EVE4x-70A/G-IPS-1024600A

For all variants of the EVE4x-70A/G-IPS-1024600A

Hardware Manual

Revision 1.0

PCB Revision: 1.0 or Higher

Contents

On Shore and In-House Design

In-House Manufacturing

In-House Sales

In-House Support

In Calgary, Canada

Sales	Support	Online
Phone: (403) 229-2737	Phone: (403) 229-2737	Purchasing: www.matrixorbital.com
Email: sales@matrixorbital.ca	Email: support@matrixorbital.ca	Support: www.matrixorbital.com

Free support forums

https://www.lcdforums.com/forums

Example Code on GitHub

https://github.com/MatrixOrbital

Customization

Need a custom solution? No problem! Since we manufacture our products in-house, we are highly flexible, have low MOQ`s and provide you what you need. From custom headers to custom cables to entire custom displays, we can make what you need.

1. Introduction

Hardware manual for the EVE4x-70A-IPS & EVE4x-70G-IPS Displays for PCB 1.x

The EVE4x-70G features an easy to mount oversized capacitive touch screen. Panel mounting of the display is seamless and smooth providing a crisp modern look. It easy to clean, sanitize, water and dust resistant.

IPS display technology offers the widest viewing angle with no grey inversion, clearer image and crisp colour.

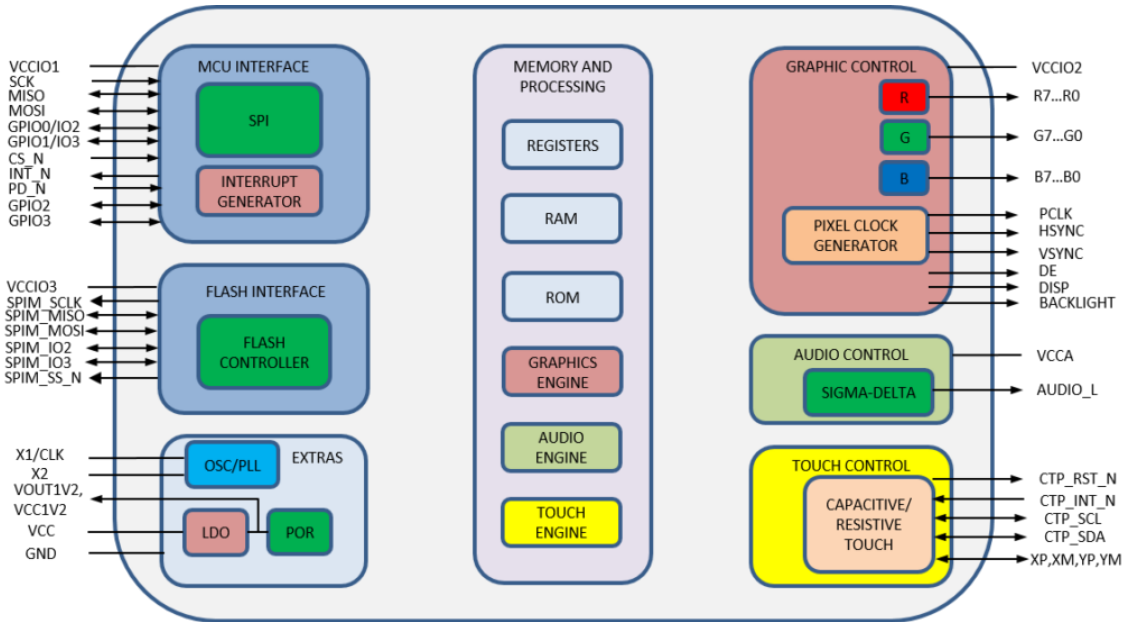
1.1. Key Features

- 7.0" 1024x600 SPI TFT
- IPS 1000cd/m2 Sunlight Readable Display
- Available with:
    - No touch panel (-TPN)
    - Resistive touch panel (-TPR)
    - Capacitive touch panel (-TPC)
    - Oversized Capacitive touch panel (G -TPC)
- 0mb or 32Mb or 128Mb QSPI NOR Flash
- BT817 or BT818 EVE4
- 1 MB graphics RAM
- 5-15V
- SPI/QSPI interface
- Industrial MATE-N-LOK locking headers
- Optional USB interface with FTDI FT232H
- Optional Haptic feedback
- Optional Speaker
- Integrated backlight LED Driver with software brightness control
- Designed, supported and Made in CANADA
- Long life cycle
- Customer silk screening available
- Semi-custom & Custom designs available

1.2. Block Diagram

2. EVE Graphics Engine

The EVE series chips are graphics controllers with add-on features such as audio playback and touch capabilities, and contain a rich set of graphic objects (primitive and widgets) that can be used for displaying various menus and screens for a range of products including home appliances, toys, industrial machinery, home automation, elevators, and many more.



	FT812/FT813	BT815/BT816	BT817/BT818
Series	EVE2	EVE3	EVE4
Maximum Resolution	800x600	800x600	2048 pixels per line up to 1 Mega Pixels total
Example Sizes	320x240, 480x272, 800x480	320x240, 480x272, 800x480	320x240, 480x272, 800x480, 800x600, 1280x800
RGB interface	24 bits - RGB888	24 bits - RGB888	24 bits - RGB888
System Clock	60MHz	72MHz	72MHz
Touch function	FT812 – Resistive FT813 – Capacitive	BT816 – Resistive BT815 – Capacitive	BT818 – Resistive BT817 – Capacitive
Control interface	SPI/QSPI - max 30Mhz	SPI/QSPI - max 30Mhz	SPI/QSPI - max 40MHz
Object memory size	1MB	1MB	1MB
External memory support	No	Yes - max 2Gb	Yes - max 2Gb
90° screen rotation	Yes	Yes	Yes
Image decoder	BMP, DXT1, Hardware JPG	BMP, DXT1, Hardware JPG, ASTC	BMP, DXT1, Hardware JPG, ASTC
Video playback	Yes	Yes	Yes
GPIO	4	4	4

Matrix Orbital uses both the BT817 and BT818 EVE chips.

Model	Touch	EVE IC Used
TPN	Non Touch	BT817 or BT818 based on stock level
TPR	Resistive Touch	BT818
TPC	Capacitive Touch	BT817

2.1 Programming manual, examples, software from Bridgetek

Programing Manual:
https://brtchip.com/wp-content/uploads/2022/04/DS_BT817_8.pdf

EVE Utilities
https://brtchip.com/toolchains/

2.2 Matrix Orbital Example Code and Support

Free support forums

https://www.lcdforums.com/forums/viewforum.php?f=45

Example Code on Github

https://github.com/MatrixOrbital

3. Part Numbering

The EVE4x has multiple size and touch variants, to ensure that there is an option for every application. If you do not see a combination for your application please contact us.

3.1. Part Numbering Scheme

EVE4x	-70	A	-IPS	1024600A	-BLH	-TPN	-F32	-USB	-SPK	-VS	-HAP
1	2	3	4	5	6	7	8	9	10	11	12

3.2. Options

#	Designator	Options
1	Product Type	EVE4x
2	Display Size	35: 3.5” 43:4.3” 50:5.0” 70:7.0”
3	Screen Type	A: Standard TFT G: Extended Bezel capacitive touch panel
4	IPS	IPS Panel
5	1024600	Resolution 1024x600
6	Backlight	-BLM: 300 Nit < Brightness < 600 Nit -BLH: 600 Nit < Brightness < 1000 Nit -BLD: Brightness > 1000 Nit
7	Touch	-TPC: Capacitive -TPR: Resistive -TPN: None
8	Memory	-F0: 0 Mb QSPI NOR Flash memory -F32: 32 Mb QSPI NOR Flash memory -F64: 64 Mb QSPI NOR Flash memory -F128: 128 Mb QSPI NOR Flash memory … -F2056: 2Gb QSPI NOR Flash memory
9	USB Interface	FTDI FT232H USB Interface and 5-15V option
10	Speaker	Mono Speaker
11	Voltage	5-15V Wide Voltage
12	Haptic	Haptic Motor

4. Development Accessories

EVE-USB2SPI-KIT-B

The USB to SPI Bridge is used for initial testing, decrease development time and the easiest way to upload data to the NOR Flash.

EVE2-SHIELD

The Scoodo is an interface module for Matrix Orbital EVE SPI TFT displays to Arduino Uno, STM32-Nucleo and Parallax Propeller Shield products.
Please note this is not compatible with –VS models

EVE-SPI2BBC

A simple breakout board that allows converts the EVE's 20 pin FFC cable to a 20 position 2.54mm 2x10 row straight pin header.
Please note that 3.3V marking is the same as VCC

EVE-FFC20

FFC Cable, 20-pin, 0.5mm pitch, 6" long, Top one side – Bottom one side, backers both sides.

5. Characteristics & Specifications

5.1. Power

By default, the display must be powered by the 2 pin MATE-N-LOK header or barrel jack and cannot be powered over USB only. If you would like to power the display over USB only, please contact us.

Option	VCC	BLVCC	Note
Standard	3.3V	5-15V	VCC and BLVCC are separate
-VS	5-15V	5-15V	VCC and BLVCC are tied together

ONLY POWER THE DISPLAY VIA ONE POWER HEADER, ex FPC OR 2 pin MATE-N-LOK

Parameter	Min	Typ	Max	Unit	Remarks
Supply Voltage					
	5.0	12.0	15.0	V	-VS/-USB

5V	Min	Typ	Max	Unit
Logic	-	100	-	mA @ 5V
Backlight	0	-	1100	mA @ 5V
Haptic			400	mA @ 5V
Speaker			120	mA @ 5V

5.2. Optical

A minimum 50,000 hour backlight is available, please contact us.

Optional optically bonding is availed, please contact us.

Item	All	TPN	TPR	TPC	Unit
Size	7.0”				
Pixels	1024 x 600				
Active Area	154.2 (W) x 85.9 (H)				
Pixels Pitch	0.1506 (W) x 0.1432 (H)				
Luminance		1000	800	900	nit or cd/m2
Contrast Ratio		500	500	500	
Viewing Direction	Free/All 160°				
LED Life*	Minimal 30,000 hours Typical 50,000 hours				

* The LED Life-time is defined as the estimated time to 50% degradation of initial brightness running at maximum at Ta=25°.

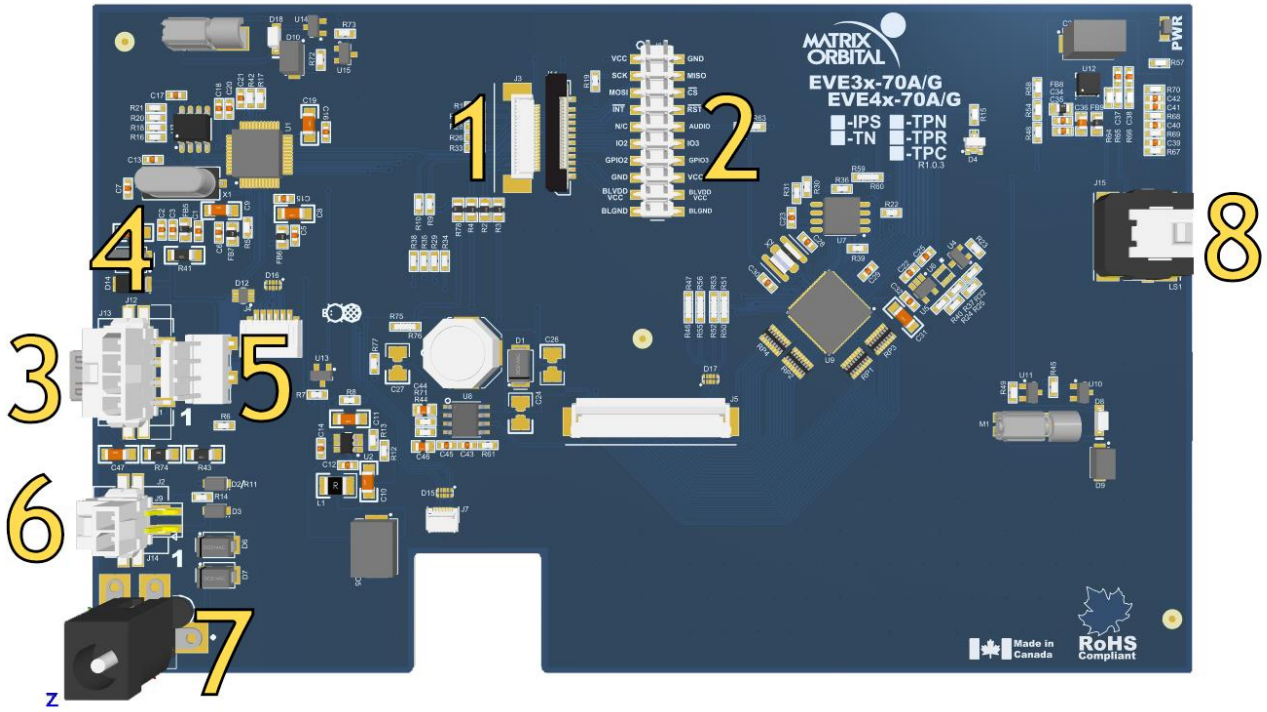
5.3. Environmental

Item	Min	Max	Unit
Operation Temperature	-20	70	C
Storage Temperature	-30	80	C
Humidity		90%*	RH

*noncondensing

7. Headers & Pinout

Please note, the EVEx-70A, EVE3x-70G, EVE4x-70A and EVE4x-70 share the same interface board, the only exception is that the mounting holes are not present on the EVE3x-70G and EVE4x-70G



#	Header	Standard Mate
1	SPI 20-Pin FPC	Horizontal 20 pin, 0.5mm, bottom contact, Optional Vertical
2	SPI 2x10-Pin	Male 20-pin, 2x10 2.54mm pitch
3	USB	Mini-B USB, Horizontal or Vertical
4	USB MATE-N-LOK 4-pin	Micro MATE-N-LOK 1445022-4, Horizontal or Vertical
5	USB Alternate 4-pin	4 pin male 2.54mm pitch
6	Power 2-pin	Micro MATE-N-LOK 2-1445057-2, Horizontal or Optional Vertical
7	Power Barrel Jack	2.1mm center positive
8	Speaker 2-pin	Micro MATE-N-LOK 2-1445057-2

When the USB is selected, Header #1 and Header #2 are NOT populated!

Header Population

#	Header	Standard	USB
1	SPI 20 Pin FPC	X	
2	SPI 2x10 Pin	X	
3	USB		X
4	USB MATE-N-LOK		O
5	Alternate USB		O
6	Power 2-pin	X	X
7	Power Barrel Jack	O	O
8	Speaker 2-pin	O	O

X Standard, 0 Optional

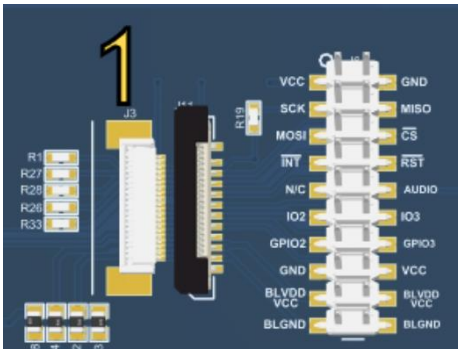
7.1. #1 SPI FPC

The 20 pin FPC header on the EVE is used to interface with an SPI controller.

Suggested mating FFC & FPC Headers and Cables

FPC Header	Part Number
Molex	5051102091
Amphenol ICC (FCI)	10051922-2010ELF

FFC Cable	Part Number
Matrix Orbital	FFC20-150-TB
Würth Elektronik	687620050002



Pin	Symbol	Type	Function
1	VCC	Power	Power Input
2	GND	Ground	Ground
3	SCK	Input	SPI clock input
4	MISO	Input/output	SPI Single mode: SPI MISO output SPI Dual/Quad mode: SPI data line 1
5	MOSI	Input/output	SPI Single mode: SPI MISO input SPI Dual/Quad mode: SPI data line 0
6	CS	Input	SPI slave select input*
7	$\overline{INT}$	Open Drain Output	Interrupt to host**
8	$\overline{INT}$		EVE reset
9	N/C	No connection	No connection
10	AUDIO	Output	Audio PWM out
11	IO2	Input/output	SPI Single/Dual mode: General purpose IO 0 SPI Quad mode: SPI data line 2
12	IO3	Input/output	SPI Single/Dual mode: General purpose IO 1 SPI Quad mode: SPI data line 3
13	GPIO2	Input/output	General purpose IO 2 or Speaker
14	GPIO3	Input/output	General purpose IO 3 or Haptic
15	GND	Ground	Ground
16	VCC	Power	Power Input
17	BLVCC	Power	Power Input or Optional Backlight Voltage***
18	BLVCC	Power	Power Input or Optional Backlight Voltage***
19	BLGND	Ground	Ground or Optional Backlight Ground***
20	BLGND	Ground	Ground or Optional Backlight Ground***

***Note:** The CS pin signifies when a SPI transaction occurs by going active low. When the pin goes inactive high, the write operation is considered complete.

****Note:** Open drain output (default) or push-pull output, active low

*****Note:** Please contact us for this option

7.2. #2 2x10 Male Header

Male Header, 20-Pin, 2x10, 2.54mm pitch.

Column 1	Column 2
1	2
3	4…

19	20

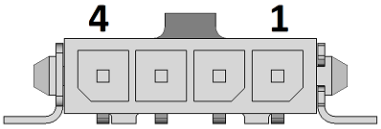
7.3. #3 Mini-B USB

Standard Mini-B USB header. When the USB is selected, Header #1 and Header #2 are NOT populated!

Cable	Part Number
Mini-B USB 3ft External Cable	EXTMUSB3FT
Mini-B USB to 4 pin Internal 2.45mm pitch	INTMUSB3FT

7.4. #4 MATE-N-LOK USB

Optional low profile power header available in vertical or horizontal configuration. Custom cables are available. By default, the display cannot be powered over USB through pin 1, but requires to be present for the display to detect USB. If you would like to power the display over USB only, please contact us.



Pin	Function
1	USB 5V
2	D-
3	D+
4	GND

7.5. #5 Alternate USB

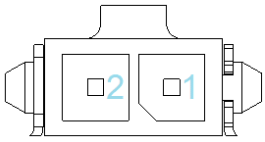
Optional 4 pin 2.54mm header.

Pin	Symbol	Function
1	VCC	5V Power
2	D-	Communication
3	D+	Communication
4	GND	Ground

7.6. #6 MATE-N-LOK Power Header

Low profile power header available in horizonal or optional vertical configuration. The display must be powered by the 2 pin MATE-N-LOK header.

Header	Header	Mate	Pins
2 pin Micro MATE-N-LOK	AMP 2-1445057-2	AMP 1445022-2	794610-1



Pin	Function
1	VCC
2	GND

Optional MATE-N-LOK to 2.1mm barrel jack cable adapter.

Part Number:
CBL-MNL2B21

Description:

2 pin MATE-N-LOK to 2.1mm barrel jack

7.7. #7 Barrel Jack

Optional vertical 2.1mm centre positive connector.

7.8. #8 MATE-N-LOK Speaker header

Optional header for an external speaker

Header	Header	Mate	Pins
2 pin Micro MATE-N-LOK	AMP 2-1445057-2	AMP 1445022-2	794610-1

7.9. PWR LED

When the EVE is powered correctly, the LED will turn on.

8. Mounting

8.1. Mounting of EVE4x-70G Series

Our G series extended capacitive touch with a double-sided adhesive already applied on the exposed back side of the over-sized cover glass. This provides an extraordinarily strong double-sided foam tape that adheres to a broad range of surfaces such as aluminum, stainless steel, galvanized steel, composites, plastics, acrylic, polycarbonate, ABS and painted or sealed wood and concrete.

Adhesive: 3M VHB 0.6mm (3M 5925) or similar.

The tape can maintain its bond in environments of 100% relative humidity at 38°C, and can withstand temperatures up to 149°C.

Figure 1: Installation

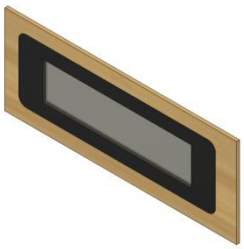


Figure 2: Completed Assembly

Application Best Practices:

- Prepared by cleaning the surface with a 50:50 mixture of isopropyl alcohol
- Ideal application temperature 21C to 38C. At room temperature 50% bond strength in 20 minutes, 90% 24 hours, 100% after 72 hours.
- Firm application pressure develops better adhesive contact and helps improve bond strength. Typically, good surface contact can be attained by applying enough pressure to ensure that the tape experiences approximately 15 psi (100 kPa) pressure. Either roller or platen pressure can be used. Note that rigid surfaces may require 2 or 3 times that much pressure to make the tape experience 15 psi.

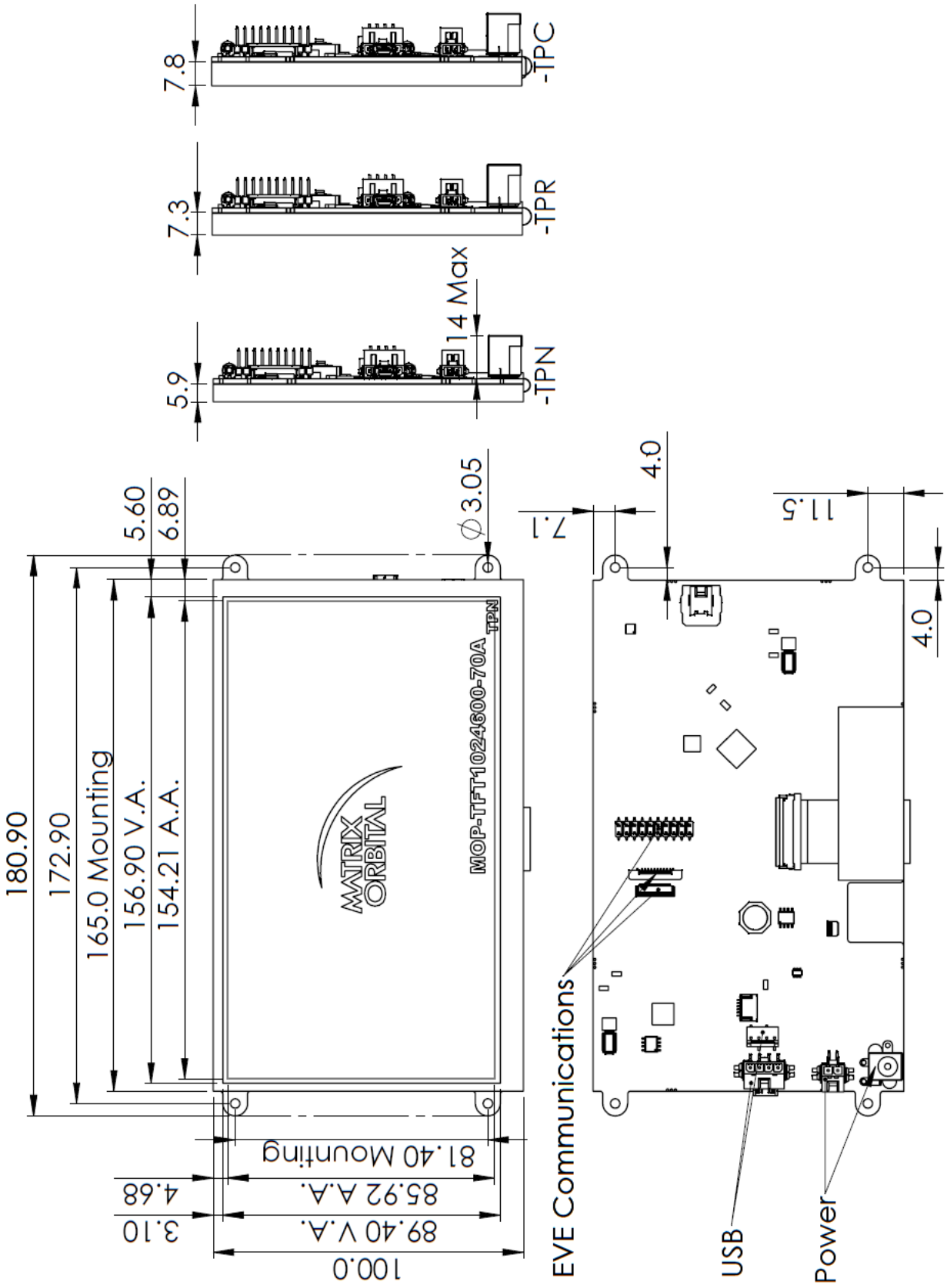
8.2. Mounting of EVE4x-70A Series

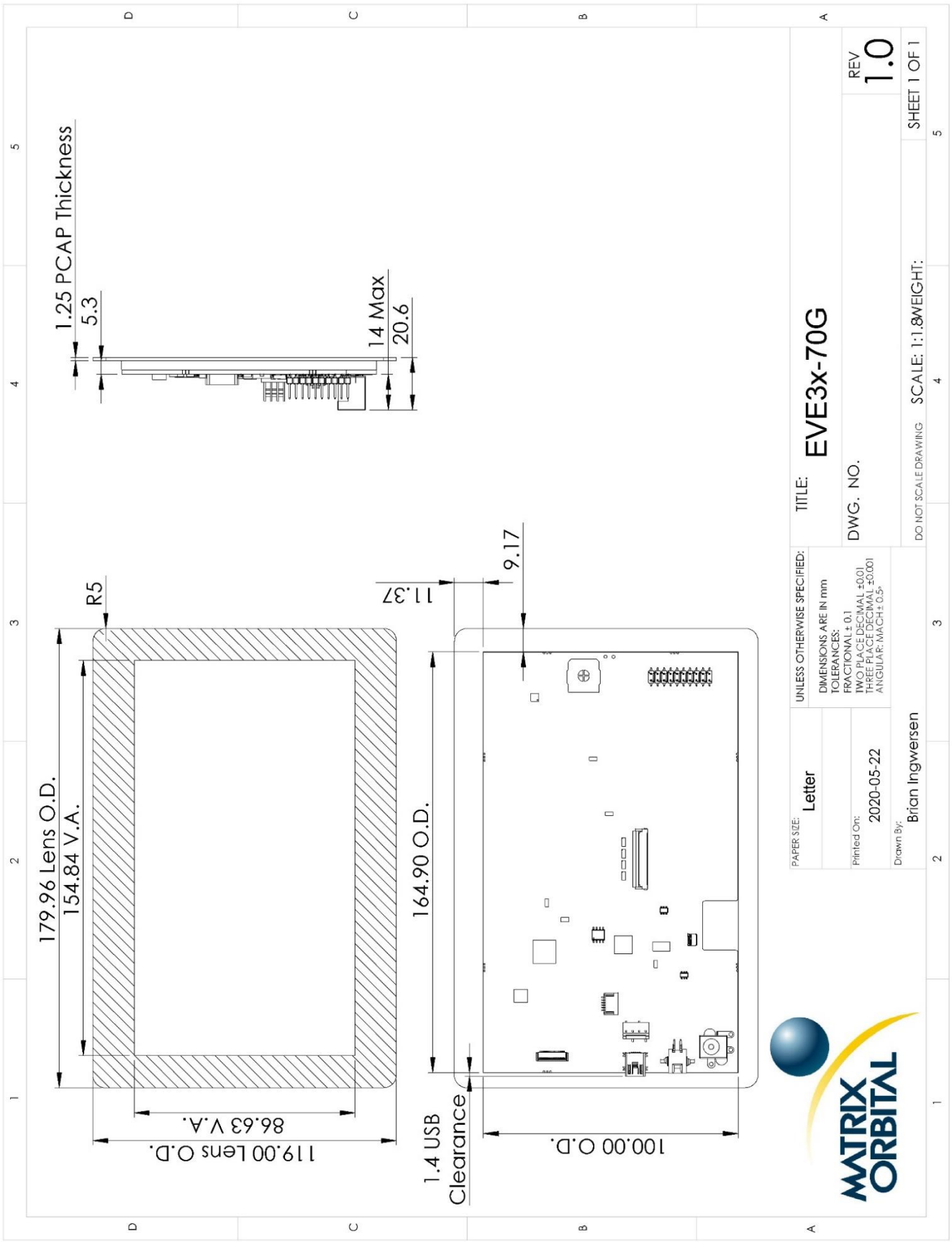
The A series uses 4 mounting points with a 3.05mm diameter. M3 and 4/40 screws can be used. Chassis grounding is optionally provided, please contact us for more information.

10. Dimensional Drawing

10.1. EVE4x-70A-IPS

All dimensions are maximum +/- 0.3mm, typical is +/- 0.15mm maximum




1.25 PCAP Thickness
5.3
14 Max
20.6
R5
179.96 Lens O.D.
154.84 V.A.
86.63 V.A.
119.00 Lens O.D.
11.37
9.17
164.90 O.D.
1.4 USB Clearance
100.00 O.D.
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN mm
TOLERANCES:
FRACTIONAL ± 0.1
TWO PLACE DECIMAL ±0.01
THREE PLACE DECIMAL ±0.001
ANGULAR: MACH ± 0.5°
PAPER SIZE: Letter
Printed On: 2020-05-22
Drawn By: Brian Ingwersen
TITLE: EVE3x-70G
DWG. NO.
REV 1.0
DO NOT SCALE DRAWING
SCALE: 1:1.8
WEIGHT:
SHEET 1 OF 1
MATRIX ORBITAL

11. Communication

11.1. SPI

The EVE communicates to hosts through SPI.

Channel Mode	Interface pins	Data	Max bus speed
MODE 0	MISO, MOSI, SCLK, CS, INT	MSB first	30 MHz

For reading from the EVE, the protocol is:

RD-Command/Addr2, Addr1, Addr0, **Dummy-Byte,** DataX, DataY, DataZ

The below diagram depicts the behaviour of both the SPI master and slave in the master read case. In this example we are reading the Register ID which is 7C.

Please notice the extra 00 before receiving the 7C, the extra 00 is the Dummy-Byte.

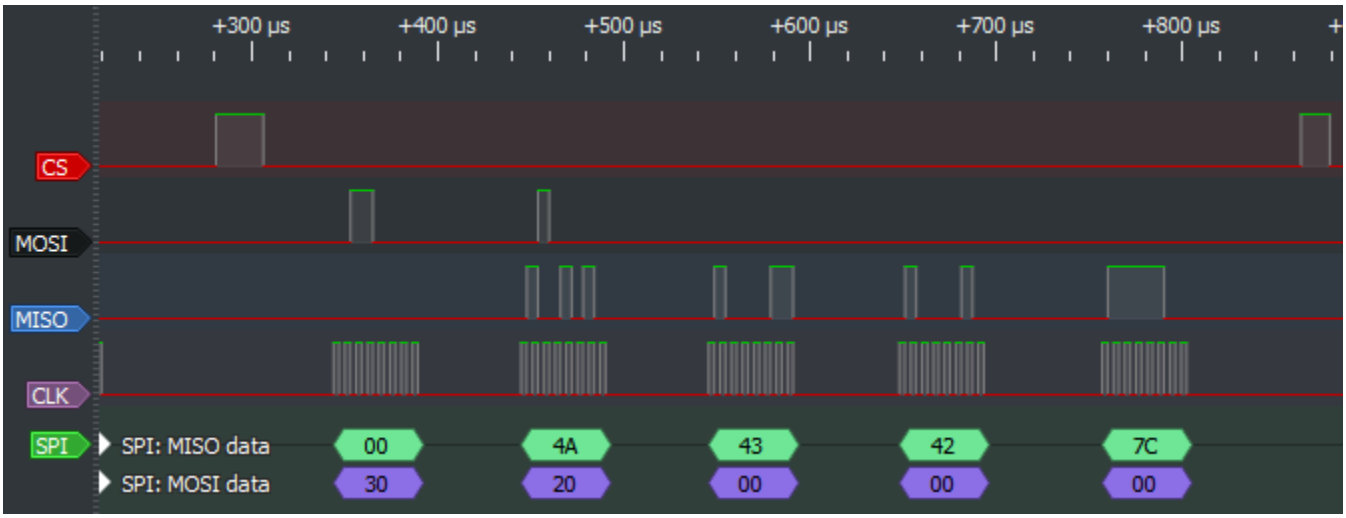


Figure 3: SPI Master and Slave bus behaviour

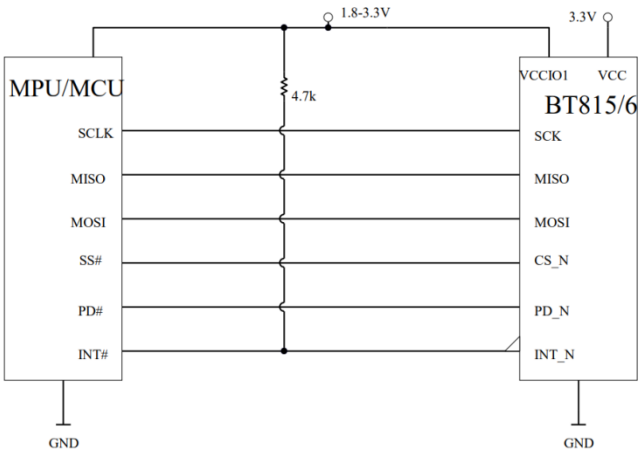


Figure 4: Single Channel SPI Interface connection

11.2. USB

12. Peripherals

12.1. General Purpose Input Outputs

The EVE provides 4 GPIO pins that are user configurable. When the Speaker is present GPIO2 is used. When the Haptic is present it uses GPIO3, leaving GPIO1 and GPIO2 available to the user.

12.2. Speaker

The EVE features an optional Speaker. GPIO2 is used to power On and Off the amplifier circuit. By default, the pin is pulled low thus the circuit is Off. To activate Speaker circuit, set GPIO2 to High.

12.3. Haptic

The EVE features an optional Haptic feedback for enhanced user interaction. It is activated with GPIO3. By default, the pin is pulled High. To activate Haptic, set GPIO3 to Low.

12.4. QSPI NOR Flash

The on-board flash memory allows you to store audio files, images, animations and videos, reducing the amount of flash memory taken up on the host side. The NOR Flash is connected directly to the EVE IC by QSPI. The EVE processor talks directly to the NOR Flash bypassing the host. This makes transfer of data from the NOR Flash to the display incredibly fast. Note: You can communicate with the EVE chip by SPI and the EVE chip will talk to the NOR Flash at QSPI with out any user interaction.

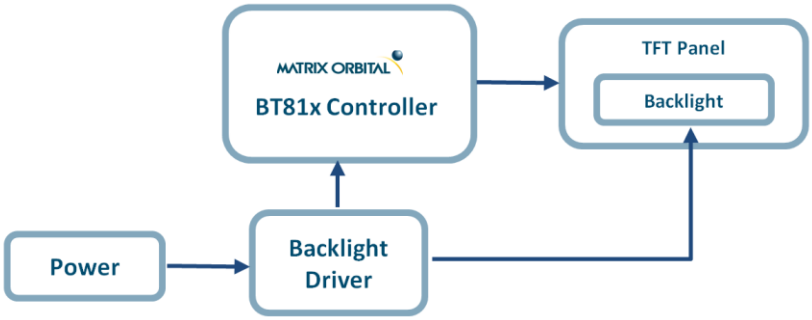
Memory
-F0: 0Mb -F32: 32Mb -F128: 128Mb

The above memory sized are offered as standard products, the maximum is 2Gb, for other sizes please contact us.

12.5. Backlight Driver

The EVE TFT Module comes equipped with its own backlight driver and integrated backlight control circuit. Backlight brightness is controlled by software PWM by the EVE chip.

Item	Data	Comment
PWM	0-128	0: OFF … 128: Maximum Brightness



12.6. Touch Panel

The EVE4x-TPR resistive touch panel sensitivity can be increased by adjusting the resistive pressure threshold. The pressure threshold is specified through the REG_TOUCH_RZ register. A lower pressure value indicates a higher-pressure threshold. It is recommended to set the pressure threshold to 1200 for testing, and adjust the value accordingly to suit your application.

The EVE4x-TPC uses a GT911 I2C touch controller. The default address is 0x05D0. The EVE needs to be initialized by setting the REG_TOUCH_CONFIG register to 0x05D0.

Parameter	-TPR	-TPC
IC	NA	GT9xx
Touch Points	1	5
Hardness	3H	6H

13. TFT Display

13.1. RGB Displays Used

For more detailed information for the TFT's Electro-Optical Characteristics, Reliability Test Conditions, Inspection Criteria, and Handling Precautions. Please consult the Parallel TFT Datasheet

EVE3 Display	Parallel TFT Datasheet
EVE3x-29A	MOP-TFT320102-29A
EVE3x-35A EVE3x-35G	MOP-TFT320240-35A MOP-TFT320240-35G
EVE3x-38A EVE3x-38G	MOP-TFT480116-38A MOP-TFT480116-38G
EVE3x-39A EVE3x-39G	MOP-TFT480128-39A MOP-TFT480128-39G
EVE3x-43A EVE3x-43G	MOP-TFT480272-43A MOP-TFT480272-43G
EVE3x-50A EVE3x-50G	MOP-TFT800480-50A MOP-TFT800480-50G
EVE4x-70A-IPS EVE4x-70G-IPS	MOP-TFT1024600-70A-IPS MOP-TFT1024600-70G-IPS

13.2. TFT Display Timings

Display Timings	Display				
	EVE3x-29	EVE3x-35	EVE3x-43	EVE3x-50	EVE4x-70
REG_HSIZE					**1024**
REG_VSIZE					**600**
REG_HCYCLE					**1259**
REG_HOFFSET					**319**
REG_HSYNC0					**12**
REG_HSYNC1					**230**
REG_VCYCLE					**635**
REG_VOFFSET					**34**
REG_VSYNC0					**12**
REG_VSYNC1					**22**
REG_ PCLK					**1**
REG_SWIZZLE					**0**
REG_PCLK_POL					**1**
REG_CSPREAD					**0**
REG_DITHER					**1**

14. Contact

Sales	Support	Online
Phone: +1-403-229-2737	Phone: +1-403-229-2737	Purchasing: www.matrixorbital.com
Email: sales@matrixorbital.ca	Email: support@matrixorbital.ca	Support: www.matrixorbital.ca

15. Revision History

Revision	Date	Description	Author
1.0	May 4, 2021	Initial Release	Henry