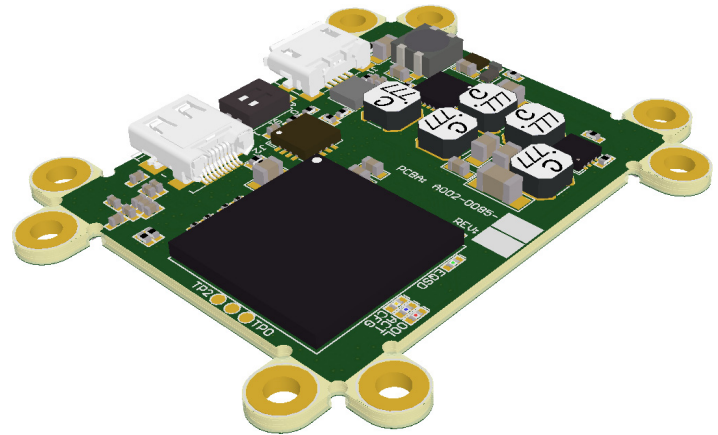
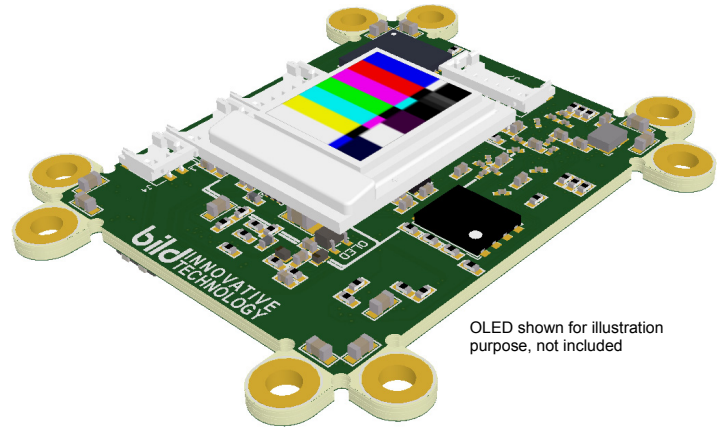


Features

- Supports all Variants of SXGA096
- Low Power: < 1.75W (less OLED)
- Digital RGB Video Interface
DVI, HDMI (no HDCP): 24bRGB
w/ active TMDs equalization for enhanced reception
- Monocular: 1 OLED Channel
- Supported Video Timing Format
SXGA
- User-selectable Control Options
USB, UART, Discrete
- Continuous Image Optimization
- Mechanically Centered OLED Image
- Power Enable / Disable Feature
Rapid start-up
Ultra-Low-power disable
- User-configurable Mounting Features (Tabs)
- Industrial Temperature Range (-40~70C)



Applications

- Head Mounted Displays (HMD)
- Wearable Devices
- Virtual / Augmented Reality
- Embedded Viewers
- Electronic Viewfinder
- Instrumentation
- Hobby

General Description

The BIT1012AX is a high-performance low-cost full-featured driver supporting all variants of the eMagin SXGA096 OLED. Integrated dual-mode DVI / HDMI digital video input and multiple control interface options enable a compact single-board design suitable for virtually any application including binocular HMDs for users with narrow interpupillary distance (IPD).

Product Highlights

Lightweight low-profile compact design is optimized for both monocular and binocular display devices for both direct-view and reflective eyepiece designs. Symmetrical layout placing the OLED image centroid in the exact center of the Driver supports easy monocular left/right eye switching as well as binocular side-by-side mounting. Image position and orientation controls facilitate rotation and binocular convergence adjustments / fine-tuning.

With all connectors located on a common edge directly supports plenum style end-product wire harnessing. This is especially helpful for routing wires along the upper edge of a binocular display assembly to minimize look-down obscuration of the mechanical structure.

Eight configurable #2 mounting tabs strategically arranged in 90-degree pairs at each corner provide a flexible easily customizable attachment system suitable for a variety of mechanical configurations. Unused mounting tabs can be simply snapped off and discarded.

The user selectable control interface supports easy adaptation to the most popular serial and discrete control interfaces. The 3.3V UART control option features a unique chip-select allowing multiple OLED drivers to be controlled by a common Tx/Rx pair, a unique feature intended specifically for binocular configurations. Combining the BIT1012AX OLED Driver with the BIT1100A discrete control module yields a complete standalone monocular display driver solution with convenient 3-button user controls.

Low operational power plus reduced-power standby and ultra-low-power disable modes provide flexible power control necessary to ensure long battery life for today's and future portable devices.

Additional features such as programmable brightness control steps, maximum brightness, built-in test patterns, user selectable gamma, video inversion, and video format query give the user all the necessary degrees of control to customize and diagnose the end-product – these user control features are unique to Bild's OLED Drivers.

Technical Specifications

Parameter		min	typ	max	unit
Supply Voltage	J4 Power Connector	2.5	5.0	5.5	V
	USB Connector	4.75	5.0	5.25	V
Power Consumption (less OLED)	Operating	-	1.650	2000	mW
	Reduced-Power Standby (input video active)		1400		mW
	Power Disabled		1		mW
Video	Input Type 1: DVI	1.0			
	Input Type 2: HDMI - HDCP not supported	1.3a			
	Color Depth	24b RGB			
	Frame Resolution	1280x1024			HxV
	Frame Rate	60 ~ 85			Hz
Control Interface	Option 1: USB (UART protocol)	USB 2.0, 115.2kbps			
	Option 2: UART	3.3V, 115.2kbps			
	Option 3: Discrete	2-wire, integrated pullups			
Temperature (ambient)	Operating Industrial	-40	-	70	°C
	Storage	-40	-	85	°C
Mass		7			g

Absolute Maximum Ratings

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; the functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Notes: 1) Reverse-polarity protection

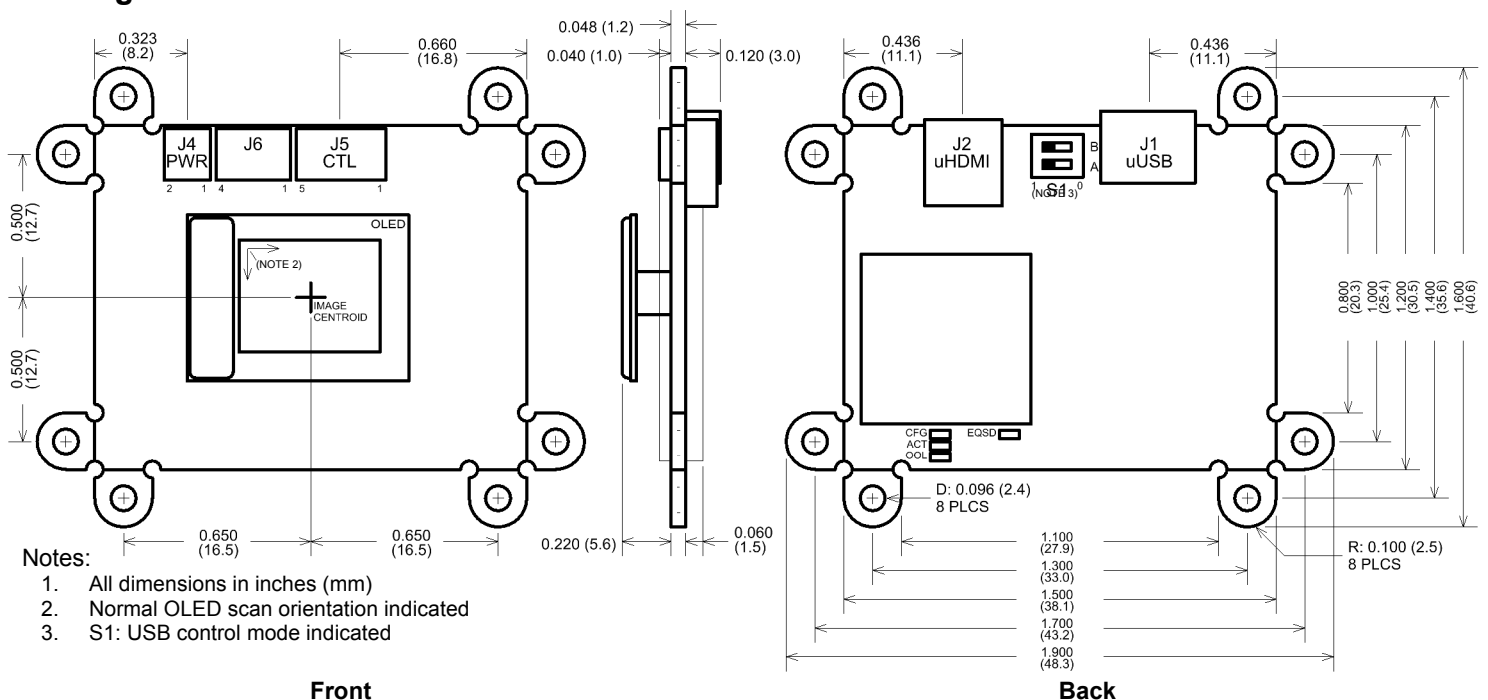
Parameter		min	max	unit	Note
Supply Voltage	J1 USB Connector	-0.3	6.0	V	1
	J4 Power Connector	-6.0	6.0	V	
Digital IO	J1 USB: DN, DP	-0.5	3.63	V	
	J2 TMD5	-0.4	3.85	V	
	J5 DDC: SCL, SDA	-0.5	7.0	V	
J5 (pins 1~3)	-0.4	3.85	V		
Temperature (ambient)		-40	85	°C	

ESD Caution

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



Package Outline



Connectors

J1: USB

Type: micro USB Type B
Pinout:

Pin #	Function
1	+5V / Supply Power
2	USB_DN
3	USB_DP
4	nc
5	GND

J2: uHDMI

Type: micro HDMI Type D
Pinout:

Pin #	Function
1	HPD
2	nc
3	TMDS_D2+
4	GND
5	TMDS_D2-
6	TMDS_D1+
7	GND
8	TMDS_D1-
9	TMDS_D0+
10	GND
11	TMDS_D0-
12	TMDS_CK+
13	GND
14	TMDS_CK-
15	nc
16	GND
17	DDC_SCL
18	DDC_SDA
19	+5V

J4: Power

Manufacturer: Molex
Manufacturer PN: 78171-0002
Mating PN: 78172-0002
Pinout:

Pin #	Function
1	Supply Power
2	GND

J5: Control

Manufacturer: Molex
Manufacturer PN: 78171-0005
Mating PN: 78172-0005
Pinout:

Pin #	Function (by S1 A B Control Setting)			Pull-up/down
	0 0 Discrete	1 0 UART	1 1 USB	
1	PD1	TX	n/a	50kOhm pullup to 3.3V
2	PD2	RX	n/a	50kOhm pullup to 3.3V
3	n/a	CSn	n/a	10kOhm pulldown to GND
4	PWR_EN			10kOhm pullup to supply voltage
5	GND			n/a

Operation

Supply Power

The BIT1012AX supports application of supply power via either the micro USB connector or dedicated Supply Power connector J4. The dedicated J4 Supply Power path provides reverse polarity protection whereas the USB supply power path does not. Automatic input supply power selection is performed according to the following table:

USB Pwr	J4 Pwr	Selected Supply Power
No	Yes	J4 Power
Yes	No	USB Power
Yes	Yes	J4 Power

Setting serial command **POWER** to **0** places the BIT1012A in a reduced power state in which all video functions are disabled but serial communications remain active. Restoring serial command **POWER** to **1** returns the BIT1012AX to a fully operational state.

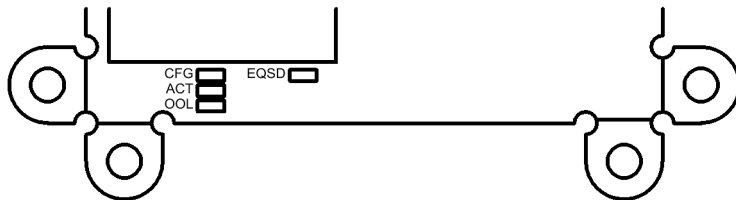
Deasserting J5 pin 4 (PWR_EN) to logic low places the BIT1012AX into an extremely low power state in which serial communication is unavailable. Reasserting PWR_EN to logic high will cause a re-start of the BIT1012AX.

Status Indicator LEDs

The BIT1012AX features three (3) status indicator LEDs as follows:

Label	Color	Status Function
CFG	Amber	ON Configuration incomplete / in progress
		OFF Configuration complete
ACT	Blue	Luminance modulation indicates processor activity
OOL	Red	ON HDMI / DVI clock not locked
		OFF HDMI / DVI clock locked
EQSD	Green	ON HDMI EQ Signal Detected
		OFF HDMI EQ Signal Not Detected

Status LED locations shown below:



ACT, OOL, and EQSD Status LEDs can be disabled via the **LEDEN** serial command (ref: BIT-UG-0005).

Input Video

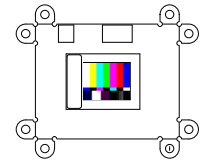
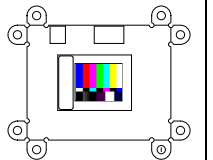
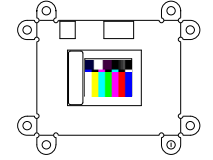
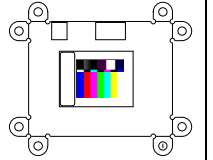
The BIT1012AX supports both HDMI 1.3a and DVI 1.0 formats at 24 bit RGB. EDID contents specify the following timing formats:

Parameter	VESA Standard	Reduced Blanking (RB)		
	1280x1024_60	1280x1024_60(RB)	1280x1024_75(RB)	1280x1024_85(RB)
FP Pixel Clock Frequency	108.00 MHz	81.187 MHz	101.484 MHz	115.010 MHz
FH Horizontal Frequency	63.981 kHz	61.880 kHz	77.350 kHz	87.660 kHz
FV Vertical Frequency	60.020 Hz	60.020 Hz	75.025 Hz	85.024 Hz
HS Horizontal Sync	112 col : 1.037 us	8 col : 0.099 us	8 col : 0.079 us	8 col : 0.070 us
HB Horizontal Backporch	248 col : 2.296 us	12 col : 0.148 us	12 col : 0.118 us	12 col : 0.104 us
HA Horizontal Active	1280 col : 11.852 us	1280 col : 15.766 us	1280 col : 12.613 us	1280 col : 11.129 us
HF Horizontal Frontporch	48 col : 0.444 us	12 col : 0.148 us	12 col : 0.118 us	12 col : 0.104 us
HT Horizontal Total	1688 col : 15.630 us	1312 col : 16.160 us	1312 col : 12.928 us	1312 col : 11.408 us
VS Vertical Sync	3 row : 46.889 us	2 row : 32.320 us	2 row : 25.856 us	2 row : 22.815 us
VB Vertical Backporch	38 row : 0.594 ms	3 row : 48.481 ms	3 row : 38.785 ms	3 row : 34.223 ms
VA Vertical Active	1024 row : 16.005 ms	1024 row : 16.548 ms	1024 row : 13.238 ms	1024 row : 11.682 ms
VF Vertical Frontporch	1 row : 15.630 us	2 row : 32.320 us	2 row : 25.856 us	2 row : 22.815 us
VT Vertical Total	1066 row : 16.661 ms	1031 row : 16.661 ms	1031 row : 13.329 ms	1031 row : 11.761 ms

Image Orientation

Image orientation is adjustable via discrete and serial control according to the following table.

ref: BIT-UG-0005: User Guide, OLED Driver UART Protocol

HSCAN	VSCAN	Image Orientation	HSCAN	VSCAN	Image Orientation
0	0		1	0	
0	1		1	1	

Control Interface – Channel Selection

The BIT1012AX is controlled via one of several user-selectable interfaces according to the following table:

A B	S1 Switch Position		Selected Control Interface
	Physical		
1 1			USB (Factory Default)
0 1			UART
1 0			<i>Reserved</i>
0 0			Discrete

Control Interface - Serial

USB and UART serial control interface, protocol, and commands are described by the following documents:

- BIT-UG-0000** User Guide, UART Protocol, General
- BIT-UG-0005** User Guide, UART Protocol, OLED Driver

USB serial interface implements an FTDI FT234XD-R UART transceiver.

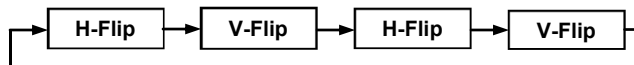
Control Interface - Discrete

Discrete control is implemented via a 2-wire logic interface whereby control action is initiated by driving one or both inputs to GND (logic low). These inputs can be driven by active digital logic or simple pull-down as by a normally-open switch. The control action is defined by the table below. All control actions are executed upon release (return to logic high) – no sustained assertion actions are supported.

PD1	PD2	Control Action
1	1	No operation
0	1	Brightness Increment
1	0	Brightness Decrement
0	0	Image Orientation Flip

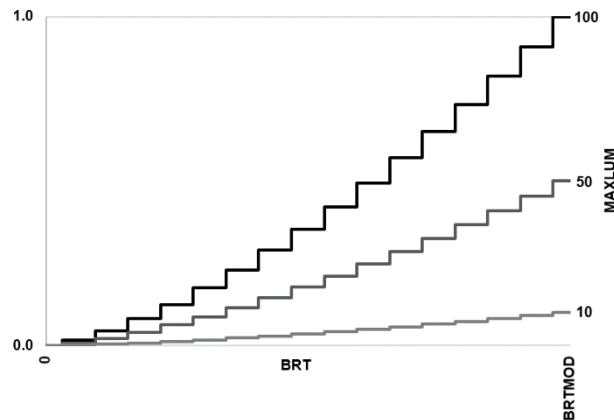
Brightness Increment / Decrement steps are defined by the **BRTMOD** register (ref: BIT-UG-0005).

The Image Orientation Flip control action performs sequential alternating horizontal and vertical scan reversals (flips) upon successive assertions as follows:



Brightness Control

BIT1011AX brightness is adjusted in perceptually linearized discrete steps defined by control parameters **BRT**, **BRTMOD**, and **MAXLUM** (ref: BIT-UG-0005) as illustrated below (normalized luminance scale).

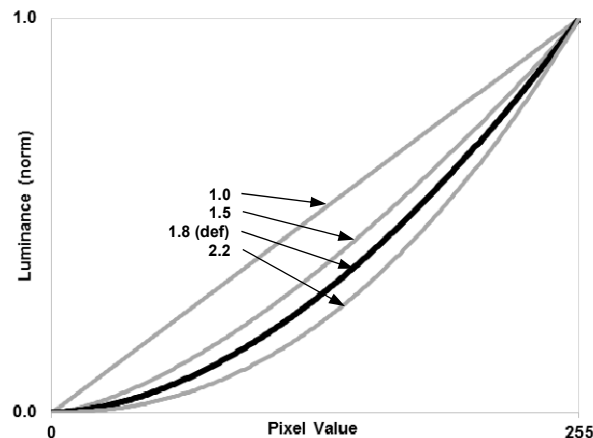


Serial control supports direct arbitrary control of the **BRT**, **BRTMOD**, and **MAXLUM** brightness control parameters.

Discrete control supports single-step increment and decrement of the **BRT** parameter.

Gamma Control

BIT1012AX gamma is adjusted by the **GAMMA** (ref: BIT-UG-0005) command which applies a standard normalized exponential transfer function ($\text{PixelValue}^{\text{GAMMA}}$) to emulate CRT phosphor characteristics as shown below.



Equalizer Control

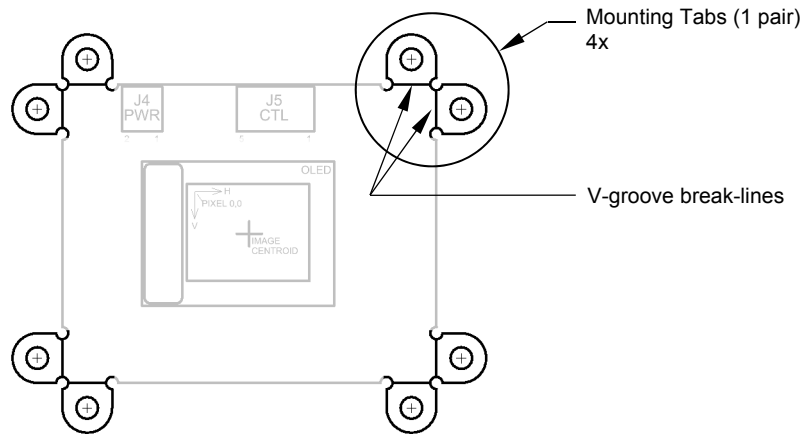
The BIT1012AX features adjustable active TMDS equalization which can improve DVI / HDMI performance by compensating for skin-effect and dielectric losses in long cables and / or cables with intermediate connectors. This equalization does not guarantee operation with cables that do not meet the specifications of HDMI 1.3a but can provide improved operation in some cases.

The equalization features several adjustable parameters that can be tuned in conjunction for a particular implementation. Typically, only adjustments to the **EQBOOST** parameter are needed. However, in some cases, it may also be necessary to adjust the **EQOUTLVL** parameter for improved operation.

See User Guide BIT-UG-0005 for a complete detailed list of all EQ control commands.

Mounting Tabs

The BIT1012AX features eight (8) configurable EMI mounting tabs. These through-plated mounting tabs are located in pairs at the corners of the OLED Driver and provide high-frequency AC coupling to GND. To accommodate a variety of mechanical mounting configurations, these tabs can be removed as needed from the OLED Driver by breaking away at the pre-cut v-groove break lines. Care must be taken to prevent damage to the OLED Driver.



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Revision History

Rev	Date	Description
A	03/18/21	Initial Release