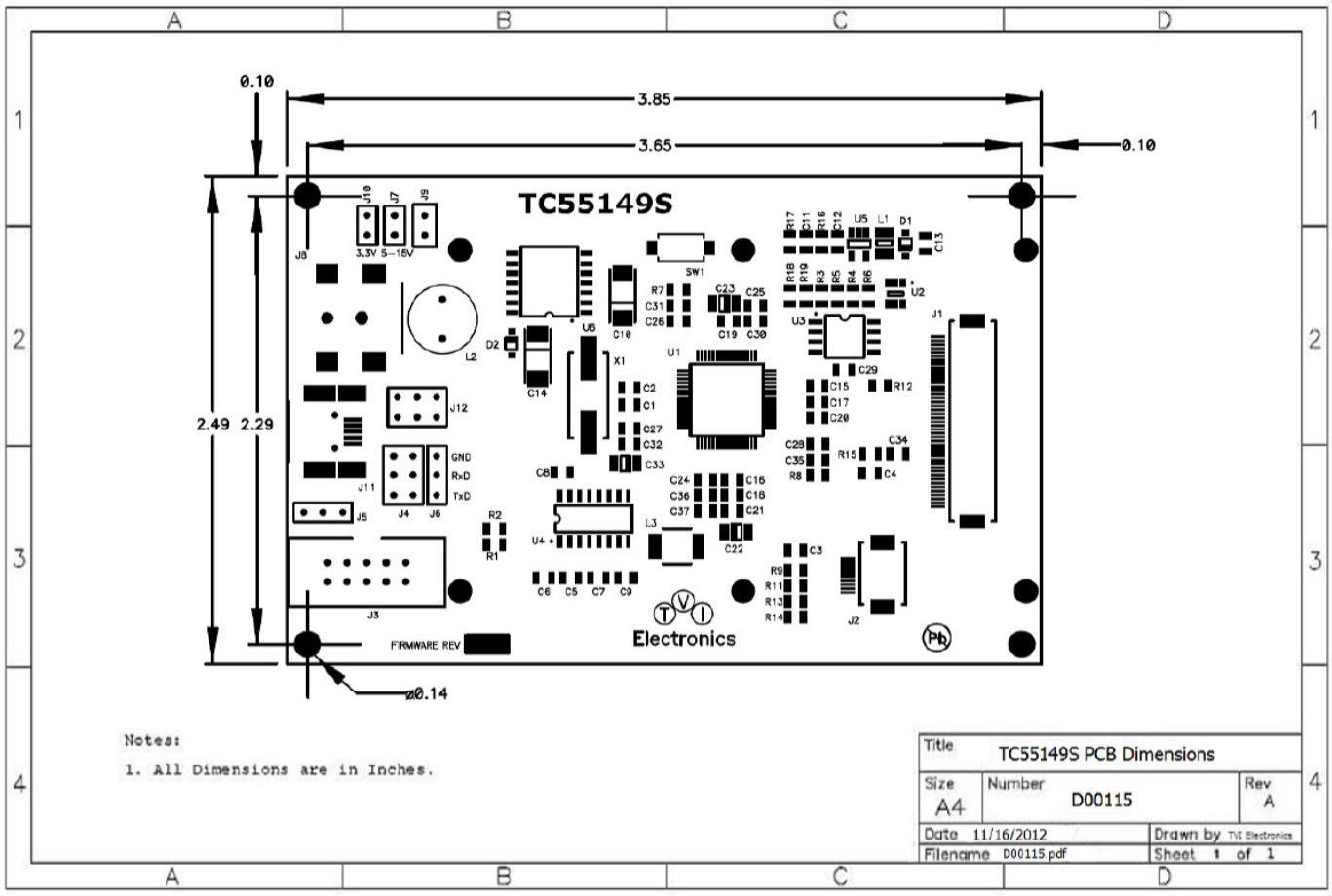
* Bypass on board voltage regulator

4.2. TC55149S CONTROLLER OPERATING TEMPERATURE

The TC55149S controller is rated for commercial temperature operation of -20ºC to 70ºC.

5.MECHANICAL SPECIFICATIONS

This chapter contains the TC55149S controller board mechanical specifications.



5.1. TC55149S CONTROLLER PHYSICAL DIMENSIONS

- 97.8mm (W) x 17.5mm (H) x 63.2mm (D)
  3.85in (W) x .69in (H) x 2.49in (D)