



# Application Note

## AN\_559

# Migrating from FT2xxB

**Version 1.0**

**Issue Date: 30-05-2022**

This Application Note shows alternative ICs as FT232B and FT245B are not recommended for new designs.

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## 1 Introduction

This Application Note shows alternative ICs as FT232B and FT245B are not recommended for new designs.

- FT232B is a USB Full Speed device to UART interface which was first available in 2002.
- FT245B is a USB Full Speed device to FIFO interface which was first available in 2002.

FT232B and FT245B are intended for Legacy Designs only. Fresh Date codes are NOT guaranteed.

Both devices are used with FTDI's [VCP](#) and [D2XX](#) drivers and the same applies to the alternative ICs.

This document provides details of alternative and recommended ICs for new designs.

## 2 FT232B Alternative ICs

Table 2.1 shows a comparison of FT232B to other alternative ICs.

	FT232B	FT232R	FT230X	FT231X	FT234X	FT232H	FT23xHP
USB Speed	Full	Full	Full	Full	Full	High	High
USB Power Delivery	No	No	No	No	No	No	Yes
UART Hardware Flow Control	Full	Full	Basic (CTS/RTS)	Full	Basic (CTS/RTS)	Full	Full
Maximum UART Speed	3Mbaud	3Mbaud	3Mbaud	3Mbaud	3Mbaud	12Mbaud	12Mbaud
Additional GPIO	0	4	4	4	1	4	4
EEPROM	External	Internal	Internal	Internal	Internal	External	External
Package(s)	32-pin QFN / QFP	32-pin QFN / 28-pin SSOP	16-pin QFN / SSOP	20-pin QFN / SSOP	12-pin DFN	48-pin LQFP / QFN	56-pin / 64-pin QFN

**Table 2.1 – FT232B Alternative ICs**

All ICs in Table 2.1 allow for conversion from USB to UART. This also allows for RS232/RS485/RS422 communication with additional external transceivers.

FT232H and FT23xHP allow for USB High Speed and faster UART speed.

FT23xHP allows for additional USB Power Delivery feature.

All alternative ICs allow for additional GPIO / bit bang in addition to the UART interface.

FT232R and FT-X (FT230X/FT231X/FT234X) have an integrated EEPROM.

There are a variety of packages available with the smallest being FT234X.

FT232H and FT23xHP have larger packages due to additional functionality available like MPSSE (for I2C/SPI/JTAG), FIFO and USB Power Delivery features.

FT232H and FT23xHP also offer additional variants with multiple channels:

- FT2232H (2 channels) and FT4232H (4 channels)
- FT223xHP (2 channels) and FT423xHP (4 channels)

### 2.1 USB to UART Evaluation Hardware

FTDI provides hardware which can be used for test, evaluation, and reference before developing your own custom hardware.

You can purchase via our [Website](#) and [Sales Network](#) including our [Global Suppliers](#).

### 2.1.1 FT232R

[EVAL232R](#)[UM232R](#)[MM232R](#)[UB232R](#)[TTL-232R Cables](#)[RS232 Cables](#)

### 2.1.2 FT230X

[UMFT230XB-NC](#)[UMFT230XB-WE](#)[UMFT230XB-01](#)[UMFT230XA-02](#)[UMFT230XA-01](#)

### 2.1.3 FT231X

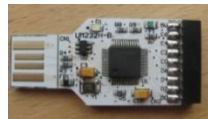
[UMFT231XC](#)[UMFT231XE](#)[UMFT231XA-01](#)[LC231X](#)

[Chipi-X10](#)

## 2.1.4 FT234X

[UMFT234XD-WE](#)[UMFT234XD-NC](#)[UMFT234XD-01](#)[UMFT234XF](#)[LC234X](#)[TTL-234X Cables](#)

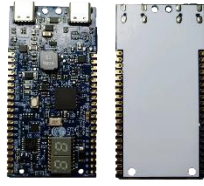
## 2.1.5 FT232H

[UM232H](#)[UM232H-B](#)[UM232H-B-NC](#)[UM232H-B-WE](#)[C232HD Cables](#)

## 2.1.6 FT23xHP



[UMFT233HPEV](#)



[UMFT233HPEV-SD](#)



[UMFT232HPEV-S](#)



### 3 FT245B Alternative ICs

Table 2.1 shows a comparison of FT245B to other alternative ICs.

	<b>FT245B</b>	<b>FT245R</b>	<b>FT240X</b>	<b>FT232H</b>	<b>FT23xHP</b>
USB Speed	Full	Full	Full	High	High
USB Power Delivery	No	No	No	No	Yes
FIFO Type	Asynchronous	Asynchronous	Asynchronous	Asynchronous / Synchronous	Asynchronous / Synchronous
Maximum FIFO Speed	1 Mbyte/sec	1 Mbyte/sec	1 Mbyte/sec	8 Mbyte/sec / 40 Mbyte/sec	8 Mbyte/sec / 40 Mbyte/sec
EEPROM	External	Internal	Internal	External	External
Package(s)	32-pin QFN / QFP	32-pin QFN / 28-pin SSOP	24-pin QFN / SSOP	48-pin LQFP / QFN	56-pin / 64-pin QFN

**Table 3.1 – FT245B Alternative ICs**

All ICs in Table 3.1 allow for conversion from USB to FIFO.

FT232H and FT23xHP allow for USB High Speed and faster FIFO speed.

FT23xHP allows for additional USB Power Delivery.

FT245R and FT240X have an integrated EEPROM.

There are a variety of packages available with the smallest being FT240X.

FT232H and FT23xHP have larger packages due to additional functionality available like MPSSE (for I2C/SPI/JTAG) and USB Power Delivery features.

FT232H and FT23xHP also offer additional variants with multiple channels which can be used with 2 Asynchronous or 1 Synchronous FIFO configuration:

- FT2232H (2 channels)
- FT223xHP (2 channels)

Note Synchronous FIFO can only be used with the D2XX Drivers where Asynchronous can be used with the VCP or D2XX drivers.

#### 3.1 USB to FIFO Evaluation Hardware

FTDI provides hardware which can be used for test, evaluation, and reference before developing your own custom hardware.

You can purchase via our [Website](#) and [Sales Network](#) including our [Global Suppliers](#).

##### 3.1.1 FT245R

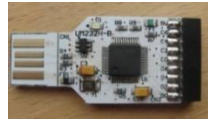


[UM245R](#)

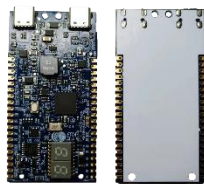
### 3.1.2 FT240X

[UMFT240XE-01](#)[UMFT240XA-02](#)[UMFT240XA-01](#)

### 3.1.3 FT232H

[UM232H](#)[UM232H-B](#)[UM232H-B-NC](#)[UM232H-B-WE](#)[C232HD Cables](#)

### 3.1.4 FT23xHP

[UMFT233HPEV](#)[UMFT233HPEV-SD](#)[UMFT232HPEV-S](#)

## 4 Hardware Considerations

This section details some of the hardware considerations to consider when migrating from FT232B and FT245B. Please refer to the respective IC datasheet for all information.

All alternative ICs are not pin compatible.

Please note the following:

- FT2xxB includes FT232B and FT245B.
- FT2xxR includes FT232R and FT245R.
- FT-X includes FT230X, FT231X, FT234X and FT240X.

### 4.1 USB Data Lines

FT2xxB has a 1.5Kohm resistor connected to the USB DP line for USB full speed identification. This is not required on the alternative products as this is built into the ICs.

FT2xxB has 27ohm series resistors on the USB Data Lines for edge rate control. This is different across the alternative ICs. Some require series resistors and capacitors to GND for edge rate control. Refer to [AN\\_146 USB Hardware Design Guidelines for FTDI ICs](#) for more information. Also refer to Table 4.1.

	FT2xxB	FT2xxR	FT-X	FT232H / FT23xHP
Resistor Value (ohm)	27	0	27	0
Capacitor Value (Farad)	0	47	47	0

**Table 4.1 – Edge Rate Control**

### 4.2 I/O Voltage

FT2xxB I/O operates between 3V and 5.25V. Table 4.2 shows a comparison to the alternative ICs.

	FT2xxB	FT2xxR	FT-X	FT232H / FT23xHP
I/O Voltage (V)	3 – 5.25	1.8 – 5.25	1.8 – 3.3	3.3

**Table 4.2 – I/O Voltage**

This data shows:

- If FT2xxB is originally operating at 3.3V, then FT2xxR, FT-X and FT232H/FT23xHP are all suitable alternatives.
- If FT2xxB is originally operating at 5V, then only FT2xxR is a suitable alternative.

FT2xxR and FT-X are also suitable for external hardware which operates as low as 1.8V.

### 4.3 Device Power

All FTDI devices can get power from the USB Host Supply (5V) or can be self-powered. So, these devices can be easily powered from the USB Host Supply:

- FT2xxB requires +4.35 volt to +5.25V on VCC.
- FT2xxR requires +3.3V to +5.25V on VCC.
- FT-X requires +2.97V to +5.5V on VCC.

FT232H and FT23xHP require 3.3V to be connected to VREGIN pin. An LDO can be used to convert USB Host 5V supply to 3.3V in a USB Bus Powered configuration.

In a USB Self-Powered configuration, the VCC and VREGOUT supplies are sourced elsewhere (not from the USB Host 5V supply).

## 4.4 Clocking

FT2xxB must be used with an external 6MHz crystal or resonator.

FT2xxR has an internal clock generator which means an external crystal is not required. However, if VCC is less than 4V an external 12MHz crystal or oscillator must be used.

FT-X has an integrated clock circuit which requires no external crystal.

FT232H and FT23xHP must be used with an external 12MHz crystal or oscillator.

## 4.5 EEPROM

FT2xxB can be used with an external EEPROM, or it can be used with default configuration.

FT2xxR and FT-X have an integrated EEPROM allowing for customization without the need for any external EEPROM.

FT232H and FT232HP do not have an internal EEPROM so if customization is required and external EEPROM is required.

## 5 IC PCB Layout

Please refer to [TN\\_166 FTDI Example IC Footprints](#) for example IC PCB footprints for all FTDI ICs to help with custom PCB creation.

## 6 Conclusion

This Application Note details the alternative ICs to FT232B and FT245B and lists evaluation hardware available to allow end users to evaluate the recommended alternatives before developing their own custom hardware. Some hardware considerations are also detailed but the IC datasheets should be consulted for all information.

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## Appendix A – References

### Document References

[ICs](#)

[Modules](#)

[Cables](#)

[VCP Drivers](#)

[D2XX Drivers](#)

TN\_166 [FTDI Example IC Footprints](#)

AN\_146 [USB Hardware Design Guidelines for FTDI ICs](#)

[Sales Network](#)

[Global Suppliers](#)

### Acronyms and Abbreviations

Terms	Description
DP	Data Plus
EEPROM	Electrically Erasable Programmable Read Only Memory
FIFO	First In First Out
GND	Ground
GPIO	General Purpose Input Output
I2C	Inter-Integrated Circuit
IC	Integrated Circuit
JTAG	Joint Test Action Group
LDO	Low Dropout Regulator
MPSSE	Multi-Protocol Synchronous Serial Engine
PCB	Printed Circuit Board
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
VCP	Virtual COM Port



## Appendix B – List of Tables & Figures

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## Appendix C – Revision History

Document Title: AN\_559 Migrating from FT2xxB  
Document Reference No.: FT\_001531  
Clearance No.: FTDI#574  
Product Page: <https://ftdichip.com/product-category/products/ic/>  
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Revision	Changes	Date
1.0	Initial Release	30-05-2022