HV583
128-Channel High-Voltage Driver IC Evaluation Board
User's Guide

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Object of Declaration: HV583 128-Channel High-Voltage Driver IC Evaluation Board

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Manufacturer: Microchip Technology Inc.
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USA

This declaration of conformity is issued by the manufacturer.

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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA

Derek Carlson
VP Development Tools

12-Sep-14
Date

NOTES:

Table of Contents

NOTES:

Preface

NOTICE TO CUSTOMERS

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Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DS50000000A", where "50000000" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the HV583 128-Channel High-Voltage Driver IC Evaluation Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Warranty Registration
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the HV583 128-Channel High-Voltage Driver IC Evaluation Board as a development tool. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the HV583 128-Channel High-Voltage Driver IC Evaluation Board.
- **Chapter 2. "Installation and Operation"** – This chapter includes a detailed description of each function of the HV583 128-Channel High-Voltage Driver IC Evaluation Board and instructions on how to use it.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the HV583 128-Channel High-Voltage Driver IC Evaluation Board**.**
- **Appendix B. "Bill of Materials (BOM)"** – Lists the parts used to build the HV583 128-Channel High-Voltage Driver IC Evaluation Board**.**
- **Appendix C. "HV583 Typical Waveforms"** – Describes the various plots and waveforms for the HV583 128-Channel High-Voltage Driver IC Evaluation Board**.**

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending in the Warranty Registration Card entitles users to receive new product updates. Interim software releases are available at the Microchip web site.

RECOMMENDED READING

This user's guide describes how to use the HV583 128-Channel High-Voltage Driver IC Evaluation Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

- **HV583 Data Sheet – *"128-Channel Serial to Parallel Converter with Push-Pull Outputs"* (DS20005461)**.

Additional documentation (including schematic and code samples) is available under the PIC32 Starter Kit (DM320001) section on the web site.

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The Development Systems product group categories are:

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- **Emulators** – The latest information on Microchip in-circuit emulators.This includes the MPLAB REAL ICE™ and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICkit™ 3 debug express.
- **MPLAB IDE** – The latest information on Microchip MPLAB IDE, the Windows® Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers, such as PICkit 2 and 3.

CUSTOMER SUPPORT

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- Distributor or Representative
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- Field Application Engineer (FAE)
- Technical Support

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Technical support is available through the web site at:
http://www.microchip.com/support

DOCUMENT REVISION HISTORY

Revision A (December 2015)

- Initial release of this document.

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter covers the following topics:

- HV583 Device Overview
- HV583 Evaluation Board Overview
- HV583 Evaluation Board Kit Contents

1.2 HV583 DEVICE OVERVIEW

The HV583 is a unipolar 128-channel, low-voltage serial to high-voltage parallel converter with push-pull outputs, dedicated to printer driver and plasma display applications. The device has been designed for applications that require high channel count and high output voltage swing (0-80V) with current sinking and sourcing capabilities of 30 mA.

The device consists of four parallel 32-bit Shift registers, a 128-bit latch and 128 high-voltage outputs. The 32-bit Shift registers can operate up to a 40 MHz speed rate, allowing for fast data update. The parallel arrangement of the registers permits four times the speed of a single register, providing a fast update rate for the 128 output channels. Data flow can be shifted from a clockwise to a counterclockwise direction via the DIR pin. All high-voltage outputs can be forced to a low-level, high-level or high-impedance state (high Z) through the $\overline{OL}$, $\overline{OH}$ and OE pins, respectively.

1.3 HV583 EVALUATION BOARD OVERVIEW

The HV583 128-Channel High-Voltage Driver IC Evaluation Board facilitates the quick implementation for display and printer driver applications with its flexible input/output connection interface.

The evaluation board is designed to be operated together with the Microchip Technology PIC32 Starter Kit (DM320001) or with a generic signal pattern generator via the dedicated J5 pin header connector (see Figure 1-1).

There are 32 test point pads corresponding to the first 32-bit register (D1A/D1B) that control the high-voltage outputs: $HV_{OUT}0$, 4, 8...124. Ground pads are provided along with the test point pads to facilitate the analysis of the high-voltage output channels. Refer to Figure 1-1 and to the HV583 Data Sheet.

All output channels are available via a 160-position, high-density array female connector, where only 128 positions are used (refer to the Evaluation Board – Schematic in **Appendix A. "Schematic and Layouts"** for more details).

The HV583 contains four parallel 32-bit Shift registers. Each 32-bit Shift register features two ports that can be set as either inputs or outputs by controlling the DIR pin, as shown in the following list:

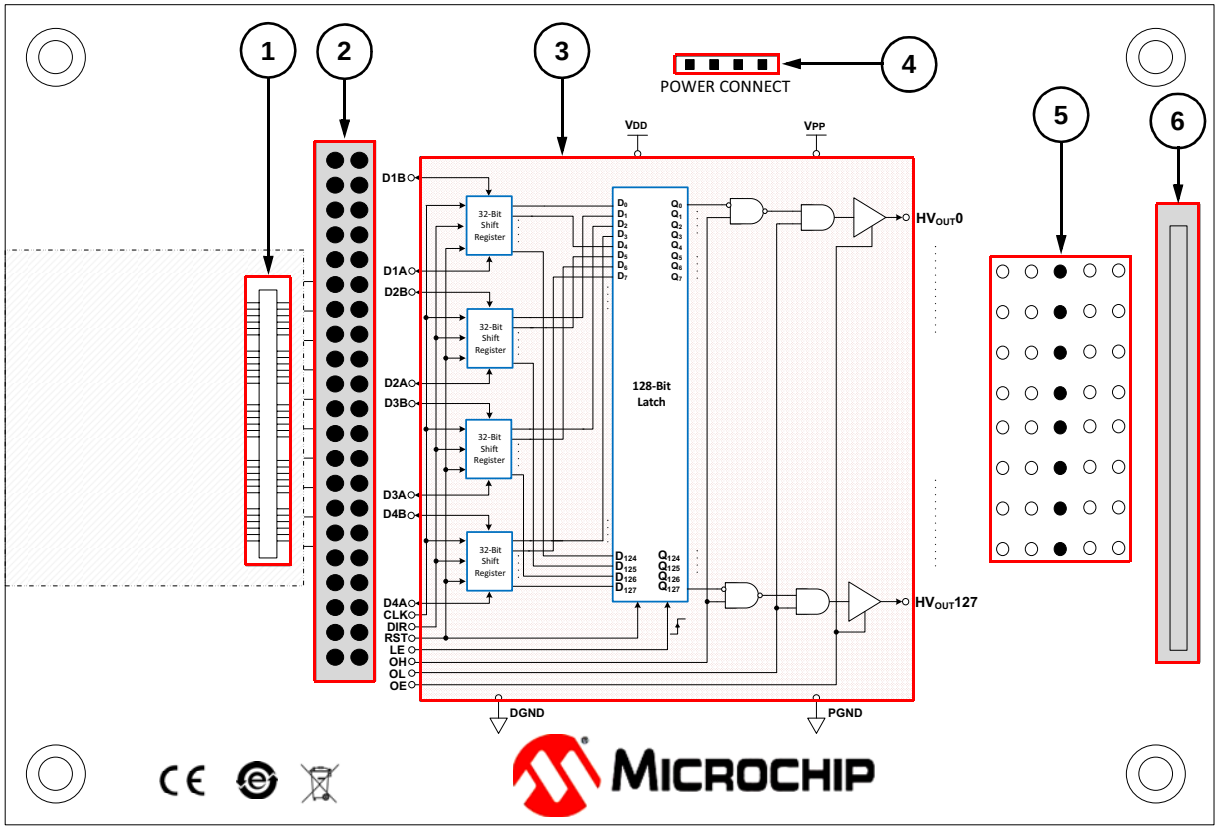
- setting the DIR pin high enables the DnA pins as inputs and the DnB pins as outputs (counterclockwise input data)
- setting the DIR pin low configures DnB pins as inputs and DnA pins as outputs (clockwise input data)

Shunt (zero Ohm) resistors are placed right after the pin header connectors (D1B to D4B) to facilitate the adjustment of the Input registers in any desired manner.

Note: The HV583 128-Channel High-Voltage Driver IC Evaluation Board comes equipped with shunt resistors only on the DnB pins. Shunt resistors are not installed on the DnA pins.

1.3.1 HV583 Evaluation Board Block Diagram

Figure 1-1 presents the HV583 128-Channel High-Voltage Driver IC Evaluation Board block diagram with the main sections labeled and explained.



Legend:

1 = FX10A-120S/12-SV(71) connector (J2) for PIC32 Starter Kit (DM320001), not included

2 = Header connector for (generic) signal pattern generator (J5), not installed

3 = HV583 169-Ball TFBGA package

4 = Power connection pin header

5 = 32 $HV_{OUT}n$ test points and ground pads

6 = 160-position, high-density array female connector

FIGURE 1-1: *HV583 128-Channel High-Voltage Driver IC Evaluation Board Block Diagram.*

1.4 HV583 EVALUATION BOARD KIT CONTENTS

The HV583 128-Channel High-Voltage Driver IC Evaluation Board Kit includes:

- HV583 128-Channel High-Voltage Driver IC Evaluation Board (ADM00677)
- Important Information Sheet

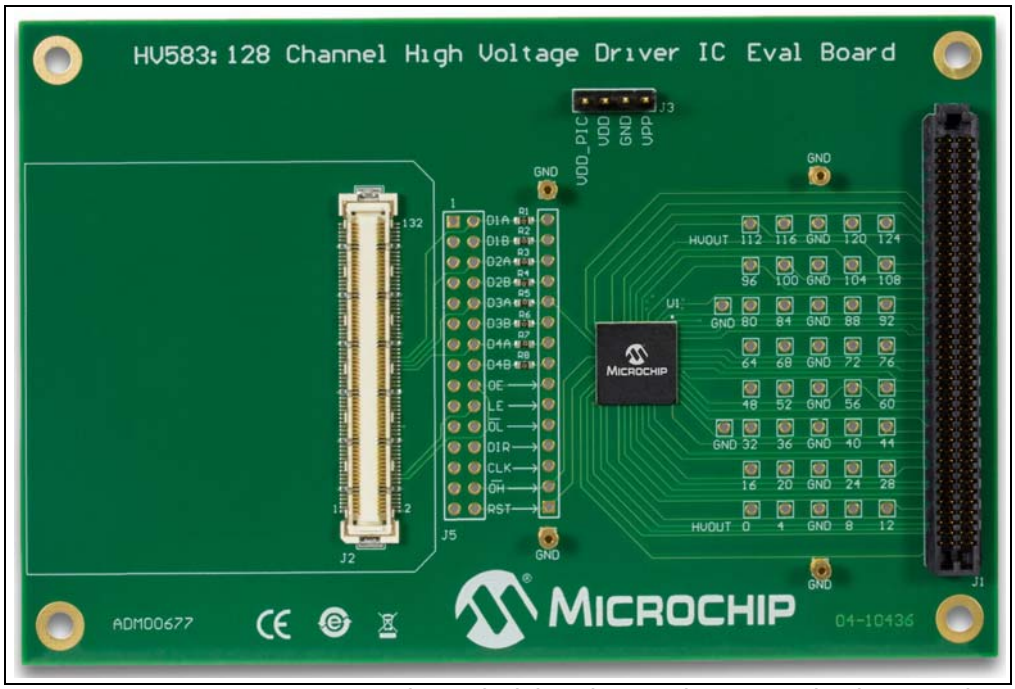


FIGURE 1-2: *HV583 128-Channel High-Voltage Driver IC Evaluation Board – Top View.*

NOTES:

Chapter 2. Installation and Operation

2.1 GETTING STARTED

The HV583 128-Channel High-Voltage Driver IC Evaluation Board is fully assembled and tested.

2.1.1 Tools Required for Operation

- A low DC power supply for V_{DD} (and VDD_PIC) that can produce 5V
- A high DC power supply for V_{PP} with a voltage range up to +80V
- A logic signal driver: PIC32 Starter Kit (DM320001) or a generic signal pattern generator
- An oscilloscope and/or a multimeter to observe waveforms and measure electrical parameters.

2.2 SETUP PROCEDURE

To prepare the HV583 128-Channel High-Voltage Driver IC Evaluation Board for operation, the following steps must be followed:

WARNING

Read the HV583 128-Channel High-Voltage Driver IC Evaluation Board User's Guide (this document) fully before proceeding to board setup.

1. Connect the power supplies by following the steps indicated by this power-up sequence:
   a) Connect GND
   b) Apply V_{DD}
   c) Connect VDD_PIC (if PIC32 Starter Kit is mounted and used)(1)
   d) Set logic input signals to a known state
   e) Apply V_{PP}

Note 1: If the PIC32 Starter Kit is used and connected to the USB debug cable, there is no need to power the VDD_PIC pin.

Note: To power down the board, follow the reverse order of the power-up sequence.

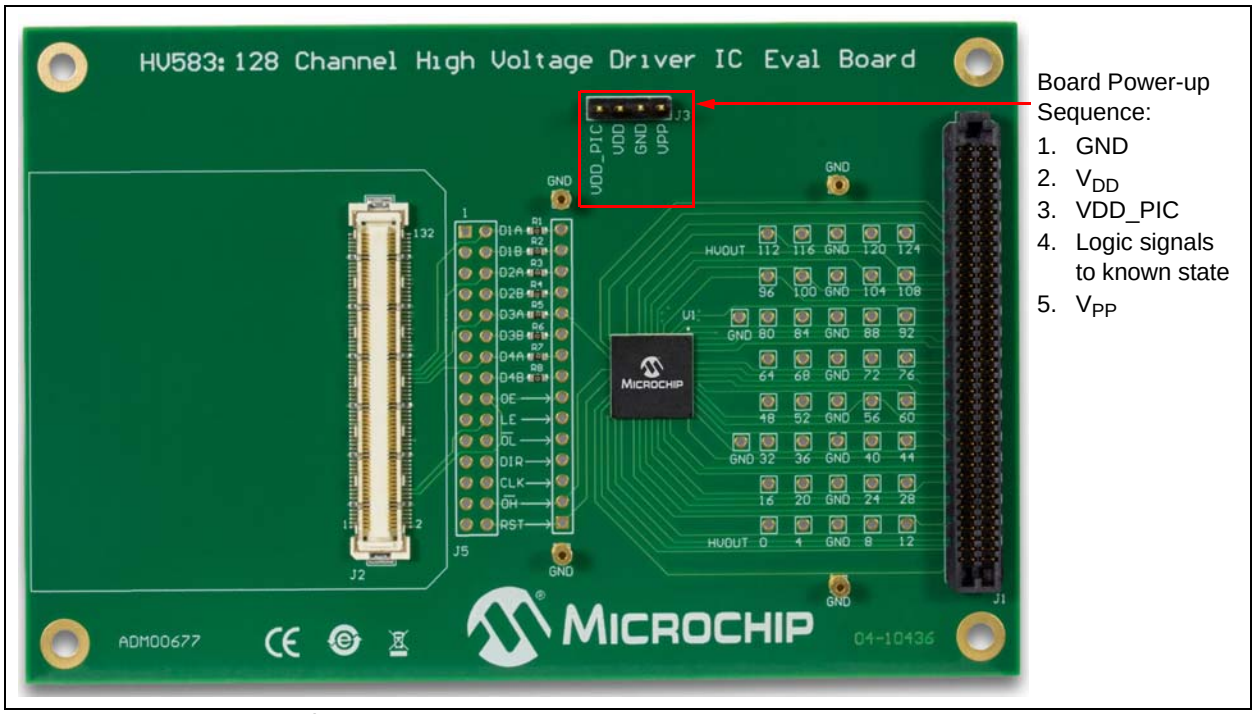


FIGURE 2-1: *Board Power-up Sequence.*

2. Apply the voltage settings by following the steps indicated in Table 2-1.

TABLE 2-1: VOLTAGE SETTINGS

Step	Terminal Name	Description
1	GND	Ground
2	V_{DD}	5.0V, logic power supply for HV583
3	VDD_PIC	5.0V, power supply for PIC32 Starter Kit(1)
4	V_{PP}	+15V to +80V, high-voltage power supply for all $HV_{OUT}n$

Note 1: If the PIC32 Starter Kit is used and not connected to the USB debug cable.

After following the power-up sequence and applying the voltage settings correctly, the evaluation board is ready to operate.

The HV583 128-Channel High-Voltage Driver IC Evaluation Board can be driven by a generic signal pattern generator or by the suggested PIC32 Starter Kit (DM320001). **Section 2.3 "Using the Evaluation Board with a Generic Logic Signal Pattern Generator"** and **Section 2.4 "Using the Evaluation Board with the PIC32 Starter Kit (DM320001)"** elaborate on the operation and evaluation process in detail.

2.3 USING THE EVALUATION BOARD WITH A GENERIC LOGIC SIGNAL PATTERN GENERATOR

2.3.1 Introduction

The HV583 128-Channel High-Voltage Driver IC Evaluation Board can be operated by a generic logic signal pattern generator, or by any signal driver, via the J5 pin header connector (pin header not installed).

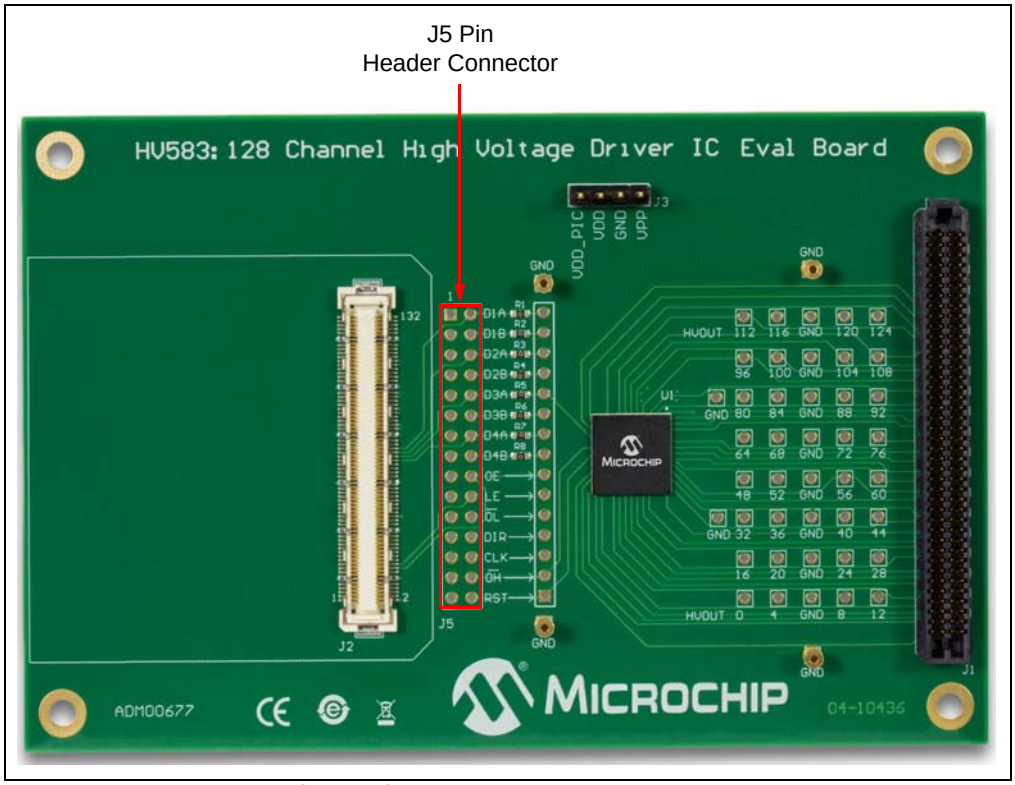


FIGURE 2-2: *J5 Pin Header Connector.*

The user must ensure the minimum DC and AC electrical parameters are achieved by the signal pattern generator. For more information, refer to the HV583 data sheet (DS20005461).

2.3.2 Operating the Evaluation Board

When operating the evaluation board with a generic logic signal pattern generator, the VDD_PIC pin should not be powered on. The VDD_PIC pin is an optional power pin used only for the PIC32 Starter Kit (DM320001).

In case a read operation is required for the signal driver, it is recommended to operate the pattern generator at the same voltage potential as the evaluation board (V_{DD}). If, for instance, the signal pattern generator is operating at a lower voltage (e.g., 3.3V) than that of the evaluation board (5.0V), this will cause the ESD protection diodes of the signal generator to forward bias and possibly damage the board.

WARNING
If a read-back operation is required by the generic signal pattern generator (or by any signal driver), the operational voltage level of the logic signals must be equal to the voltage potential of the evaluation board (V_{DD}).

Figure 2-3 presents the logic diagram of a sample data transmission for testing and understanding the functionality of the HV583.

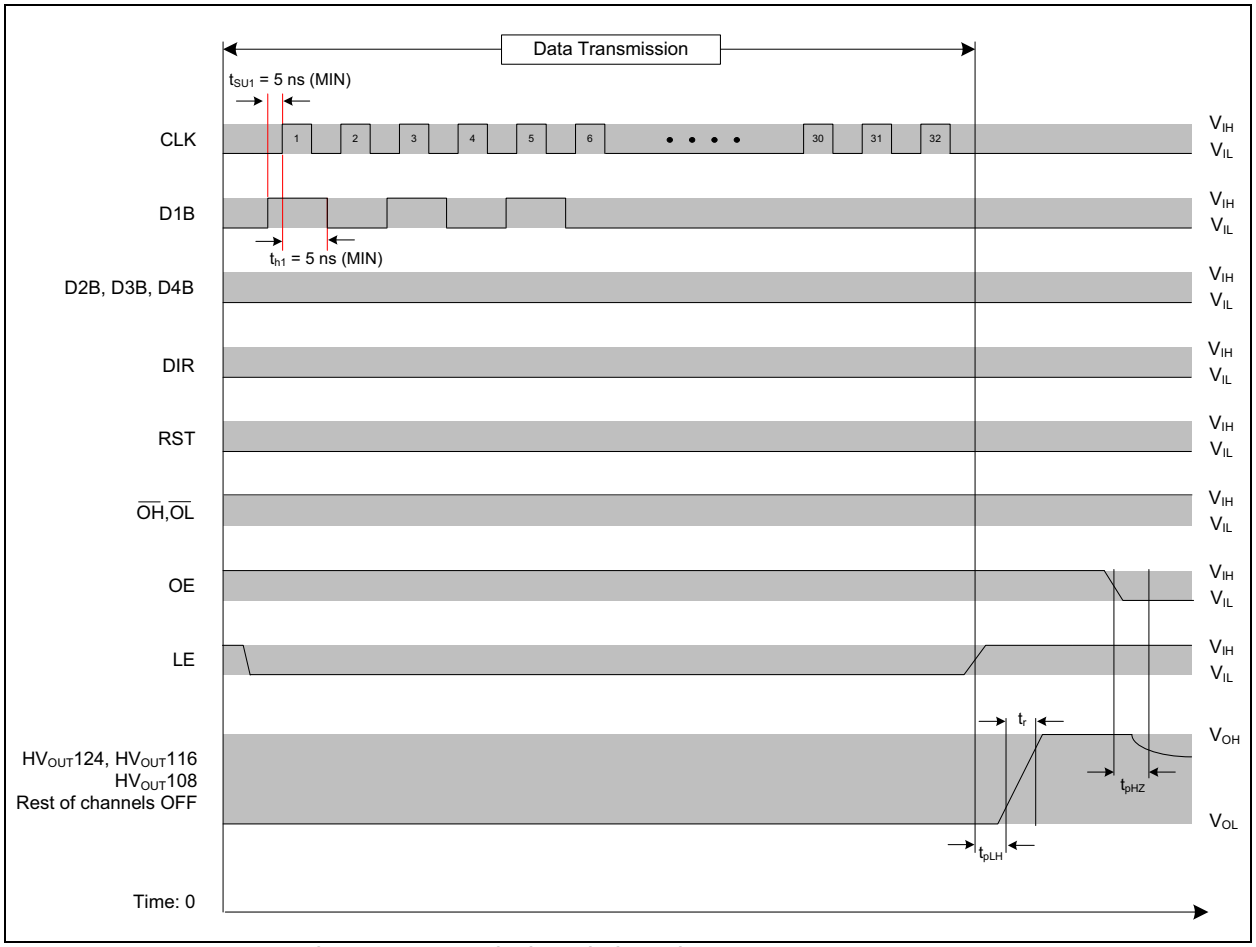


FIGURE 2-3: *Sample Data Transmission Timing Diagram.*

2.4 USING THE EVALUATION BOARD WITH THE PIC32 STARTER KIT (DM320001)

2.4.1 Introduction

The HV583 128-Channel High-Voltage Driver IC Evaluation Board can be operated by the Microchip PIC32 Starter Kit (DM320001) via the FX10A-120S/12-SV(71) connector, J2 (see Figure 2-4).

Note: Several PIC32 Starter Kits might be compatible with the HV583 Evaluation Board, but only the DM320001 is supported with code.

2.4.2 Software Requirements

In order to operate the PIC32 Starter Kit, the MPLAB® X IDE software and MPLAB® XC32 compiler must be installed in the user's system. Software and compilers are available for download on the Microchip web site at: www.microchip.com.

For detailed information regarding the installation and usage of MPLAB X IDE software, refer to the *"MPLAB® X IDE User's Guide"* (DS50002027).

2.4.3 Connecting the PIC32 Starter Kit to the HV583 Evaluation Board

Mount the PIC32 Starter Kit (DM320001) onto the J2 connector before powering up the board. Follow the power-up sequence and apply the voltage settings indicated in **Section 2.2 "Setup Procedure"**.

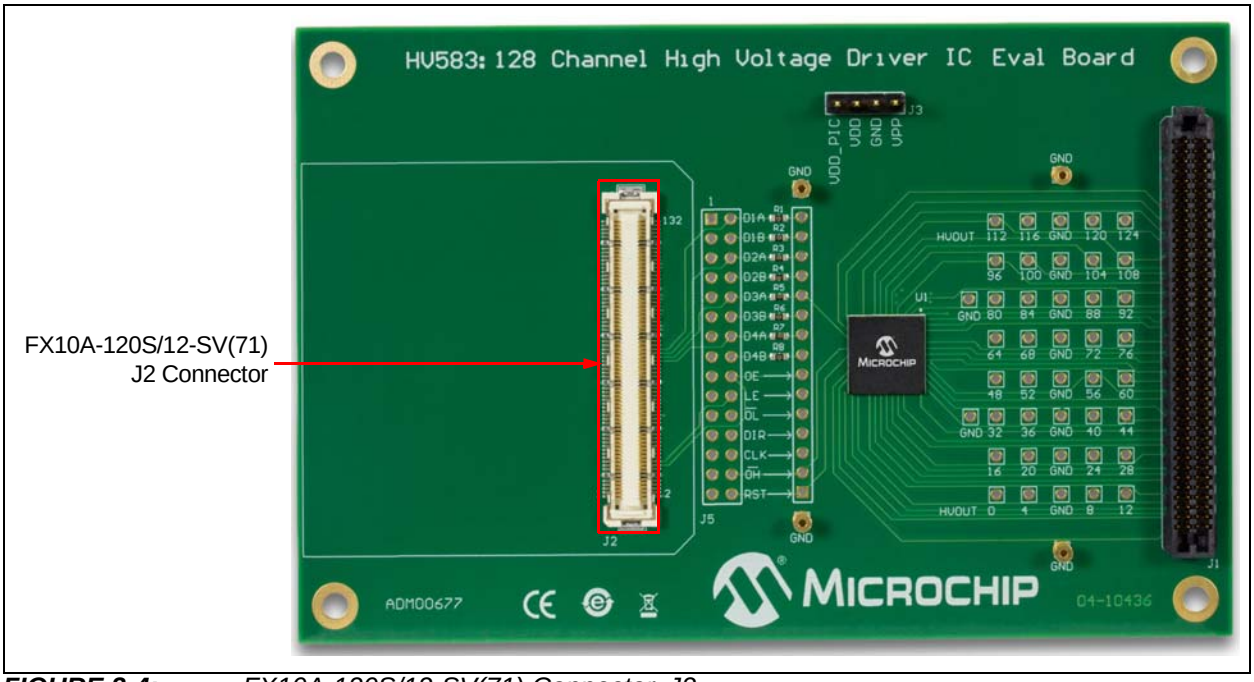


FIGURE 2-4: *FX10A-120S/12-SV(71) Connector, J2.*

2.4.4 PIC32 Starter Kit Software Code

The source code for driving the HV583 128-Channel High-Voltage Driver IC Evaluation Board, `PIC32_HV583.x`, is available for download on the Microchip web site. The objective of the code is to provide a starting platform for utilizing the HV583 evaluation board.

The code flowchart is presented in Figure 2-5.

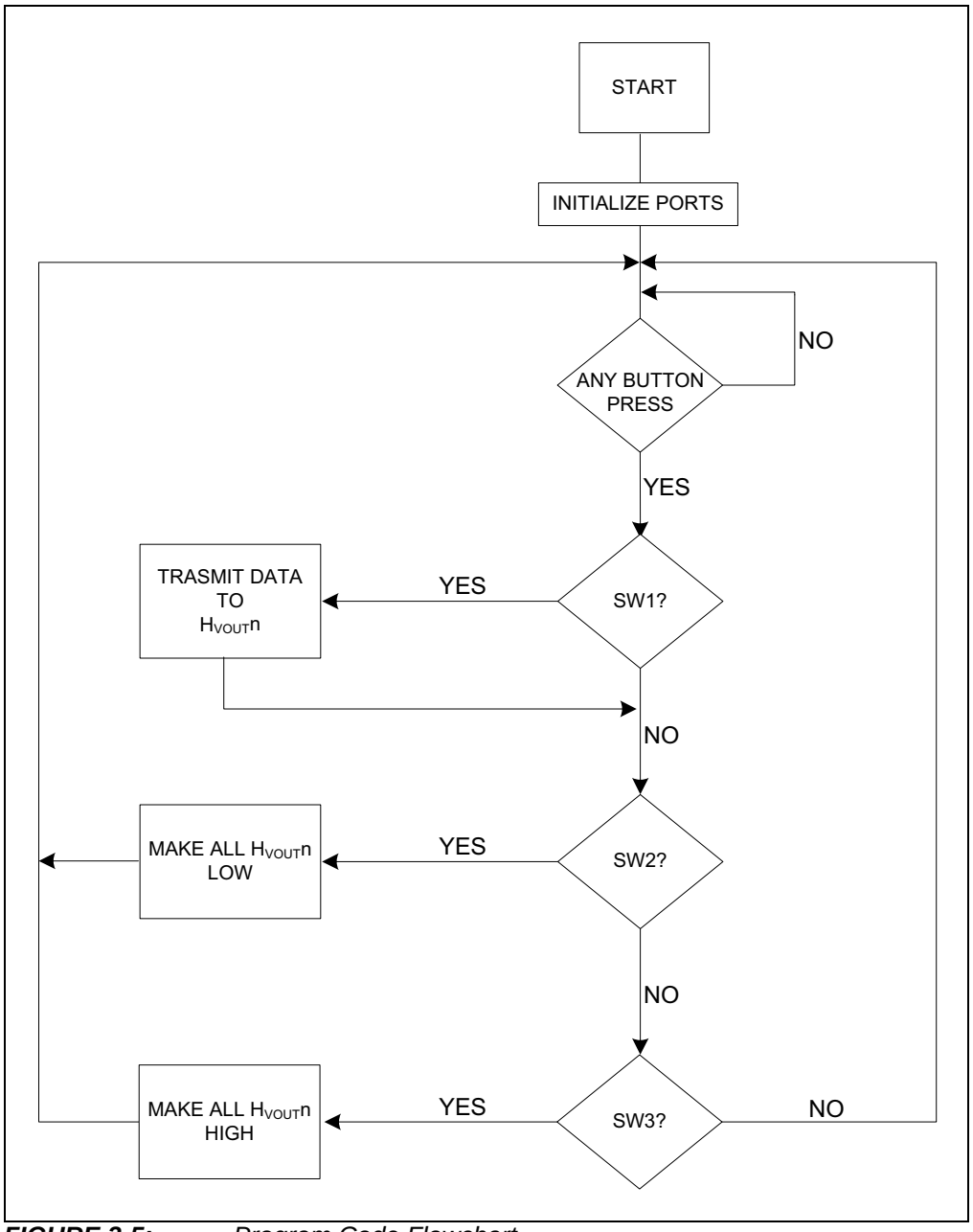


FIGURE 2-5: *Program Code Flowchart.*

Table 2-2 provides a summary of the software code operation.

TABLE 2-2: SOFTWARE CODE OPERATION(1)

Switch	Description
SW1	LED 1 turns on, data is sent to Input registers, D1B, D2B, D3B and D4B
SW2	LED 2 turns on, makes all ($HV_{OUT}n$) High-Voltage channels low (GND)
SW3	LED 3 turns on, makes all ($HV_{OUT}n$) High-Voltage channels high (V_{PP})

Note 1: Push button switches are located on the PIC32 Starter Kit; see Figure 2-6 and **Section 2.4.6 "Modifying the Control Signals and Data in the Code"**.

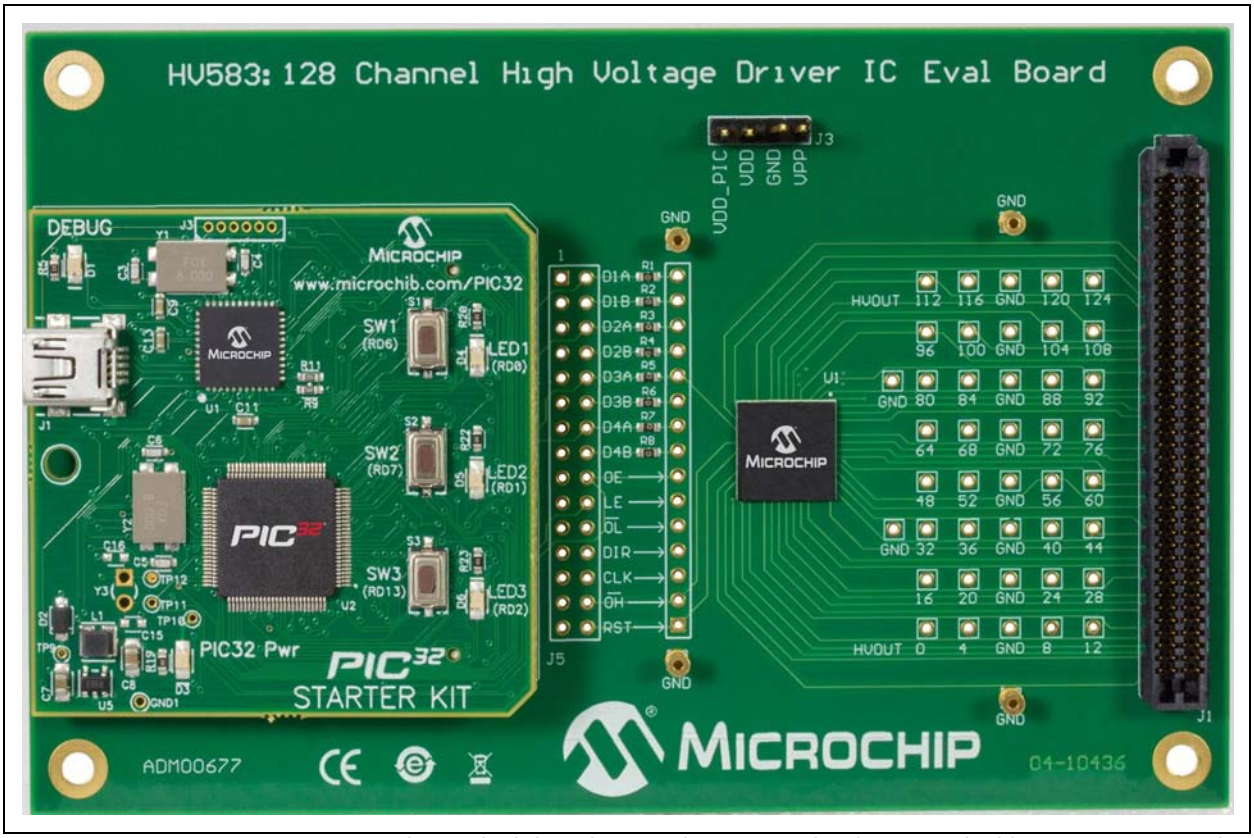


FIGURE 2-6: *HV583 128-Channel High-Voltage Driver IC Evaluation Board with PIC32 Starter Kit (DM320001) Connected on J2 – Top View.*

2.4.5 Programming the PIC32 Starter Kit

This section assumes that the MPLAB X IDE software and the MPLAB XC32 compiler are installed on the user's system, and the PIC32 Starter Kit is connected to the PC via the USB debug cable.

To load the `PIC32_HV583.x` code, follow these steps:

1. Open the MPLAB X IDE and then the `PIC32_HV583.x` program code.
2. Select the **Clean and Build Project** icon ( ). Ignore warning messages.
3. Select the **Make and Program Device** icon ( ).

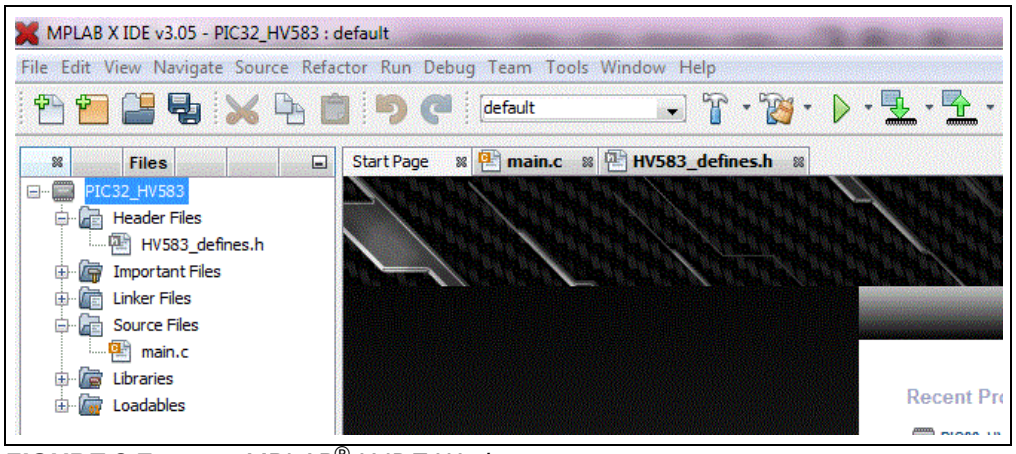


FIGURE 2-7: *MPLAB® X IDE Workspace.*

2.4.6 Modifying the Control Signals and Data in the Code

To modify the control signals and the data to be sent to the HV583, open the `HV583_defines.h` file located under the Header Files folder.

To change the control signals, LE, OE, DIR, RST, $\overline{OH}$ and $\overline{OL}$, locate the section in the file labeled, `INPUT CONTROL SIGNALS` (see Figure 2-8), and modify accordingly. Data transmission is controlled by pressing the push button switches on the PIC32 Starter Kit (see Figure 2-6). The user can select one of three available cases:

- `HV583_CASE_1_ENABLE` and `HV583_CASE_1_DISABLE` control the data transmission; selectable by pressing SW1.
- `HV583_CASE_2_ENABLE` makes all $HV_{OUT}n$ channels low; selectable by pressing SW2.
- `HV583_CASE_3_ENABLE` makes all $HV_{OUT}n$ channels high; selectable by pressing SW3.

```
//============================================================//
//------------------------------------------------------------//
//----------      INPUT CONTROL SIGNALS          ------------//
//------------------------------------------------------------//
//============================================================//
#define HV583_CASE_1_ENABLE        0b110010  // (LSB)LE  = LOW,  OE = HIGH, DIR = LOW,  RST = LOW, OH = HIGH, OL = HIGH
#define HV583_CASE_1_DISABLE       0b110011  // (LSB)LE  = HIGH, OE = HIGH, DIR = LOW,  RST = LOW, OH = HIGH, OL = HIGH
#define HV583_CASE_2_ENABLE        0b010010  // (LSB)LE  = LOW,  OE = HIGH, DIR = LOW,  RST = LOW, OH = HIGH, OL = LOW
#define HV583_CASE_3_ENABLE        0b100010  // (LSB)LE  = LOW,  OE = HIGH, DIR = LOW,  RST = LOW, OH  = LOW, OL = HIGH
```

FIGURE 2-8: *Input Control Signals: LE, OE, DIR, RST, $\overline{OH}$ and $\overline{OL}$.*

To change the data to be sent to the Input registers of the HV583, scroll to the bottom of the file, locate the section, `DATA TO SEND TO REGISTERS`, and change the values as desired (see Figure 2-9).

The HV583 consists of four 32-bit Shift registers.

The first 32-bit register uses D1A/D1B as input/output pins. The second register uses D2A/D2B, the third register uses D3A/D3B and the fourth register uses D4A/D4B.

In the code, `DATA_1`, corresponds to the first bit of data to be sent to all of the four registers. The Least Significant Bit (LSB) corresponds first to D1A/D1B, second to D2A/D2B, third to D3A/D3B, and fourth to D4A/D4B.

```
//=========================================================================//
//-------------------------------------------------------------------------//
//-----------        DATA TO SEND TO REGISTERS      -----------------------//
//-------------------------------------------------------------------------//
//=========================================================================//
#define DATA_1  0b1011 //((LSB)D1A/B = 1 , D2A/B =1, D3A/B = 0, D4A/B = 1)
#define DATA_2  0b1110
#define DATA_3  0b1111
#define DATA_4  0b1100
#define DATA_5  0b1111
#define DATA_6  0b1110
#define DATA_7  0b1110
#define DATA_8  0b1110
#define DATA_9  0b1110
#define DATA_10 0b1110
#define DATA_11 0b1110
#define DATA_12 0b1110
#define DATA_13 0b1110
#define DATA_14 0b1110
#define DATA_15 0b1110
#define DATA_16 0b1010
#define DATA_17 0b1110
#define DATA_18 0b1110
#define DATA_19 0b1110
#define DATA_20 0b1110
#define DATA_21 0b1000
#define DATA_22 0b1010
#define DATA_23 0b1000
#define DATA_24 0b1000
#define DATA_25 0b1000
#define DATA_26 0b1000
#define DATA_27 0b1000
#define DATA_28 0b1000
#define DATA_29 0b0110
#define DATA_30 0b1000
#define DATA_31 0b1110
#define DATA_32 0b1001
```

FIGURE 2-9: *Data to Send to the HV583 Input Registers.*

The code flow is specified in the `main.c` file (see Figure 2-7) located under the Source Files folder.

NOTICE

By default, the code provided sends data into the DnB Input registers of the HV583.

WARNING

The PIC32 Starter Kit (DM320001) cannot be used to read data back from the HV583 Evaluation Board because of the difference in the logic voltage level: 3.3V (PIC32) vs. 5.0V (V_{DD}). If used, this will cause the ESD protection diodes in the PIC32 board to forward bias and possibly damage the board.

NOTES:

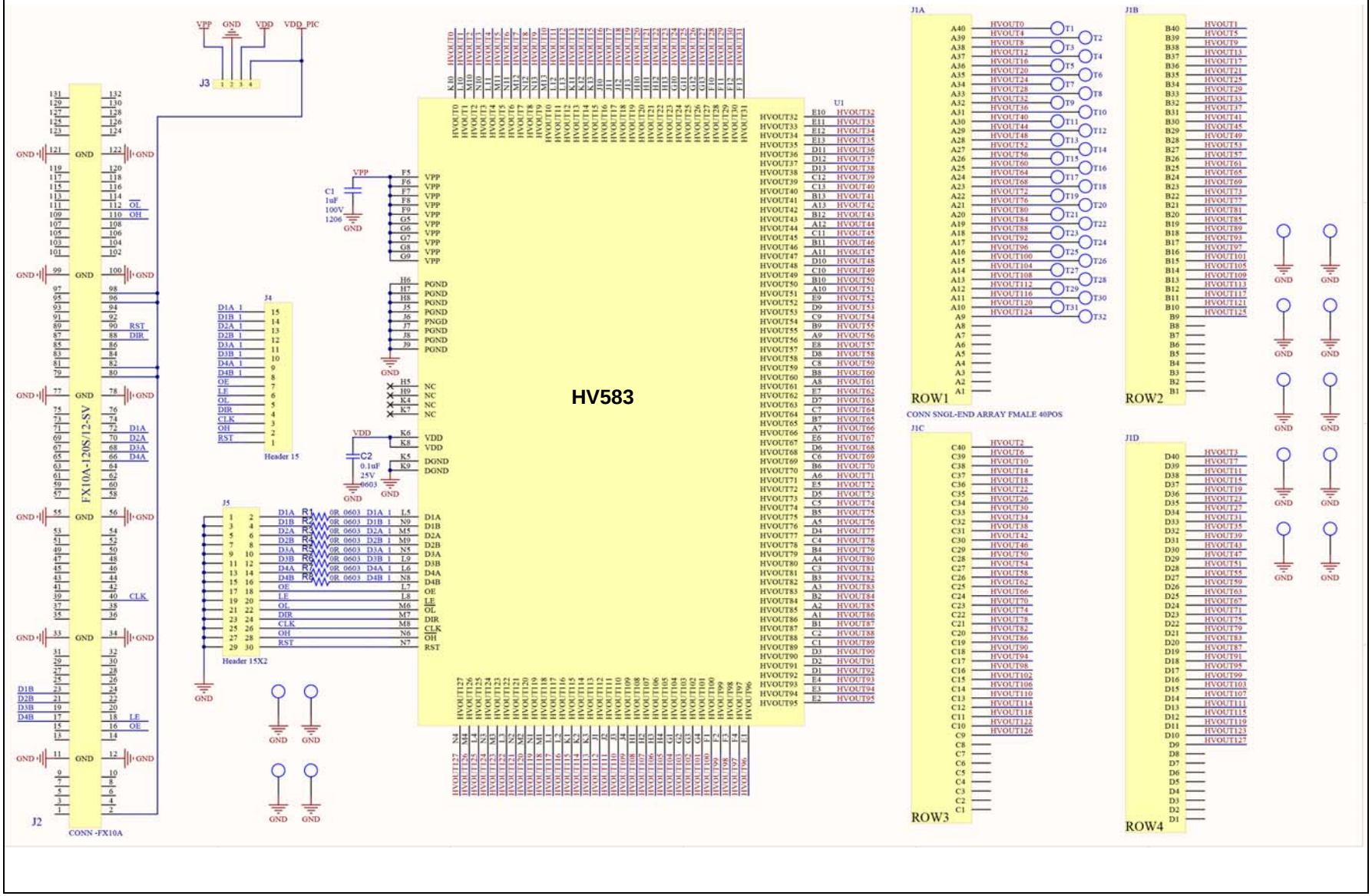
Appendix A. Schematic and Layouts

A.1 INTRODUCTION

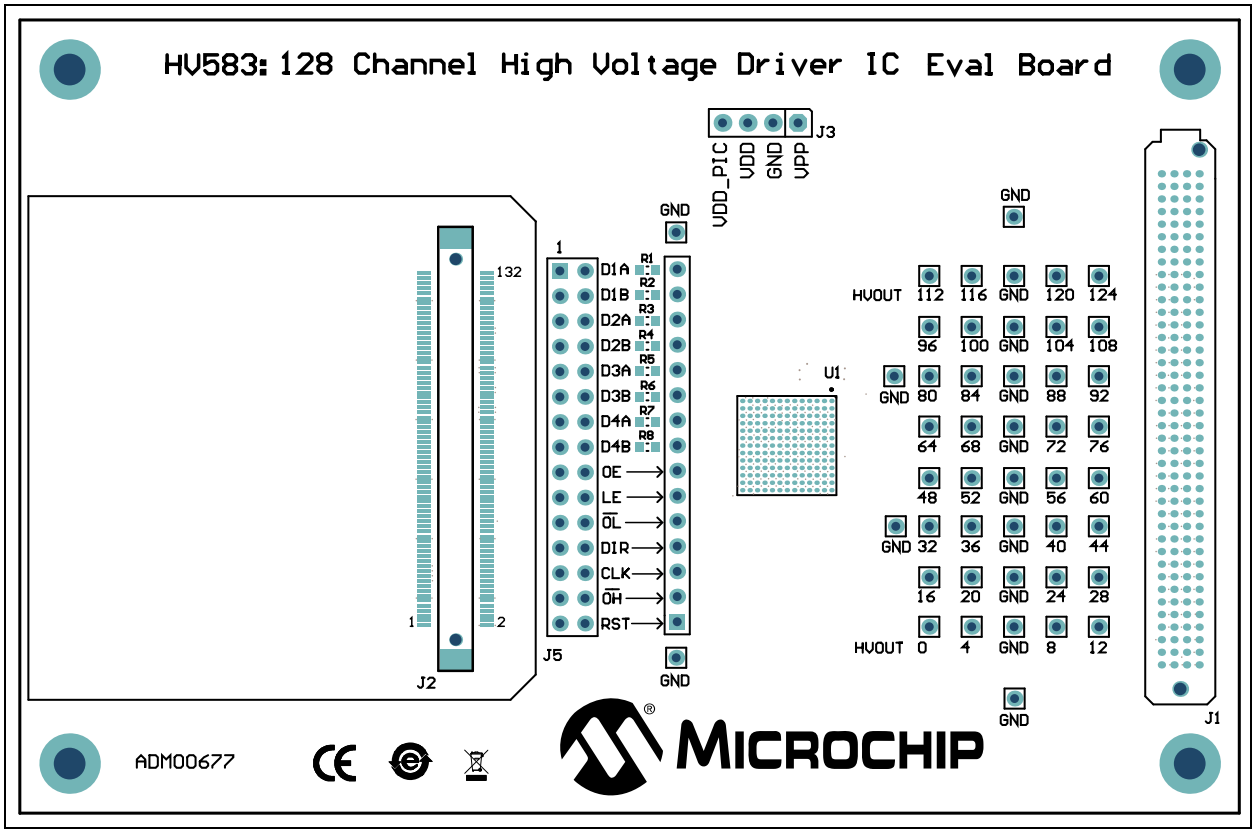
This appendix contains the following layouts and schematic for the HV583 128-Channel High-Voltage Driver IC Evaluation Board (ADM00677):

- Evaluation Board – Schematic
- Evaluation Board – Top Silk
- Evaluation Board – Top Copper and Silk
- Evaluation Board – Top Copper
- Evaluation Board – Ground Plane
- Evaluation Board – Mid Layer 1
- Evaluation Board – Mid Layer 2
- Evaluation Board – Power Plane
- Evaluation Board – Bottom Copper
- Evaluation Board – Bottom Copper and Silk
- Evaluation Board – Bottom Silk

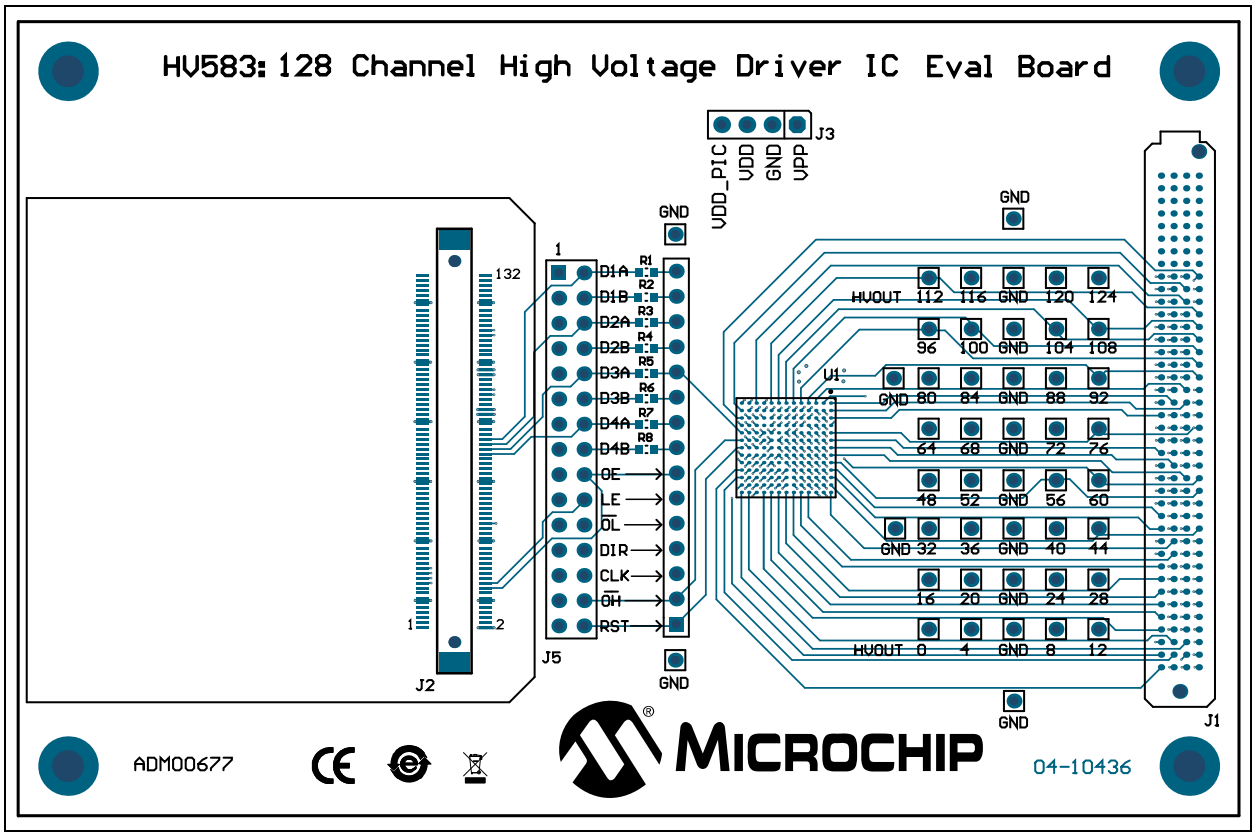
A.2 EVALUATION BOARD – SCHEMATIC



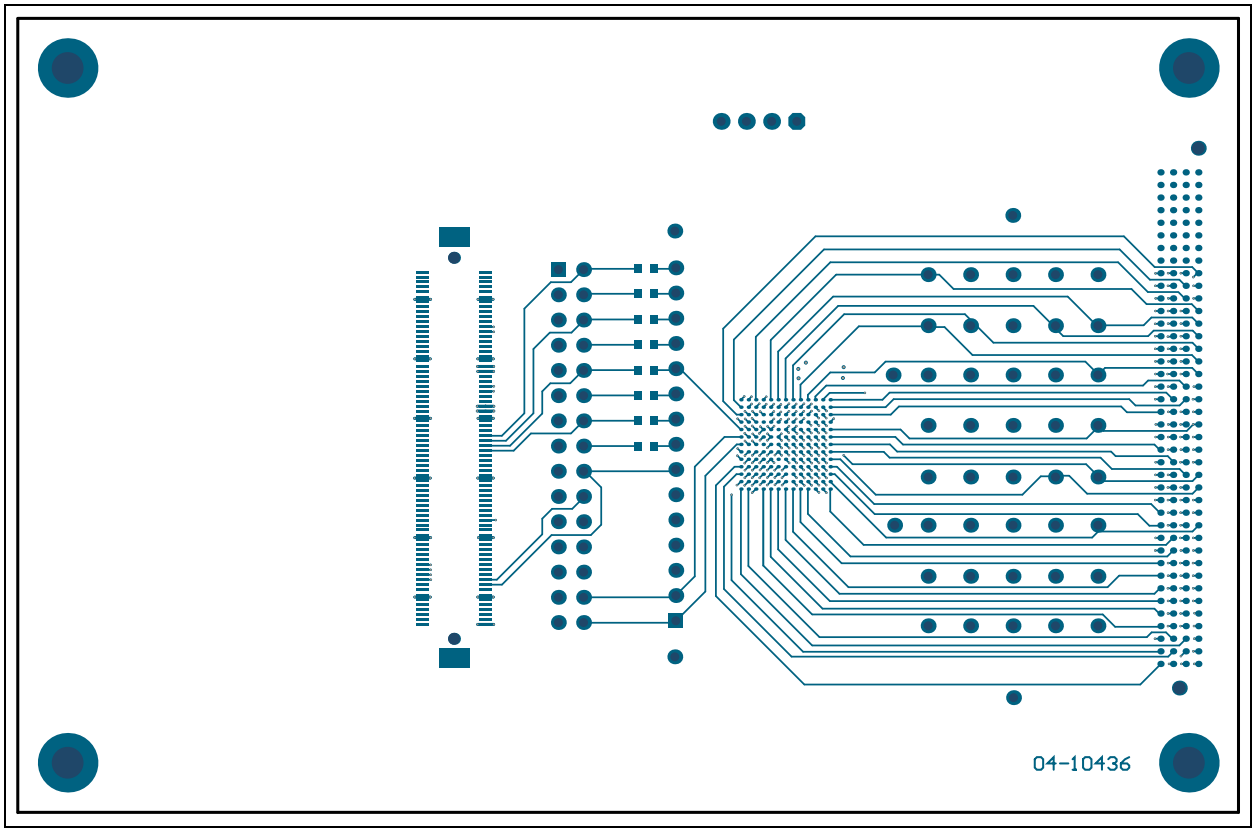
A.3 EVALUATION BOARD – TOP SILK



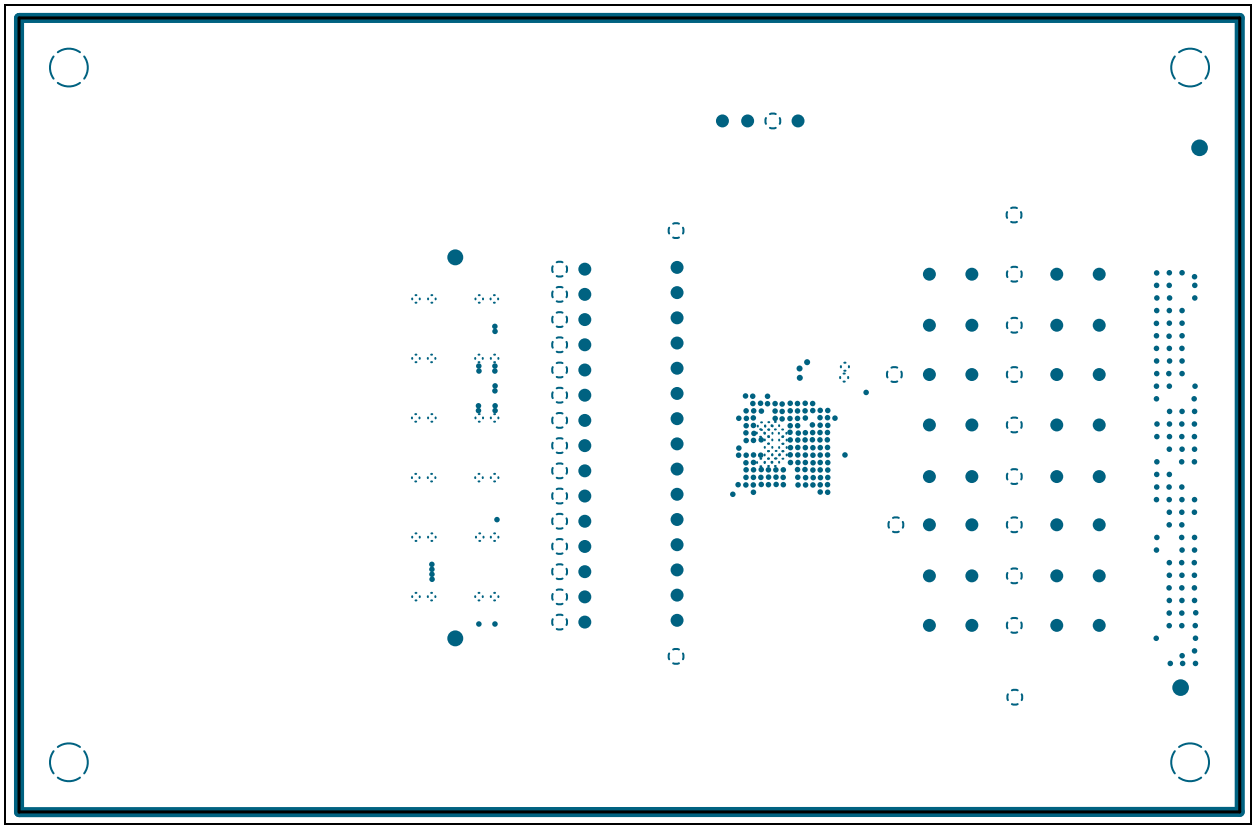
A.4 EVALUATION BOARD – TOP COPPER AND SILK



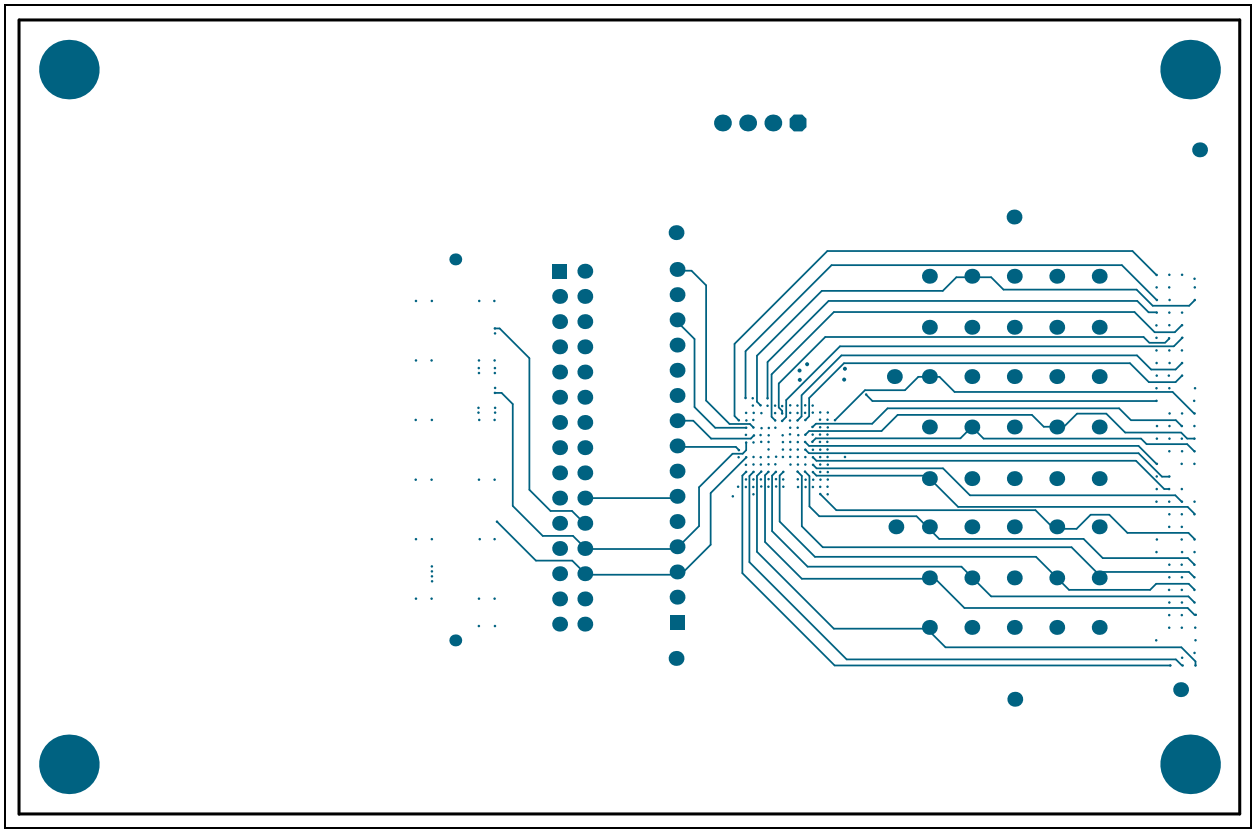
A.5 EVALUATION BOARD – TOP COPPER



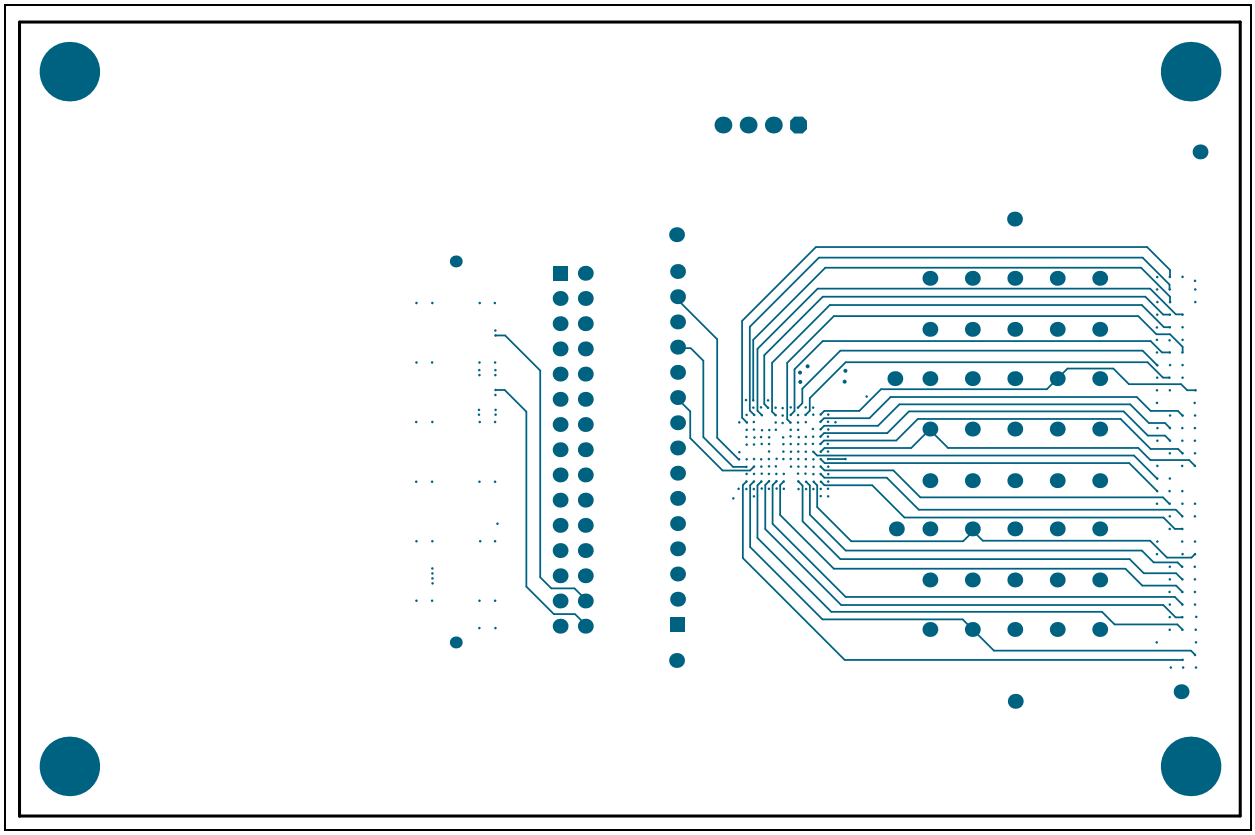
A.6 EVALUATION BOARD – GROUND PLANE



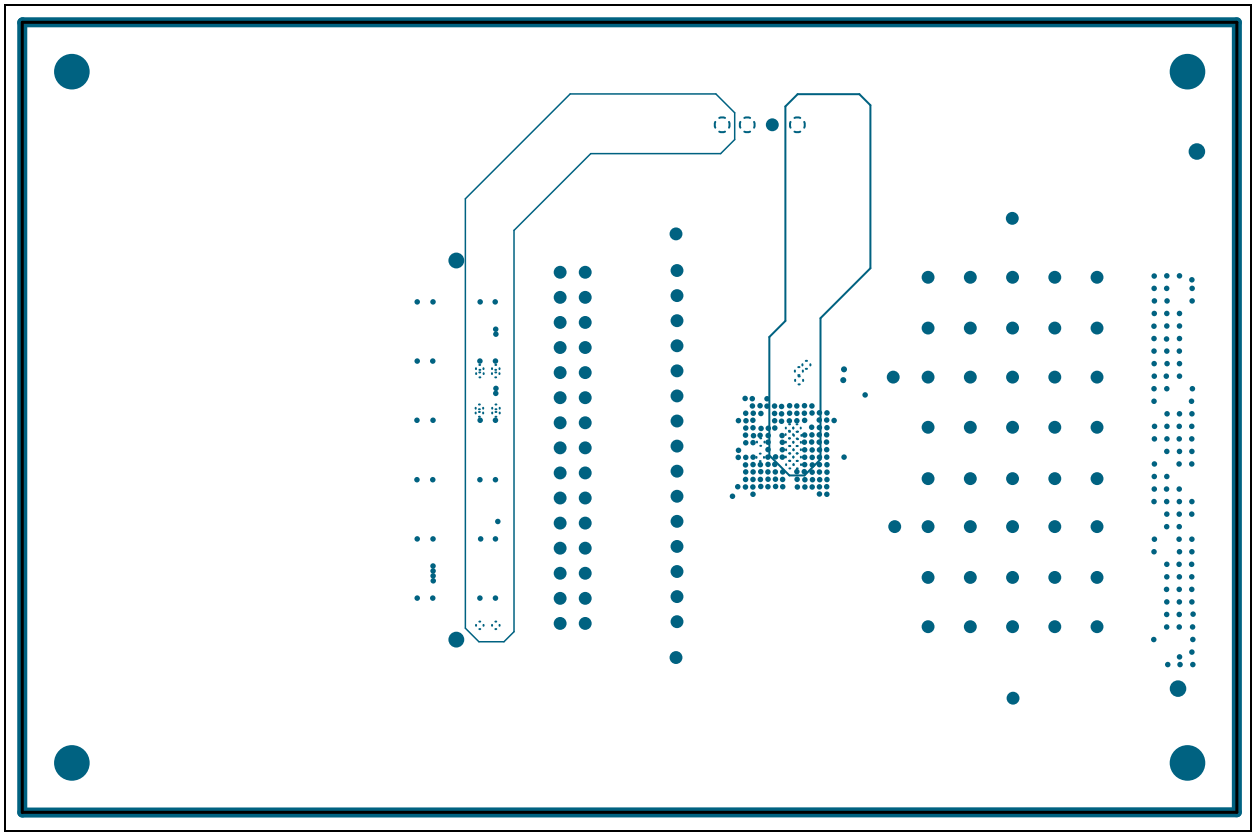
A.7 EVALUATION BOARD – MID LAYER 1



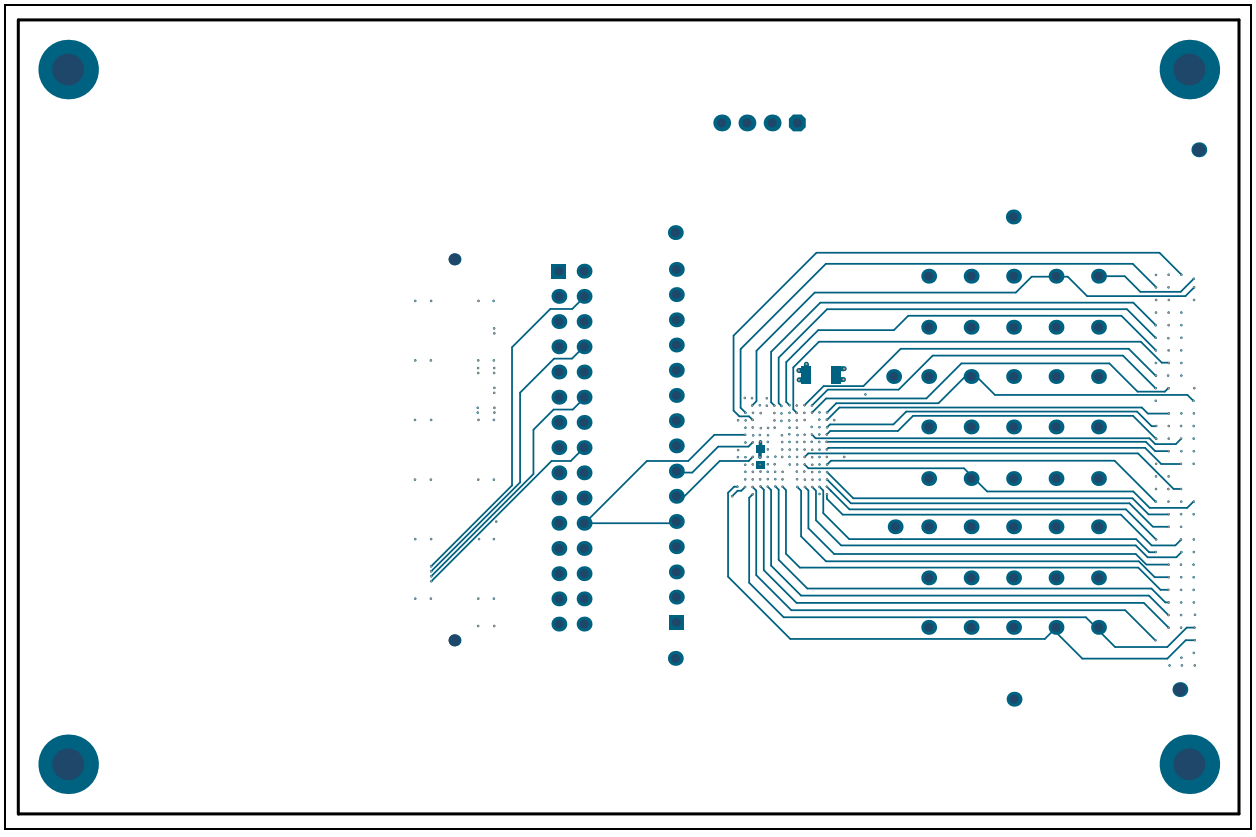
A.8 EVALUATION BOARD – MID LAYER 2



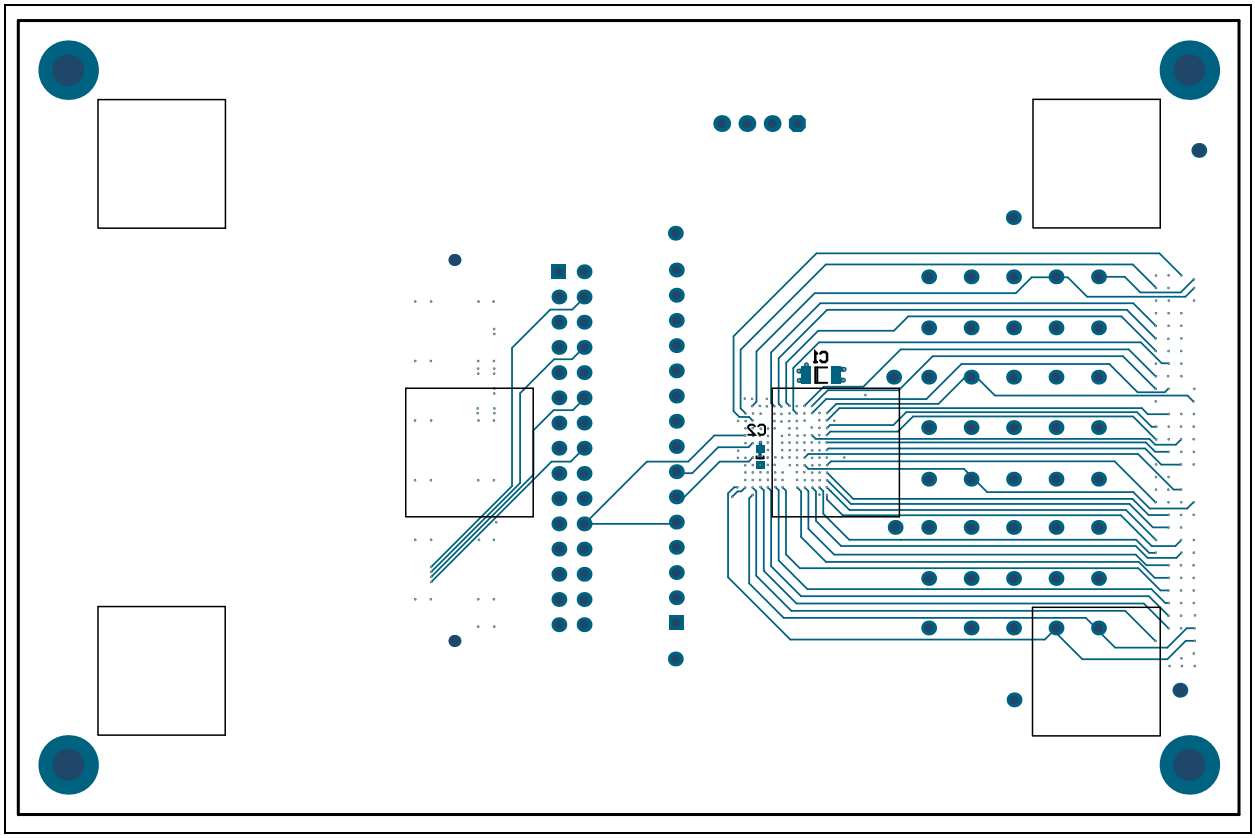
A.9 EVALUATION BOARD – POWER PLANE



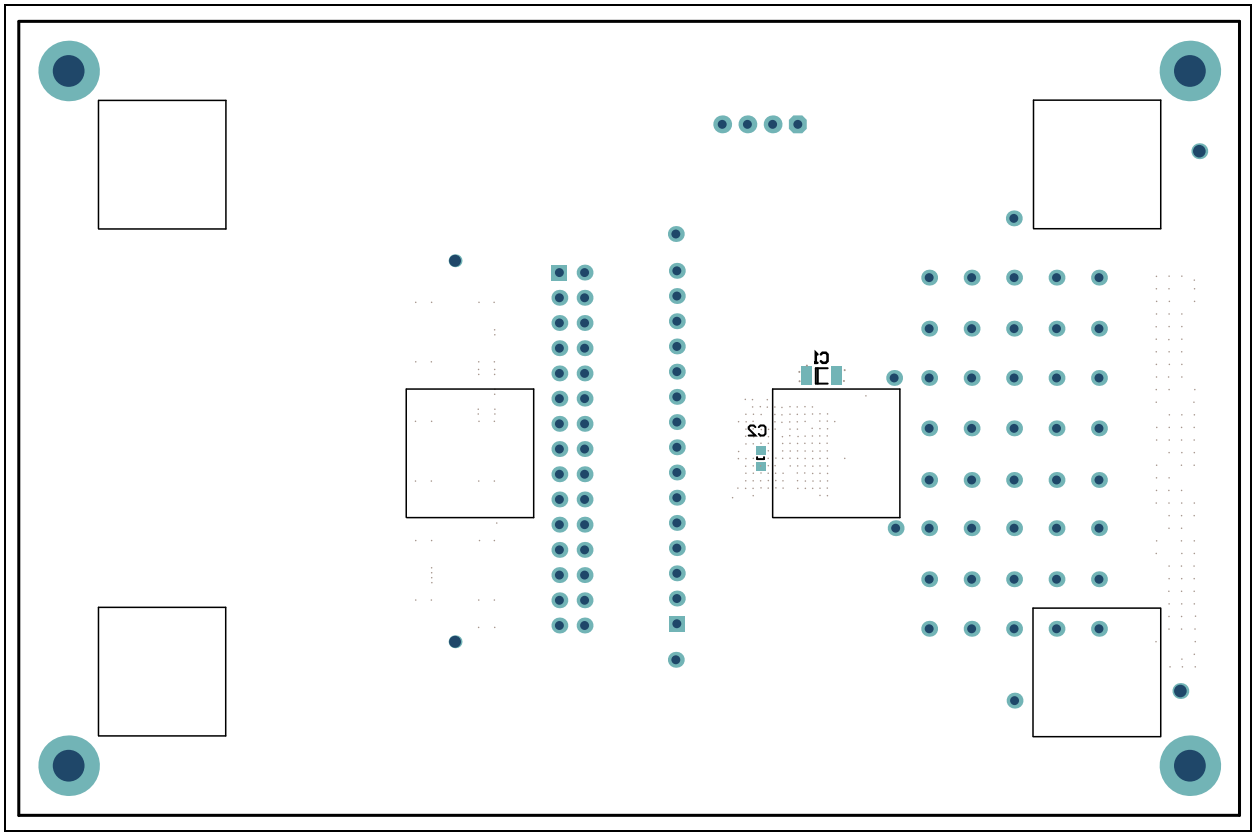
A.10 EVALUATION BOARD – BOTTOM COPPER



A.11 EVALUATION BOARD – BOTTOM COPPER AND SILK



A.12 EVALUATION BOARD – BOTTOM SILK



NOTES:

Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Designator	Description	Manufacturer	Part Number
1	C1	Ceramic Capacitor, 1 µF, 100V	AVX Corporation	12061C105KAT2A
1	C2	Ceramic Capacitor, 0.1 µF, 25V	AVX Corporation	06033C104JAT2A
1	J1	160 Position High-Density Array Connector, Female	Molex®, LLC	0465574145
1	J2	Board-to-Board High-Speed Connector, 120 Positions, w/Post, SMD	Hirose Electric Co. Ltd.	FX10A-120S/12-SV(71)
1	J3	Connector Header, 4 Positions, 100", SGL, Gold	Samtec Inc.	TSW-104-07-G-S
4	GND	Connector PC Pin, Circular, 0.030 Diameter, Gold	Mill-Max Manufacturing Corp.	3132-0-00-15-00-00-08-0
6	N/A	Rubber Bumper Square, 0.5"L x 0.5"W, Black	3M	SJ-5518 (BLACK)
1	PCB	HV583 128-Channel High-Voltage Driver IC Evaluation Board – Printed Circuit Board	—	04-10436
4	R1, R3, R5, R7	**DO NOT POPULATE**	—	—
4	R2, R4, R6, R8	Resistor, SMD, 0.0 Ohm, Jumper, 1/10W	Stackpole Electronics, Inc.	RMCF0603ZT0R00
1	U1	HV583, Unipolar 128-Channel Low-voltage Serial to High-Voltage Parallel Converter with Push-Pull Outputs	Microchip Technology Inc.	**HV583GA-G**

Note: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

NOTES:

Appendix C. HV583 Typical Waveforms

C.1 INTRODUCTION

Waveforms presented in this section correspond to two consecutive data transmissions: Transmission 1 and Transmission 2. No load is connected to the output channels.

C.1.1 Transmission 1

Turns on **HV_{OUT}124**, **116**, **108** and **0**. Turns off the rest of the HV_{OUT} channels.

The control signals not shown in the waveforms have the states listed in Table C-1:

TABLE C-1: TRANSMISSION 1: CONTROL SIGNAL STATES

Signal	State
DIR	Low
RST	Low
$\overline{OH}$	High
$\overline{OL}$	High
D2B	Low
D3B	Low
D4B	Low

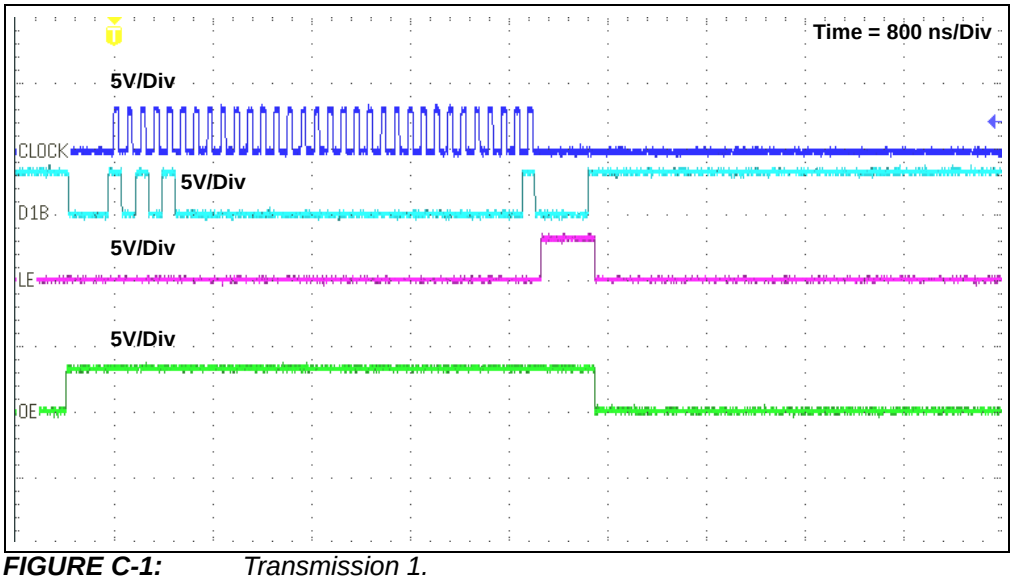


FIGURE C-1: *Transmission 1.*

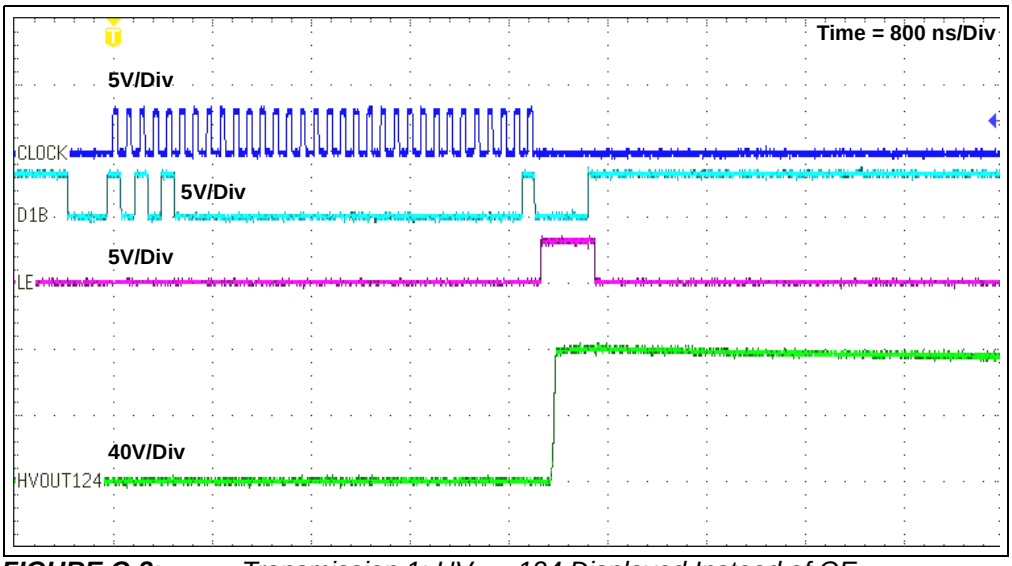


FIGURE C-2: *Transmission 1: HV_{OUT}124 Displayed Instead of OE.*

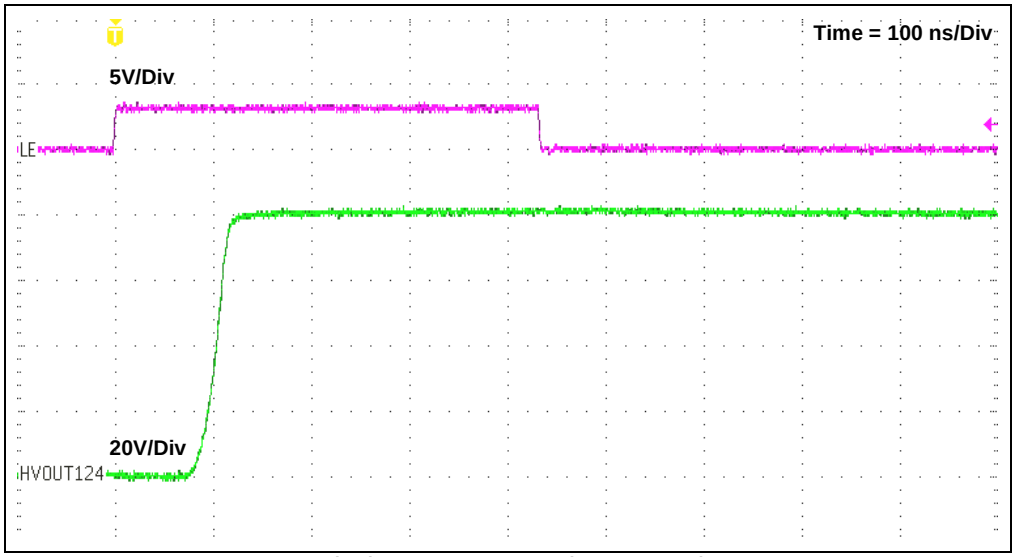


FIGURE C-3: *Transmission 1: Zoom Version, LE and HV_{OUT}124.*

C.1.2 Transmission 2

Turns on **HV_{OUT}116**, **108** and **0**. Turns off **HV_{OUT}124** and the rest of the HV_{OUT} channels. This transmission illustrates the turn-off transition for HV_{OUT}124, which is at a high level (V_{PP}) due to Transmission 1.

The control signals not shown in the waveforms have the states listed in Table C-2:

TABLE C-2: TRANSMISSION 2: CONTROL SIGNAL STATES

Signal	State
DIR	Low
RST	Low
$\overline{OH}$	High
$\overline{OL}$	High
D2B	Low
D3B	Low
D4B	Low

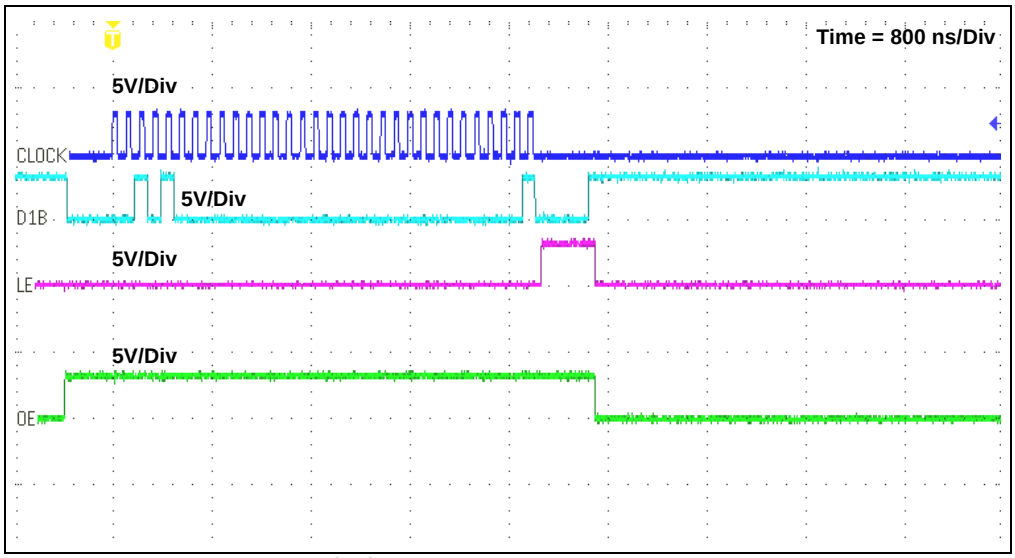


FIGURE C-4: *Transmission 2.*

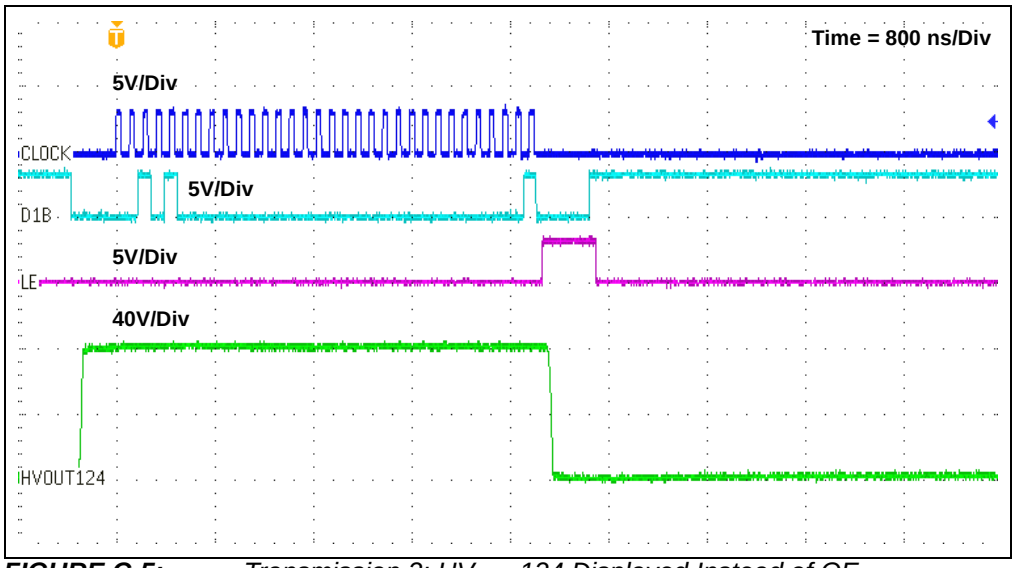


FIGURE C-5: *Transmission 2: $HV_{OUT}124$ Displayed Instead of OE.*

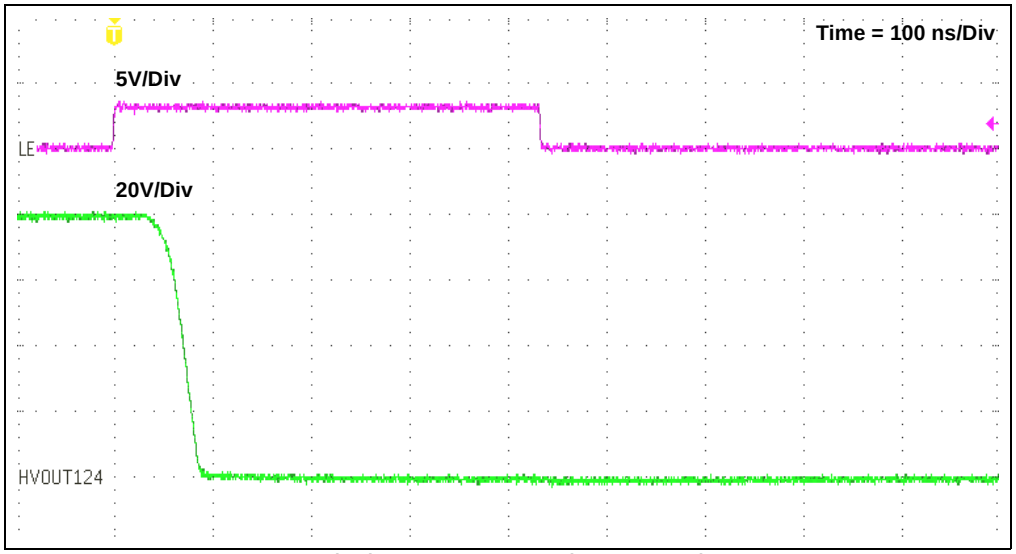


FIGURE C-6: *Transmission 2: Zoom Version, LE and $HV_{OUT}124$.*

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