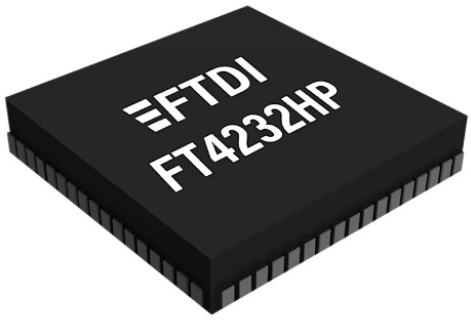

FTDI FT4232HP Hi Speed USB Device with Type C Controller IC User Guide

Contents

FTDI FT4232HP Hi Speed USB Device with Type C Controller IC

Application Note
AN_551
FT4232HP_FT2232HP_FT232HP Configuration Guide
Version 1.2
Issue Date: 14-02-2025

Configuration guide for FT4232HP, FT2232HP, and FT232HP.

The FT4232HP/FT2232HP/FT232HP are high-speed USB devices with Type-C power delivery features. This document covers power delivery configuration options. For USB configurations, refer to AN_124 User Guide for FTDI FT_PROG Utility.

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1. Introduction

The FT4232HP/FT2232HP/FT232HP are high-speed USB devices with Type-C power delivery features. The power delivery functionality offers multiple configurable options, which are described in this document. However, it is important to note that this document only covers power delivery configuration options. For USB configurations, please refer to AN_124 User Guide for FTDI FT_PROG Utility.

1.1 Overview

This document provides a description of each configurable option and the corresponding configurable values for each parameter in the EEPROM of the FT4232HP/FT2232HP/FT232HP. The EEPROM is an external component and is only necessary if a custom configuration is required for the design. If the default configuration is suitable, then an EEPROM is not needed. For default values, please refer to the sections below.

1.2 Glossary of Terms

S/N	Term	Description
1	Sink / Consumer	When the device is consuming power from the host port, the device is said to be in “Sink” mode or device is said to be a “consumer”.
2	Source / Provider	When the device is supplying power to the host, then the device is operating in “Source” mode. The device can change the role from Sink to Source if the device is self-powered and power role swap is enabled in the configuration.
3	Power Role Swap	The process of changing the role is called role swap. The device has the capability to switch the role from Sink to Source if the device is self-powered.

2. Configuration Parameters

256 bytes in the configuration EEPROM are reserved for configuration options. Table 1 gives the information for all the configurable options.

Parameter	Description	Default value	Configurable values
Sink Request Power Role Swap	Sink will initiate a PR SWAP request only if this option is set. Default settings do not support PR SWAP. However, if the device is self-powered, then PR SWAP can be supported by modifying the configurations.	0 – Disabled.	0 – Disabled. 1 – Enabled.

Sink Accept PR Swap	Option to accept PR SWAP when FT 4232HP /FT2232HP/FT232HP is a sink. If this option is not set, PR_SWAP re quest from a source will be rejected	0 – Reject.	0 – Reject. 1 – Accept.
Source Request PR SWAP	When the device is a Source, this op tion is used to decide whether to sw ap back to sink when it sees a Port2 disconnect event.	0 – Disabled.	0 – Disabled. 1 – Enabled.
Source Accept PR SWAP	When the device is a source, a PR_ SWAP request from sink can be acc epted or rejected based on this optio n.	0 – Reject.	0 – Reject. 1 – Accept.
External MCU	This is to switch over to external MC U mode.	0 – Internal MCU.	0 – Internal MCU. 1 – External MCU.
PD Auto Clock	Auto clock enable / disable. Auto clock feature is explained in se ction 2.3.	0 – Disabled.	0 – Disabled. 1 – Enabled.
Use EFUSE	This option indicates whether to use trim values from EFUSE or not. Keep this enabled always. Configura ble option is provided for characteriz ation purpose only.	1 – Use EFUSE.	0 – Do not us e EFUSE TRI M. 1 – Use E FUSE TRIM
FRS	Fast Role Swap	‘FRS DISABLED’	‘FRS DISABL ED’ ‘Default USB Power’ ‘1.5A@5V’ ‘3 A@5V’
FRS Threshold	Voltage drop threshold to trigger the FRS	4680	4680 4368 4056
EXTEND_ISET	Not used by default. In a Sink-only c onfiguration, more pins can be used as ISETS. By enabling this option, w ill give more ISETs to choose from.	0	0 – Extended ISET not use d. 1 – Extend ed ISET used.
Parameter	Description	Default value	Configurable values
ISET_ENABLED	Bit to enable / disable ISET feature.	1	0 – Disable t he ISET feat ure. All the a bove ISET fie lds will be ign ored. 1 – ISET Enabled.

GPIO 0	Configuration option for GPIO 0.	‘N/A’	Please refer to the tables Table 3 and Table 4 for the available configuration options for each GPIO. If this field is unused, then select ‘NA’.
GPIO 1	Configuration option for GPIO 1	‘N/A’	Please refer to the tables Table 3 and Table 4 for the available configuration options for each GPIO. If this field is unused, then select ‘NA’.
GPIO 2	Configuration option for GPIO 2	‘PD1_LOAD_EN’	Please refer to the tables Table 3 and Table 4 for the available configuration options for each GPIO. If this field is unused, then select ‘NA’.
GPIO 3	Configuration option for GPIO 3	‘ISET3’	Please refer to the tables Table 3 and Table 4 for the available configuration options for each GPIO. If this field is unused, then select ‘NA’.
Sink PDO1	Voltage and current profile for PDO1. Typically, PDO1 is vSafe5.	Voltage in 1mV Unit – 5000 (5V). And in 50mV Steps. Current in 1mA Unit – 3000	Voltage – 5000 (5V) Current – (0-5000) (0-5A)

Parameter	Description	Default value	Configurable values
		(3A), 10mA Steps.	
Sink PDO2	Voltage and current profile for PDO2 .	0	0 Means this profile is not used. User is allow ed to configure the profile to any valid voltage / current valu e without con flicting. A valid profile is a unique pr ofile (Same v oltage profile as another P DO not allow ed – Also the profiles shoul d be in the de scending ord er of voltage).
Sink PDO3	Voltage and current profile for PDO3 .	0	Same as abo ve.
Sink PDO4	Voltage and current profile for PDO4 .	0	Same as abo ve.
Sink PDO5	Voltage and current profile for PDO5 .	0	Same as abo ve.
Sink PDO6	Voltage and current profile for PDO6 .	0	Same as abo ve.
Sink PDO7	Voltage and current profile for PDO7 .	0	Same as abo ve.
Source PDO1	Voltage and current profile for PDO1. Typically, PDO1 is vSafe5. Default Setting does not have source capability.	Voltage in 1mV Unit – 5 000 (5V). And in 50mV Steps. Current in 1mA Unit – 3 00 (3A), 10mA Steps.	Voltage – 5000 (5V) Current – (0-5000) (0-5A)
Source PDO2	Default Setting does not have source capability.	Voltage in 50mV Unit – 0. Current in 10mA Unit – 0	
Source PDO3	Default Setting does not have source capability.	Voltage in 50mV Unit – 0. Current in 10mA Unit – 0	

Source PDO4	Default Setting does not have source capability.	Voltage in 50mV Unit – 0. Current in 10mA Unit – 0	
I2C Address	Used for external MCU.	32 (0x20)	Any Valid address.
TRIM1	Do not use this in production. Set to 0.	0	
TRIM2	Do not use this in Production.	0	
Parameter	Description	Default value	Configurable values
	Set to 0.		
External DC	This option indicates the device is self-powered and has a fixed External power supply. FT4232HP/FT2232HP/FT232HP does not support power role swap in its default settings as role swap feature needs a power supply. So, if the device is externally powered, then power role swap can be supported. Use this option to indicate externally powered device.	UNCHECK	CHECKBOX

2.1 Power Role Swap Options

There are four different combinations for power role swap. These are the four configurable options available.
1. Sink Request Power Role (PR) Swap
When this option is set, the sink initiates a power role swap request if the device is self-powered. The “External DC” option indicates whether the device is self-powered.
2. Sink Accept PR Swap
If the device receives a PR_SWAP request from the source, the sink can reject or accept it based on this option. This option should be set only if the device is powered externally through a DC power supply.
3. Source Request PR SWAP
This option does not apply to single-port devices.
4. Source Accept PR SWAP
Similarly, the device (source) can return to the sink if the current sink requests a PR_SWAP. This option determines whether to accept the request or not.

2.2 External MCU

The device comes with a default Type-C and PD state machine. If the features provided by this internal state machine do not meet the customer’s requirements, the customer has the option to implement their own state machines and additional features using the I2C slave interface available on the Customer MCU.

When using such solution, this “External MCU” option should be set if there is an EEPROM available. If no EEPROM, then GPIO_0, GPIO_1 can be pulled high to indicate the same.

2.3 PD Auto Clock

To aid in power saving, the clock can be turned off to the PD device when there is no activity. With auto clock

option enabled, the clock will turn on whenever there is any activity to the PD device and will turn off after the activity.

2.4 Use EFUSE

The PD device has an internal EFUSE block, and its size is 64bits. This EFUSE is programmed during the IC characterization time, and it is one time programmable. The value programmed in this block is used by the software to program bandgap voltage, pull up current, pull down resistance etc. “Use EFUSE” option is enabled by default. Software uses the EFUSE value only if this option is enabled. For debugging purpose, this option can be disabled but not recommended to disable it for production.

2.5 FRS

This option allows you to enable or disable Fast Role Swap (FRS). The device can quickly switch from a source to a sink. When this option is enabled, the device can switch back to the sink without causing a disconnection on the USB interface.

2.6 FRS Threshold

This option takes the threshold voltage for the FRS. The default is 4680mV. When the voltage drops below this level triggers an FRS.

2.7 ISET

The ISET pins indicate the available power profiles. By default, there are three options: ISET1, ISET2, and ISET3. However, enabling the EXTEND_ISET option will make additional ISET pins available. The table below shows the ISET options.

ISET Pin	Meaning	Remarks
ISET1	TYPE-C 5V 1P5A Profile	Optional.
ISET2	TYPE-C 5V 3A Profile	Optional.
ISET3	PDO1 Profile	Typically, 5V3A profile. If 5V3A, then ISET2 can be left unas signed so that FT_Prog will internally make ISET2 same as ISET3.
ISET4	PDO2 Profile	Available in Sink-only use case when the EXTEND_ISET option is set in the configuration.
ISET5	PDO3 Profile	Available in Sink-only use case when the EXTEND_ISET option is set in the configuration.
ISET6	PDO4 Profile	Available in Sink-only use case when the EXTEND_ISET option is set in the configuration.

2.8 EXTEND_ISET

When the device is in sink-only mode, more GPIO pins are available for use as ISET. As seen in the figure below, more ISET pins are in the GPIO dropdown list.

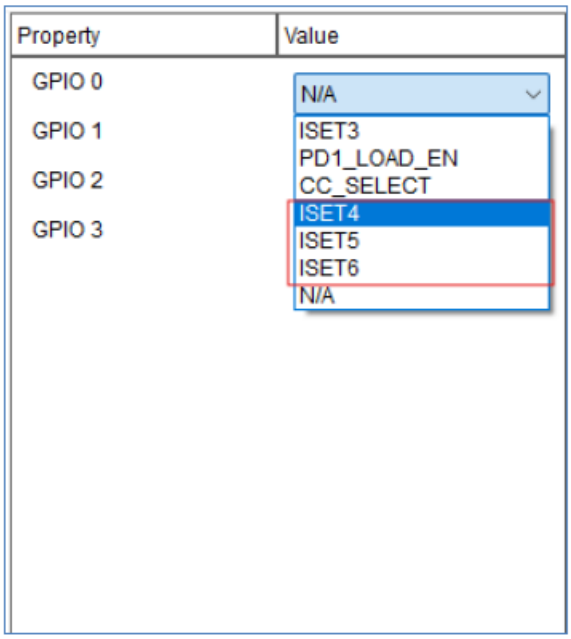

Figure 1 – GPIO Dropdown shows more ISET options when EXTEND_ISET is enabled

2.9 ISET_ENABLED

All the ISET related fields are valid only if this field is enabled. Instead of changing multiple ISET fields, this single enable/disable option helps to enable/disable the ISET feature.

2.10 GPIO 0 to GPIO 3

These are the 4 configurable GPIOs. Depending on the configuration options, these pins can be configured to use any of the options from the table below.
The Load Enable function (PD1_LOAD_EN) can drive a status LED or control the load switch circuit used to route VBUS power to the customer's hardware.

Options	Description
ISET1	TypeC 5V 1P5A Profile
ISET2	TypeC 5V 3A Profile
ISET3	PDO1 Profile (5V3A)
PD1_LOAD_EN	PD1 Load Enable Pin
CC_SELECT	CC Selector Indicator
ISET4	PDO2 Profile
Sink-only Configuration	
Options	Description
ISET5	PDO3 Profile
ISET6	PDO4 Profile

Table 3 – Options for Sink-only Configuration

When the External DC option is enabled in the configuration, the device can also support power role swapping and change the role to the source. With this option enabled, the GPIO configuration supports the following options in the table below. However, the DC power supply must always be present. In other words, the device must always be self-powered when this option is on.

Dual Role Options	
Options	**Description**
ISET1	TypeC 5V 1P5A Profile
ISET2	TypeC 5V 3A Profile
ISET3	PDO1 Profile (5V3A)
PD1_LOAD_EN	PD1 Load Enable Pin
DISCHARGE	Discharge Pin
CC_SELECT	CC Selector Indicator
PS_EN	Power Supply Enable Pin, also supplies 5V which is PDO1 Source Profile
P1	Source Pin for PDO2
P2	Source Pin for PDO3
P3	Source Pin for PDO4

Table 4 – Options for Dual Role Mode

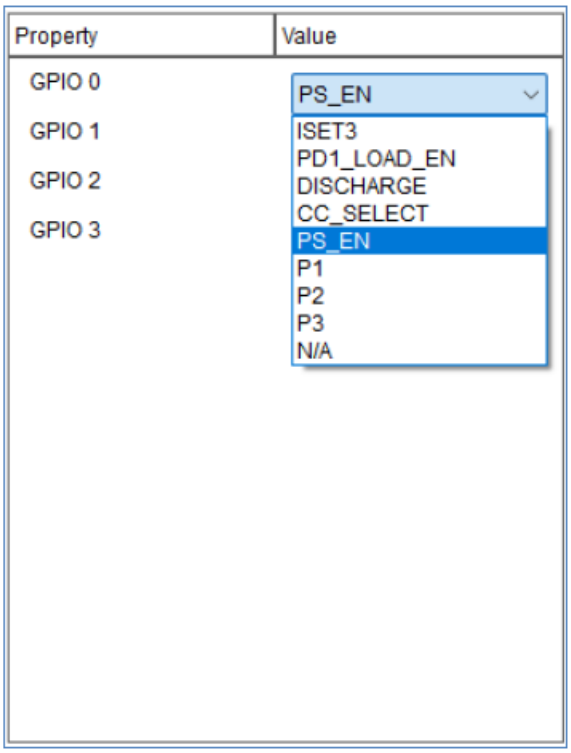

Figure 2 – GPIO Configuration options when external DC is enabled

For a Sink-only use case, the extended ISET option can select additional pins as ISET.

The power swap options should be disabled to make the device in sink-only mode. The below picture shows the various options available in Sink-only use case.

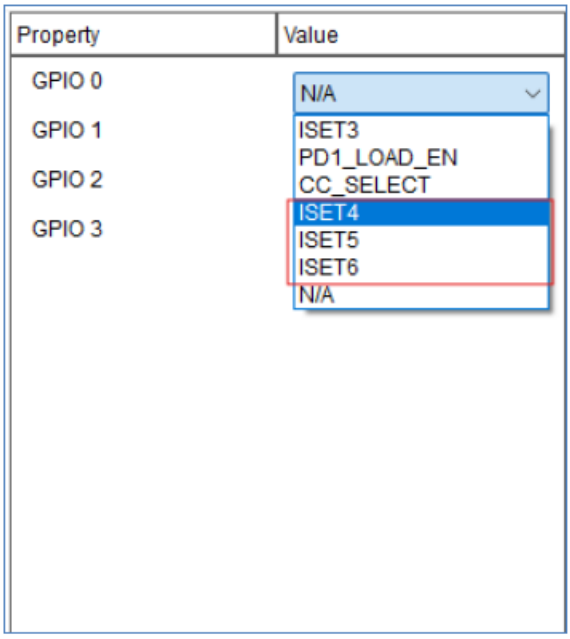

Figure 3 - ISET Options

Figure 3 – ISET Options

2.11 Sink PDO [1:7]

Option to select Voltage and Current Profile for Sink PDO1.
Corresponding to every PDO option, there is a voltage dropdown box and a current dropdown box in FT_PROG. Please select the voltage and current from this list for the PDO.
The lowest voltage profile should be PDO1 and the second lowest should be PDO2 and so on. Basically, the PDO profile should be in ascending order with respect to the voltage.

2.12 Source PDO [1:4]

Option to select Voltage and Current Profile for Source PDO1.
Corresponding to every PDO option, there is a voltage dropdown box and a current dropdown box in FT_PROG. Please select the voltage and current from this list for the PDO.
The lowest voltage profile should be PDO1 and the second lowest should be PDO2 and so on. Basically, the PDO profile should be in ascending order with respect to the voltage.

2.13 I2C Address

This is used for the case of an external MCU. The I2C address will default to 0x20 if this is not specified.

2.14 TRIM1

For Debug purpose only – Usually the TRIM values are taken from EFUSE. However, EFUSE can be overridden using this field.

2.15 TRIM2

For Debug purpose only – Usually the TRIM values are taken from EFUSE. However, EFUSE can be overridden using this field.

2.16 External DC

If the device is self-powered, then this option can be set to initiate a power role swap request to switch over the role to source. Sink Request power role swap option also should be set along with this to achieve this.

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System and equipment manufacturers and designers are responsible to ensure that their systems, and any Future Technology Devices International Ltd (FTDI) devices incorporated in their systems, meet all applicable safety,

Appendix A – References
Document References
AN_124 User Guide for FTDI FT_PROG Utility
FT_PROG
https://usb.org/sites/default/files/USB%20Power%20Delivery_1.zip USB High Speed Series ICs

Acronyms and Abbreviations

Terms	Description
BM	Bit Map
BOS	Binary Object Store
GPIO	General Purpose Input Output
PD	Power Delivery
PDO	Power Delivery Object
PR SWAP	Power Role Swap.
USB	Universal Serial Bus
USB-IF	USB Implementers Forum

Appendix C – Revision History

Document Title: AN_551 FT4232HP_FT2232HP_FT232HP Configuration Guide
Document Reference No.: FT_001493
Clearance No.: FTDI#562
Product Page: USB High Speed Series ICs
Document Feedback: Send Feedback

Revision	Changes	Date
1.0	Initial Release.	06-05-2021
1.1	Minor editorial changes for the new release version.	28-11-2023
1.2	Updates for improved user experience in FT_Prog. FT_Prog has been updated with a simpler GPIO configuration, and th e document has been updated to reflect the same. Bitmap options and GPIO multiplexing have been removed. Added tables for various GPIO configurations. Added example screenshots of FT_Prog.	14-02-2025

Specifications:

- Product Models: FT4232HP, FT2232HP, FT232HP
- Version: 1.2
- Issue Date: 14-02-2025
- Power Delivery: Type-C

FAQ

Q: Do I need an EEPROM for default configurations?

A: No, an EEPROM is only necessary for custom configurations.
Default values are available in the document.

Q: Can the device change its power role?

A: Yes, the device can change from Sink to Source if self-powered and power role swap is enabled.

Documents / Resources

	FTDI FT4232HP Hi Speed USB Device with Type C Controller IC [pdf] User Guide FT4232HP, FT2232HP, FT232HP, FT4232HP Hi Speed USB Device with Type C Controller IC, FT4232HP, Hi Speed USB Device with Type C Controller IC, Type C Controller IC, Controller IC

References

- Home - FTDI
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- Sales Network - FTDI
- User Manual