PolarFire Design Document

Advanced Tic-Tac-Toe Demo

rev 1.00.000

1. Overview

The goal of this Advanced Tic-Tac-Toe demo is to provide a starting point to work with some of Adafruit 2.8" series TFT touch displays compatible with the Avalanche Development Board using a Mi-V softcore system.

Some features of the Avalanche board are included in this design: UART, user LEDs, user pushbuttons (BasicIO interface) and the AdafruitTFT interface. On the RISC-V side: Interrupts (External IRQs), Adafruit drivers, GPIO and UART configuration and management and access to different memory devices.

Parts of a previous Tic-Tac-Toe demo targeted at the Creative development board was used as a baseline for this demo.

2. Description

Platform	Avalanche Development Board
Target	PolarFire MPF300TS-1FGC484
Clock(s)	Main: 66 MHz MMIO Sub-system: 66 MHz
FPGA usage	Around 16.2k LE (5.4%)

Steps to run the demo

1. Install your Adafruit display on the Avalanche board and ensure that you have close both the IRQ and backlight management jumpers.
2. Once the Avalanche board is powered up and USB connected, configure your preferred terminal software (ie PuTTY) on your host PC for serial communication (115200 / 8 / 1 / No parity / No Flow Control) with the FPGA. You can press the Reset pushbutton to see the demo Welcome message on the terminal.
3. The game menu should be displayed after the detection/configuration period after power-up.

3. Functions

Device	Description
Basic IO - UART	- Echo info from the demo and display detection/identification at power-up.
System Timer	- Generate a 0.5 Hz heartbeat on the green LED 2. - Manage the activation of the screensaver.
Basic IO - Pushbutton #1	- Upon depression, increase the backlight intensity by 10%.

Device	Description
Basic IO - Pushbutton #2	- Upon depression, decrease the backlight intensity by 10%.
Basic IO - LEDs	- Red LED1 active when no valid TFT display is found or connected at start-up. - Green LED1 active when the screensaver is active.
AdafruitTFT Interface	- Provide all communications interfaces to the Adafruit 2.8” series of TFT touch displays.

4. FPGA Blocks Configuration

Device	Configuration
BasicIO_Interface	UART for Terminal communication configured through Mi-V code (115200 / 8 / 1 / No parity / No Flow Control) User pushbutton #1: USER_PB1_IRQ connected to Mi-V External IRQ 30 User pushbutton #2: USER_PB2_IRQ connected to Mi-V External IRQ 29 Other ports pushed as Top Level ports to be mapped on I/O pads.
AdafruitTFT_Interface	SPI, I2C and PWM configured through Mi-V code TS_IRQn signal connected to Mi-V External IRQ 28 I2C_IRQ signal connected to Mi-V External IRQ 27 Other ports pushed as Top Level ports to be mapped on Arduino I/O pads.

5. Memory Description

Memory Device	Type	Size
Mi-V Boot	LSRAM	128KB (32768 x 32 bits)

6. Memory Map

Device	First Address	Last Address
MMIO – BasicIO_Interface	0x7000 0000	0x7000 0FFF
MMIO – AdafruitTFT_Interface	0x7000 1000	0x7000 1FFF
Memory – Mi-V Boot (LSRAM)	0x8000 0000	0x800F FFFF