

## **TPS6598x PDIO Alternate Mode**

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### **ABSTRACT**

The PDIO Alternate Mode allows users to transmit or receive up to four unique digital signals between two systems connected through USB Type-C. The PDIO signals are particularly applicable to applications such as laptop docking stations, where push button events can be used to send status information from one device to another like a virtual GPIO. This application report explains the standard implementation of the PDIO Alternate Mode and is to be used with Texas Instruments TPS6598x family of USB Type-C and USB PD controllers and associated software tools.

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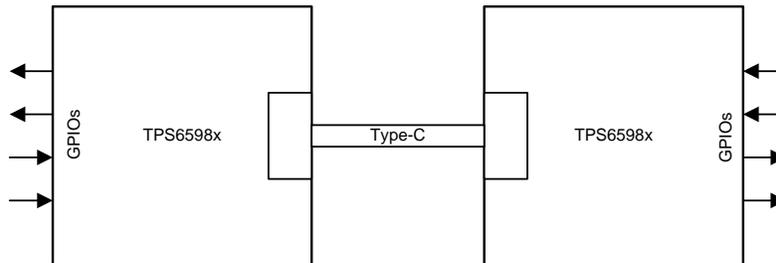
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## 1 Introduction

PDIO is a feature of TI alternate mode which allows to transmit or receive up to four slow digital signals between two systems which are connected using USB Type-C connections.

The TPS6598x USB Type-C and USB PD controllers can be configured to transmit or receive up to four digital signals to another compatible controller connected using USB Type-C connections. The user can use any four GPIOs in PDIO mode. Any change in these GPIOs is automatically transmitted over the USB Type-C link to the compatible receiver connected on the other side.



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Figure 1. Block Diagram

The PDIO feature is useful for applications such as laptop docking stations, where these GPIOs can be used to send push button events and control LEDs to indicate various states of the system.

## 2 PDIO Configuration in Host Interface Registers

The TPS65982 registers include the following:

- Configuration registers
  - 0x54, Texas Instruments VID Config Register
  - 0x5C GPIO Event Map Register

The Texas Instruments VID Config Register (0x5C) is the primary register used to control PDIO mode in the TPS6598x PD controllers. This register allows the user to enable Texas Instruments VID, PDIO Mode and auto entry. This register also allows the user to set the message index and PDIO signature.

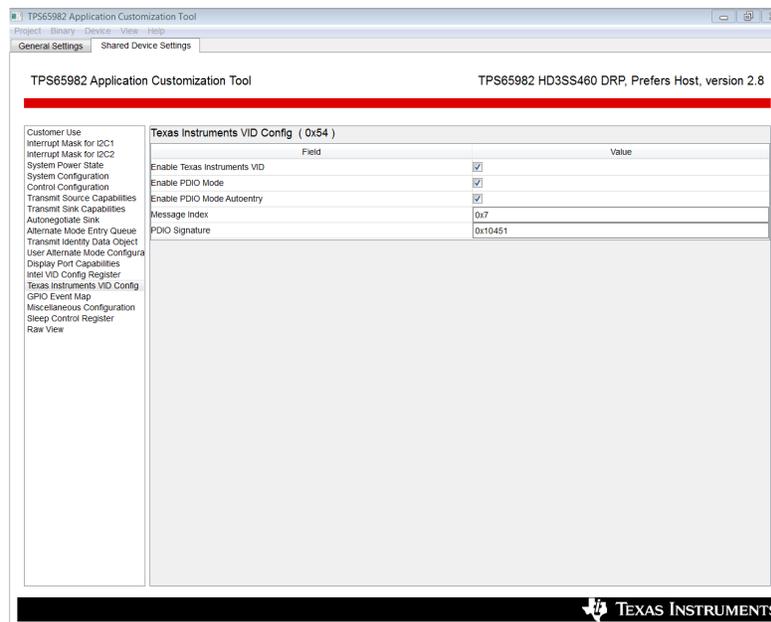


Figure 2. Texas Instruments VID Config Panel

The *Message Index* field is used to assign an array location in the billboard failure message if it occurs. According to the current setting shown in [Figure 2](#), the seventh item in the array sent by the billboard device contains information about PDIO.

The *PDIO Signature* field is a 32-bit field to assign a unique signature to a set of devices that are supposed to work together. For the PDIO feature to work, both the ends connected to the Type-C cable must have an identical PDIO signature. The last 4 bytes of the PDIO must be 0x0451 whereas the first 4 bytes can be assigned by the user. Therefore the format of the PDIO is 0xABCD0451, where ABCD is a user-assigned number.

The GPIO Event Map Register (0x5C) is used to configure the GPIOs of the TPS6598x devices. Using this register the user can assign any supported feature to a GPIO including a PDIO-input or PDIO-output function.

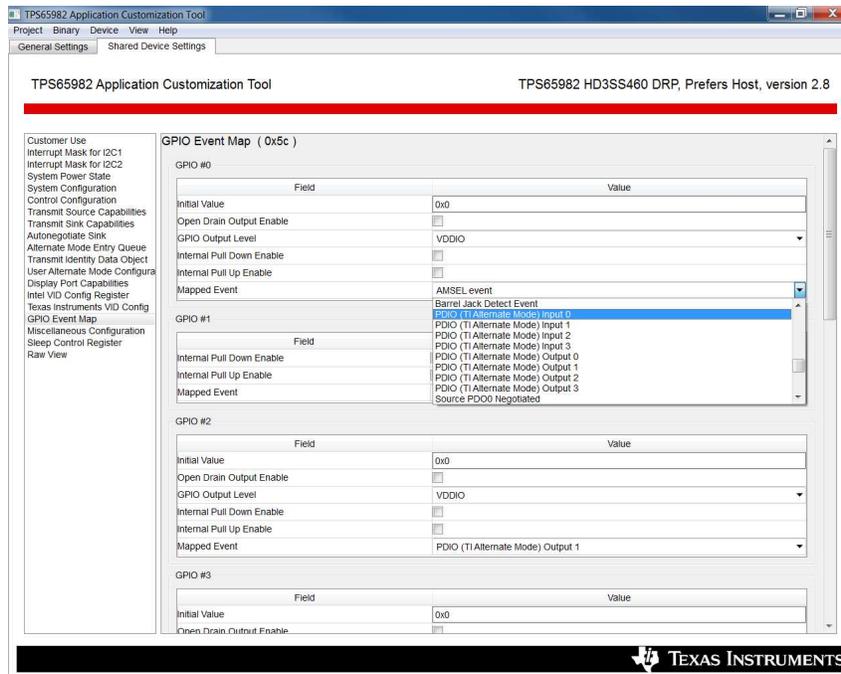


Figure 3. GPIO Config Panel

Each TPS6598x device can have a maximum of 4 PDIOs which can be configured either as an input or output.

### 3 PDIO Example

The TPS6598x Application Customization Tool contains multiple project templates, most of which can support a PDIO data transfer.

Create a new project in TPS6598x Application Customization Tool and go to the *Texas Instruments VID Config* option in the *Shared Device Settings* tab as shown in [Figure 4](#).

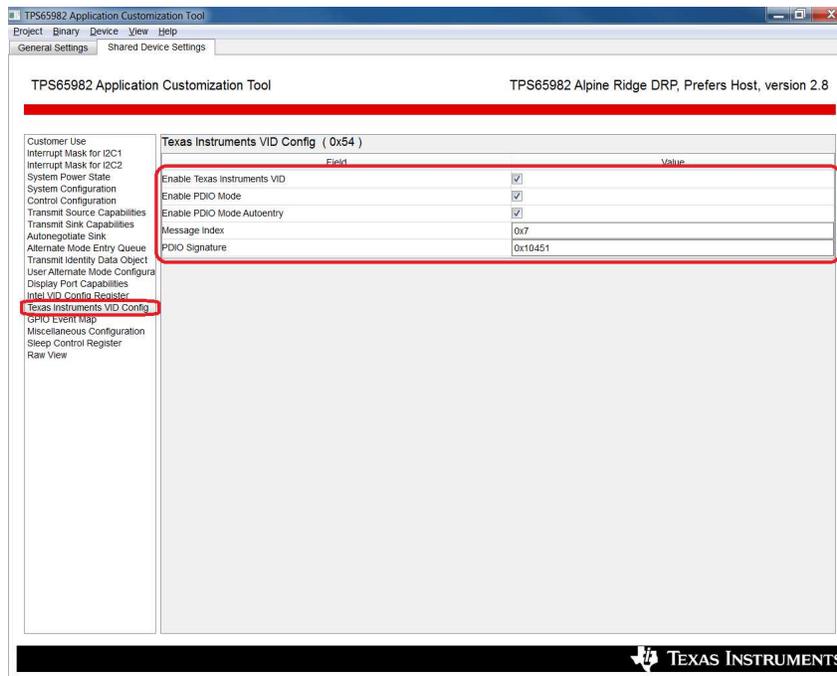


Figure 4. PDIO Settings

Enter the settings into the tool exactly as shown in Figure 4. Ensure that the *PDIO Signature* field has identical values for both the connected USB Type-C and USB PD controllers.

Go to the *GPIO Event Map* option and select up to 4 GPIOs as either input or output as shown in Figure 5. Set the other applicable settings appropriately and program the PD controllers.

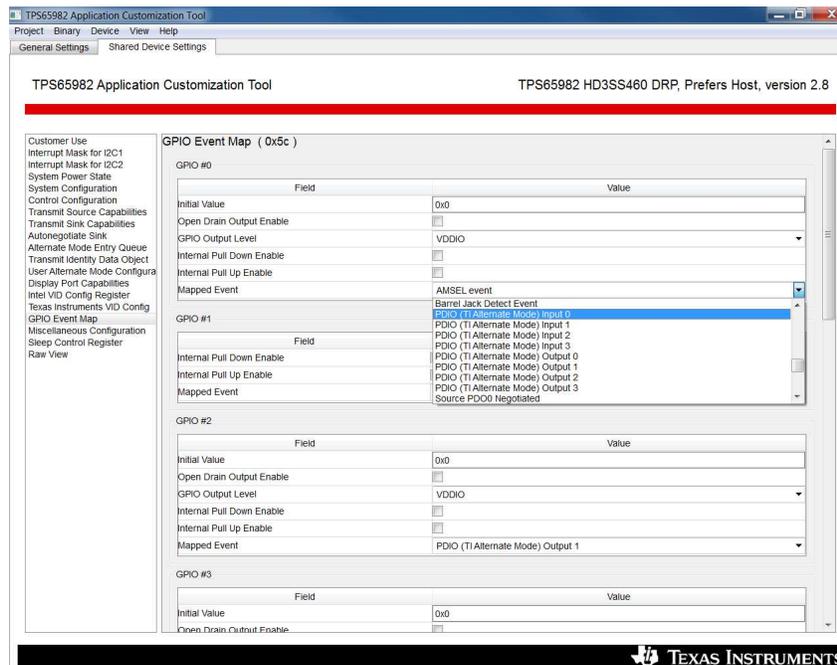
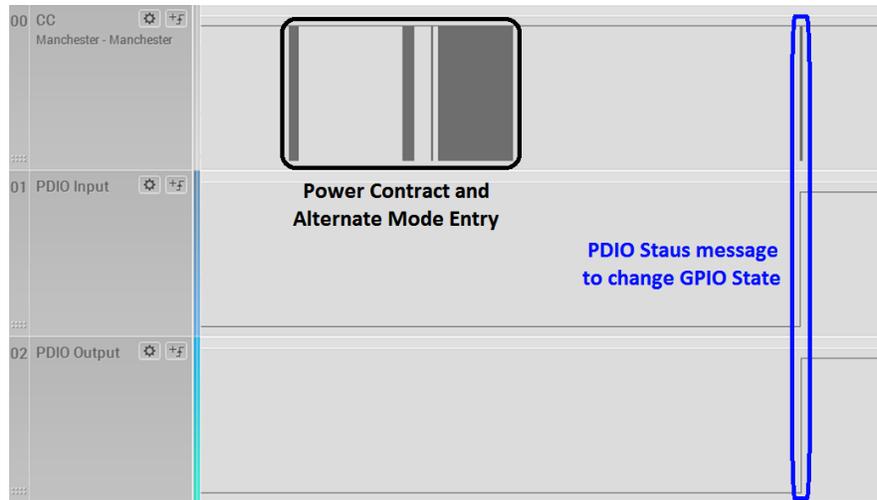


Figure 5. GPIO Settings

Connect both ends using a USB Type-C cable and ensure that the VBUS supply goes to the correct value depending on the configuration of the controllers.

Toggle one or more PDIO inputs and observe the change in state of the corresponding PDIO outputs on the other end.

The resulting scope of Type-C communication during PDIO changes should be similar to [Figure 6](#).



**Figure 6. PD Messages**

[Figure 6](#) shows the expected sequence of PD operations for this example. The change of GPIO is communicated as an *Alternate Mode* message.

- Initially, the system makes an initial contract and alternate mode communication to negotiate the contract.
- Whenever the PDIO input GPIO changes in one direction, that direction sends out an *Alternate Mode* message to send out this information.
- The other end receives this information and accordingly changes the state of the mapped GPIO.

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