ZisWorks

“ZisWorks X28”

“ZisWorks X28 KIT”

“ZisWorks X39 KIT”

“ZisWorks X28 R2 KIT”

“ZisWorks X39 R2 KIT”

GENERAL INFORMATION

Document version : 26 Jan 2019

The latest version of this document and others can be found at:
zisworks.com/downloads

CHANGELOG

Version 1.0 : 26 July 2017 : Original release
Version 1.1 : 18 August 2017 : Minor changes for public posting
Version 1.2 : 26 Jan 2019 : Update pictures, add R2 information

Table of Contents

DISCLAIMER

The ZWS UHD TCON is a timing controller board for select models of UHD panels from the Innolux corporation. ZWS has no relationship with Innolux and has independently developed these products. Use of the ZWS TCON may violate some Innolux design specifications, and as such, will void any warranties of the panels.

OVERVIEW

The ZWS X series displays and kits contain an assortment of boards, each with one or more programmable devices. ZWS X series displays offer the unique feature of user reconfiguration to allow advanced users to modify the operation of the displays. To accommodate for this functionality, user upgradability of the various firmwares is needed. A separate firmware update guide details the update process. Source code for the open portions of the system can be found at https://github.com/cirthix/

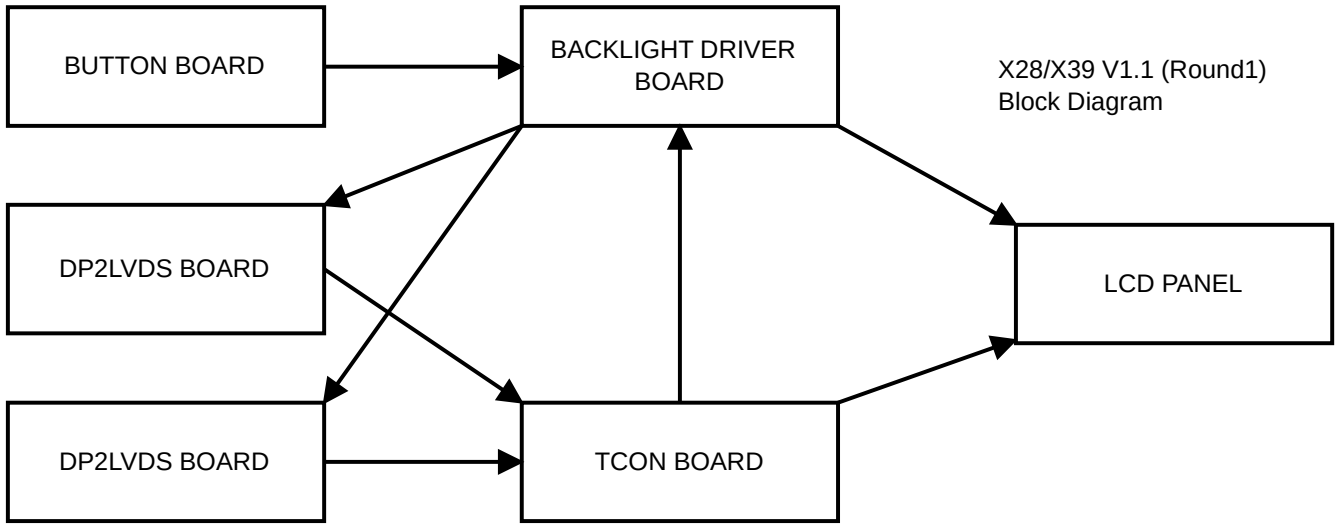
At the heart of the ZWS X series displays is a ZWS UHD TCON, an advanced timing controller board for select models of UHD panels from the Innolux corporation. With a high-performance Artix7 series FPGA from Xilinx, the ZWS UHD TCON offers system flexibility with some unique advantages over traditional TCONs for the same panels. High refresh rate support, an integrated latency-free integer scaling, flexible input behavior, and a dedicated sync output signal make this solution great.

PANEL COMPATIBILITY

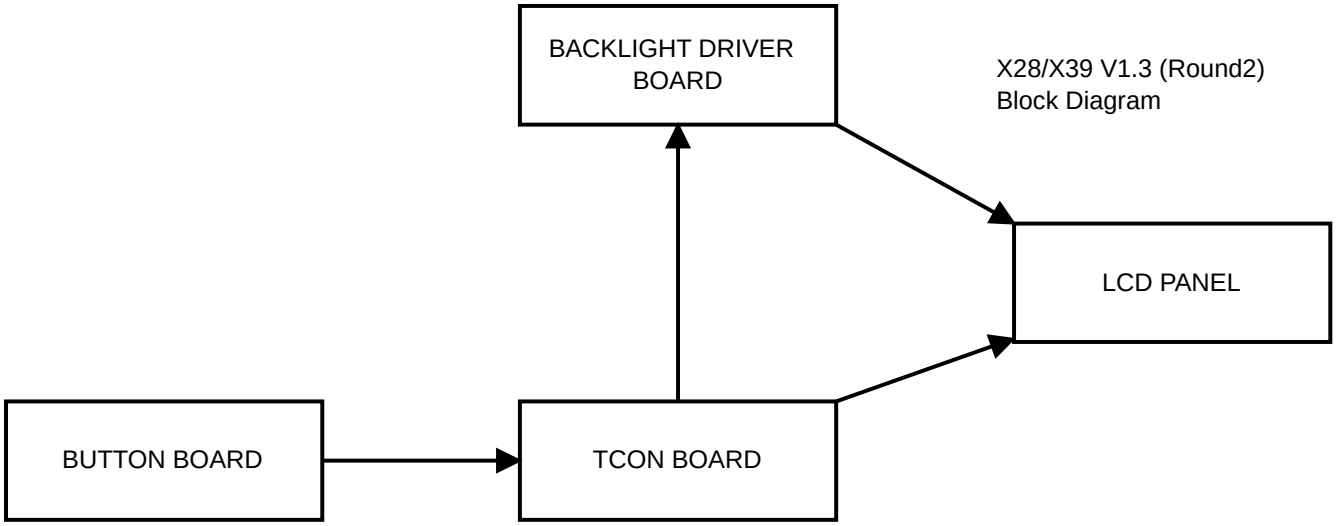
PANEL COMPATIBILITY		
M238DCJ-E50	23.8” 9.5ms AAS	WILL NOT WORK
M280DGJ-L30	28” 1ms TN	FULLY SUPPORTED
M315DJJ-K30	31.5” 9.5ms MVA	WILL NOT WORK
V390DK1-LS1	39” 6.5ms MVA	FULLY SUPPORTED
V400DK*	40” 9.5ms MVA	FULLY SUPPORTED
V420DK*	42” 9.5ms MVA	FULLY SUPPORTED
V500DK2	50” 6.5ms MVA	UNTESTED
V580DK2	58” 6.5ms MVA	UNTESTED

Panels not on this list are not supported.

SYSTEM BLOCK DIAGRAMS



X28/X39 V1.1 (Round1)
Block Diagram



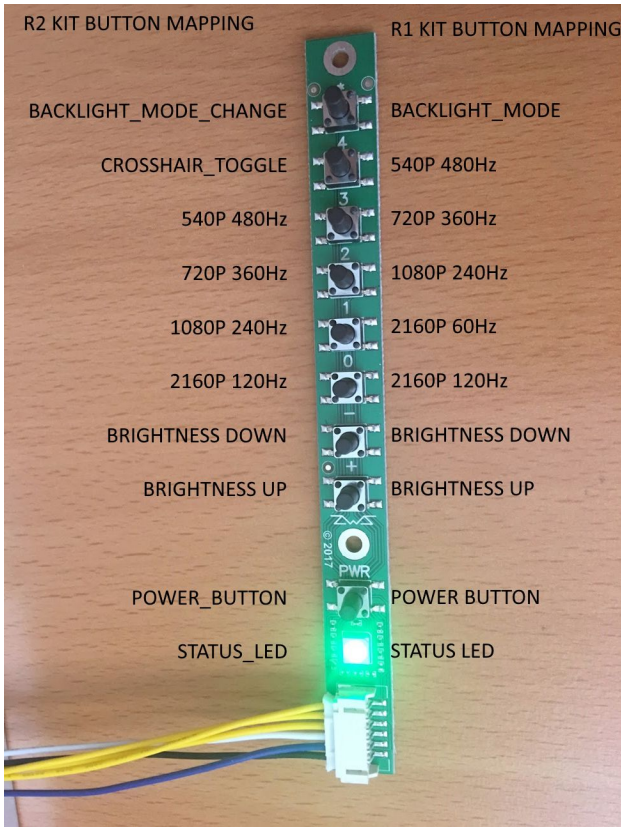
X28/X39 V1.3 (Round2)
Block Diagram

FEATURES AND SPECIFICATIONS

• Input-to-panel latency of ~30 microseconds by design
• Two DP1.2 5.4Gbit input ports
• Flexible input configuration with built-in integer scaling
• 3840*2160 @ 120Hz (two input groups)
• 3840*2160 @ 60Hz (one input group)
• 3840*1080 @ 240Hz (two input groups)
• 1920*1080 @ 240Hz (one input group)
• 3840*720 @ 360Hz (two input groups)
• 1280*720 @ 360Hz (one input group)
• 3840*540 @ 480Hz (two input groups)
• 960*540 @ 480Hz (one input group)
• Up to 540MHz Pixel clock per input group
• Up to 600MHz Pixel clock per input group (R2 boards only)
• DE-Only video timing simplifies driving requirements
• Dynamic PLL reconfiguration for a wide range of video input frequencies
• Onscreen display shows an autoscaling scrolling realtime graph of framerates
• 10 bit input (temporal dithering + 8bit panel)
• 12V DC Input supply
• High-quality power supplies from TexasInsturments
• Firmware controlled power supplies enable support of multiple panels of varying types.
• Six layer controlled impedance PCB for good signal integrity
• Output video synchronization signal for use with ZWS backlight drivers or your custom equipment
• Clearly labeled UART and JTAG connections for firmware update

BUTTON CONTROL

With so many operational modes, it is important to not confuse the user and the host system. Our solution to this problem is to provide five preset modes, each with a dedicated button. When one of the mode buttons is pressed, the EDIDs will be reprogrammed . If it is not used, the secondary board will be fully disconnected from the host system. Each mode has an EDID which presents support for only one resolution at two refresh rates.



RGB STATUS INDICATOR

An RGB status led indicates system status.

COLOR STATUS INDICATOR	
GREEN	SOFT-OFF POWER STATE
RED	ON BUT NO VIDEO SIGNAL
WHITE / YELLOW	SYSTEM IS ADJUSTING STATE
CYAN	SYSTEM ON, PWM-FREE BACKLIGHT
AMBER	SYSTEM ON, HIGH-FREQ PWM BACKLIGHT
BLUE	SYSTEM ON, STROBING BACKLIGHT
PURPLE	SYSTEM ON, SCANNING BACKLIGHT

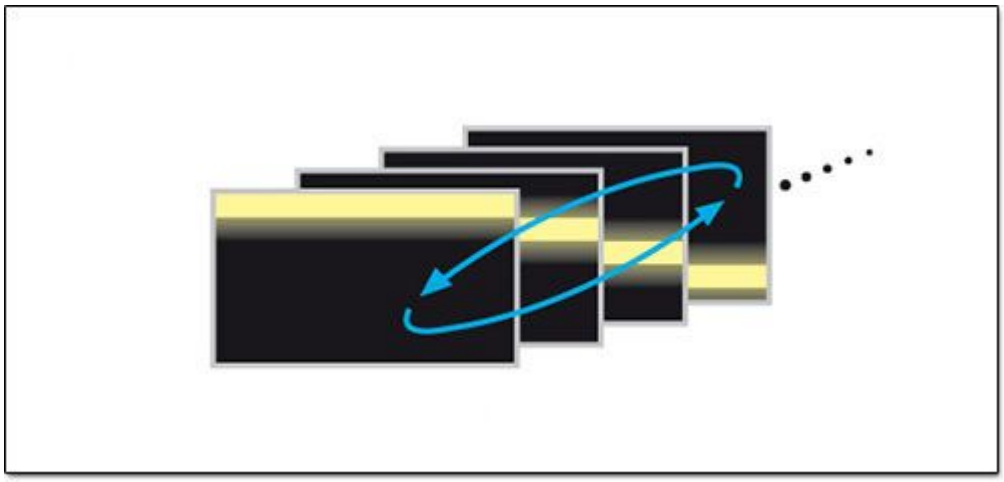
BACKLIGHT OPERATIONAL MODES

OFF : The system is off. Boost controller is disabled, backlight is off.

STABLE : The system is operating in either constant-current or high-frequency PWM mode, depending on brightness level.

STROBE : All LEDs are simultaneously pulsed at high current levels and brief active times. Pulses are timed to end with the falling edge of the pulse input. Brightness control adjusts the pulse duration and current level. Strobe mode is only available if the pulse input signal (vertical blanking indicator) is active for a sufficient amount of time.

SCAN : LED strings are pulsed individually with high current levels and brief active times. Pulses are sequential and aligned to be active immediately before the corresponding part of the display is updated. In the case of the ZWS X series displays, there are four scanning segments. Each illuminates one quarter of the screen. Using scanning mode maximizes the time available for pixel response without requiring a long vertical blanking period, a particularly important property at high refresh rates.



INPUT BEHAVIOR

Input to the TCON is handled by two Displayport inputs. If two inputs are simultaneously active, the primary group will be displayed on the left hand side of the screen with the secondary on the right. If only one group is active, it will occupy the entire screen. If two groups are used simultaneously, it is absolutely critical that the input streams be vertically synchronized within +/- 3 lines of each other. Generally, this means that the outputs must be on the same graphics card, with a possible exception of quadro-sync style solutions.+

Integer scaling of 1:1, 1:2, 1:3, and 1:4 is supported. Video streams with excessive resolution will be displayed with a warning. Nonexact scaling will result in a maximally-interger-scaled centered image with unused display area blacked-out.

Horizontal and vertical scaling are independent of each other and taller-than-wide pixels are allowed, though wider-than-tall pixels are not. This situation can be useful, for example, in a 3840*1080@240Hz scenario, if the host system is made aware of the physical pixel aspect ratio.

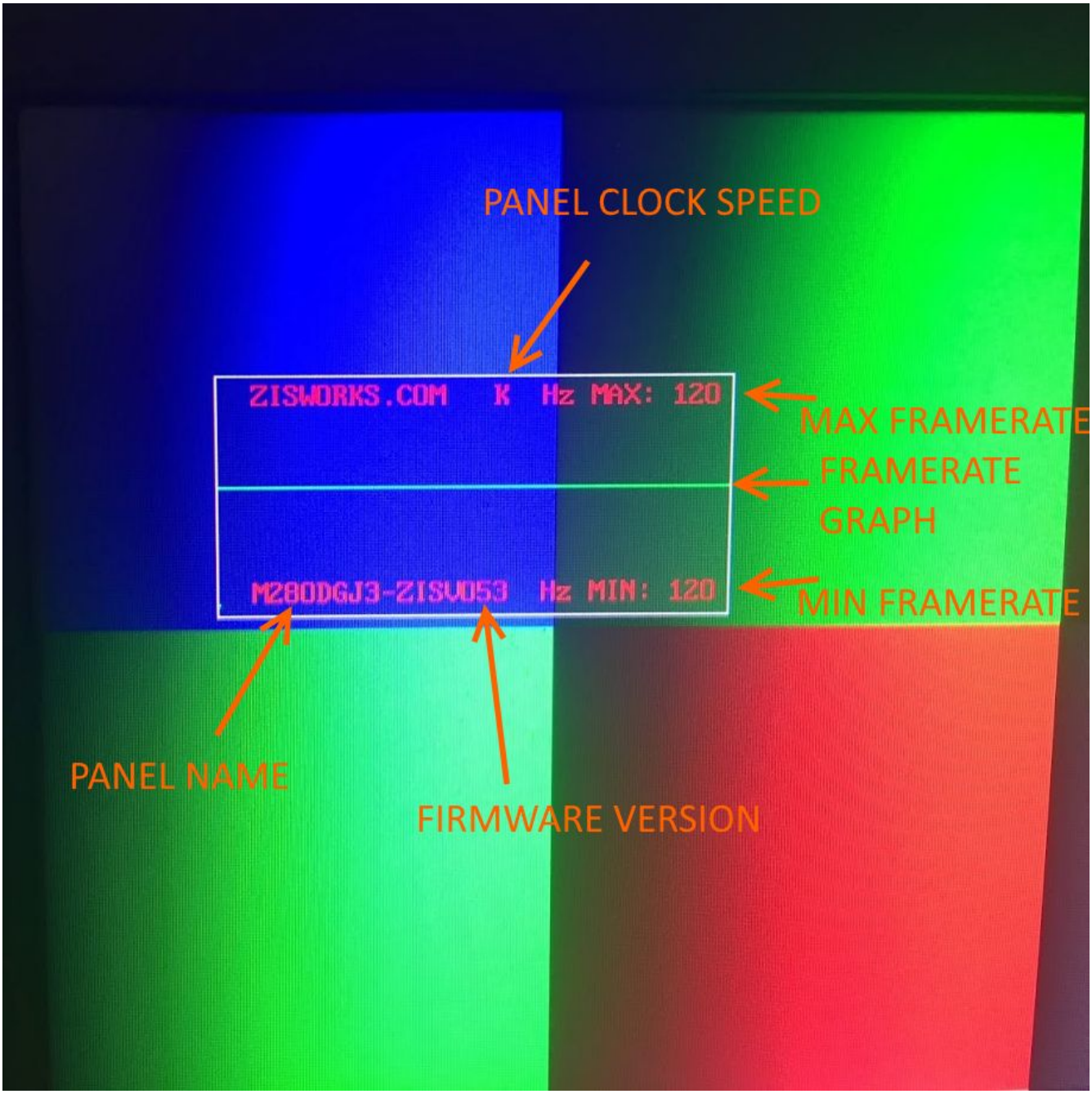
If the input is detected as invalid or partially invalid, a test pattern or overlaid warning will be shown on the screen to alert the user to the problem.

DE-Only timing mode is supported, with the HSYNC and VSYNC signals ignored internally. Any duration of DE being low for more than 8 clocks is considered the end of the current line, and any duration of DE staying low for more than 510 clocks is considered the end of the current frame. There is no set limit for the maximum vertical blanking duration.

Minimum blankings are around 16 clocks for horizontal and 4 lines for vertical. Minimum vertical blanking is increased when letterboxing.

ON SCREEN DISPLAY

An on-screen-display shows the selected panel, firmware version, and a realtime autoscaling scrolling graph of the framerate of the most recent 253 frames, with minimum and maximum values shown. The OSD is alpha-blended with the video stream and overlaid in the upper left corner of the display. DP2LVDS boards do not support dynamic refresh rates, but the TCON does. This feature will be useful in the future.



(OVER)CLOCK TABLE

The system can run at a range of possible clock speeds. At some point, the panel will begin to show visual errors. For these visual errors, only the clock speed letter indicated by the OSD during startup will matter.

This table roughly indicates which clock speed a given linerate signal will result in. For the purpose of determining core clockspeed, only the input linerate matters.

Generally speaking, M280DGJ tends to max out at around 138MHz and V390DK1 around 133MHz.

CODE	SPEED (MHz)	Linerate(KHz)
0	75.2	150
1	80	159
2	84	167
3	88	175
4	96	191
5	100	199
6	104	207
7	112	223
8	117.3	234
9	118.4	236
A	120	239
B	122	243
C	124	247
D	125.3	250
E	126	251
F	128	255
G	130.1	259
H	130.6	260
I	131.2	261
J	131.5	262
K	132	263
L	132.2	263
M	133.3	266
N	134.4	268
O	135.1	269
P	136	271
Q	137.6	274
R	138.6	276
S	140.8	281
T	144	287
U	148	295
V	149.3	298
W	152	303
X	154.6	308
Y	156	311
Z	157.3	313
+	160	319

Crosshair overlay

(R2 kits only) By pressing the CROSSHAIR_TOGGLE button, a transparent crosshair can be drawn over the center of the screen. By default, the crosshair is a transparent green X. Customization is possible but requires some effort.