HT MICRON SEMICONDUTORES S.A.
Av. Unisinos, 1550 | 93022-750 | São Leopoldo – RS | Brasil
www.htmicron.com.br

HT MICRON semicondutores

iMCP HTNB32L-XXX Application Note Driver Example

Driver Example for iMCP HTNB32L-XXX System-in-Package

Classification:	CONFIDENTIAL
Doc. Type:	USER MANUAL
Revision:	v.01
Date:	12/06/2023
Code:	HTNB32L-XXX-AN0002

SUMMARY

DOCUMENT INFO

This document provides technical details about the Driver Example available on HTNB32L-XXX SDK. It is intended to provide all the essential information required to effectively utilize and configure the available peripherals on the HTNB32L-XXX platform.

1. GENERAL DESCRIPTION

The iMCP HTNB32L-XXX is a highly compact and low-power wireless communication MCO/SiP featuring Qualcomm QCX-212 LTE IoT Modem supporting single-mode 3GPP Release 14 Cat. NB2 IoT connectivity. Its SDK (Software Development Kit) provides OpenCPU solutions based on a FreeRTOS system, where users can embed their own IoT application, as well as AT Commands, used in a master-slave model.

The Driver Example is an application developed to demonstrate how to configure and utilize the HTNB32L-XXX peripherals. All pins utilized in this application are based on the Demo Board. Implementation details are discussed throughout this document.

2. DEMO BOARD

A Printed Circuit Board, with similar characteristics to an Evaluation Board, was designed especially for this application. Pins that are not used in specific functions, such as buttons, LEDs or serial interface, are available in headers and can be used externally. Design and manufacture files can be found HERE.

3. APPLICATIONS

The Driver Example firmware is divided between four different applications: ADC Demo, GPIO Demo, I2C Demo and SPI Demo. The following sections describe these applications.

3.1. ADC Demo

ADC Demo is the application example intended to demonstrate how to use the ADC peripheral on HTNB32L. It configures three ADC channels: channel 2, Thermal channel and VBAT channel. The application can be modeled as the Finite State Machine represented in Figure 1:

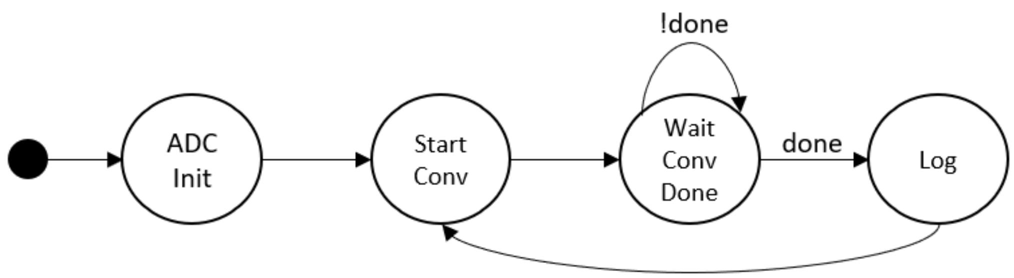

Figure 1: ADC Demo finite state machine.

Table 1: ADC Demo states description.

State	Description
ADC Init	Initialize the ADC channels.
Start Conversion	Start the ADC conversion in the initialized pins.
Wait for Conversion Done	Wait until the ADC conversion is done.
Log	Prints the ADC conversion results.

3.2. GPIO Demo

GPIO Demo is an example that demonstrates how to configure and use the HTNB32L digital pins as GPIOs. A LED and an user button were used for this purpose, both as part of the Demo Board. The GPIO Demo application can be modeled as the FSM drawn in Figure 2. The default settings used in this application are listed on Table 3 and Table 4, both are configured at *HT_I2C_Demo.h* file.

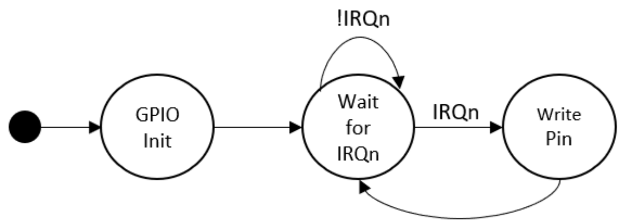

Figure 2: GPIO Demo finite state machine.

Table 2: GPIO Demo states description.

State	Description
GPIO Init	Initialize the GPIO pins used in this application.
Wait for IRQn	Waits until an IRQn is triggered by the push button.
Write Pin	Turn on/off the GPIO pin connected to the user LED.

Table 3: Button default settings.

Button Setting	Value
BUTTON_INSTANCE	1
BUTTON_PIN	3
BUTTON_PAD_ID	30
BUTTON_PAD_ALT_FUNC	PAD_MuxAlt0

Table 4: LED default settings.

LED Setting	Value
LED_INSTANCE	0
LED_GPIO_PIN	3
LED_PAD_ID	14
LED_PAD_ALT_FUNC	PAD_MuxAlt0

3.3. I2C DEMO

I2C Demo is an example that demonstrates how to configure and use the HTNB32L I2C peripherals. The example application can be modeled as the finite state machine represented at Figure 3 . Table 5 describe the possible states and Table 6 presents some default settings configured for this example.

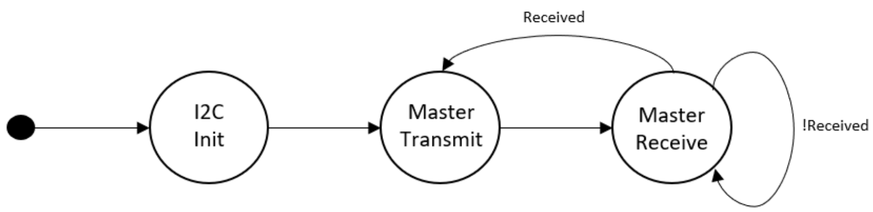

Figure 3: I2C Demo finite state machine.

Table 5: I2C Demo states description.

State	Description
I2C Init	Initialize the I2C peripheral and its respective pins used in this application.
Master Transmit	Transmit a buffer through I2C to slave device.
Master Receive	Receive a buffer from a slave device through I2C.

Table 6: I2C Demo default settings.

I2C Settings	Value
I2C INSTANCE	I2C1
I2C1_SCL_PAD_ID	16 (GPIO5)
I2C1_SDA_PAD_ID	15 (GPIO4)
SLAVE_ADDRESS	0x1F
TX_BUFFER_SIZEE	11 bytes
RX_BUFFER_SIZE	11 bytes

3.4. SPI DEMO

The SPI Demo is an application developed to provide an example of how to configure the SPI peripheral on the HTNB32L-XXX device. The whole application is implemented at *HT_SPI_DEMO.c* file and uses the *HT_SPI_TransmitReceive* function to transmit and receive a buffer.

Table 7: SPI Demo default settings.

I2C Settings	Value
SPI INSTANCE	SPI1
SPI1_MOSI_PAD_ID	14 (GPIO3)
SPI1_MISO_PAD_ID	15 (GPIO4)
SPI1_SCLK_PAD_ID	16 (GPIO5)
SPI_BUFFER_SIZE	10 bytes

3.5. WATCHDOG DEMO

The Watchdog Demo is an application developed to provide an example of configuration and usage of watch dog timer on the HTNB32L-XXX device. The watchdog timer is a specific countdown timer that prevents the device from getting frozen, having to constantly use WDT kick, otherwise the device resets. The whole application is implemented at *HT_WDT_Demo.c* file and uses the *HT_WDT_Init* function to initialize the watch dog. The *HT_WDT_App* function is used to call the Init function and to run the finite state machine represented in the figure bellow.

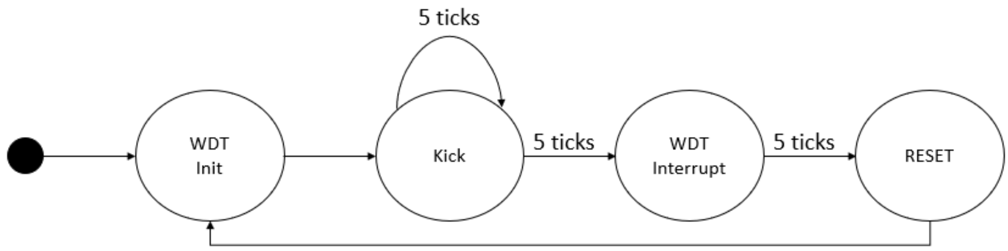

Figure 4: WDT Demo finite state machine.

Table 8: WDT Demo states description.

State	Description
WDT Init	The FSM starts initializing and configuring the WDT, the timer clock for ticks and enabling the WDT interrupt. The tick is configured with a timer of one second.
Kick	For the first five ticks, we are using the kick, which prevents the WDT interrupt from happening.
WDT Interrupt	After five ticks without a kick, the WDT interrupt happens. When the interrupt happens, you have five ticks to kick or clear the WDT interrupt flag.
RESET	After five ticks passed and no WDT interrupt clear or kicks are done, the device ends up resetting.

You can follow the FSM states using a serial terminal, like Termite. The connections and configuration needed is in the document HTNB32L-XXX-UM0001-Getting_Started.

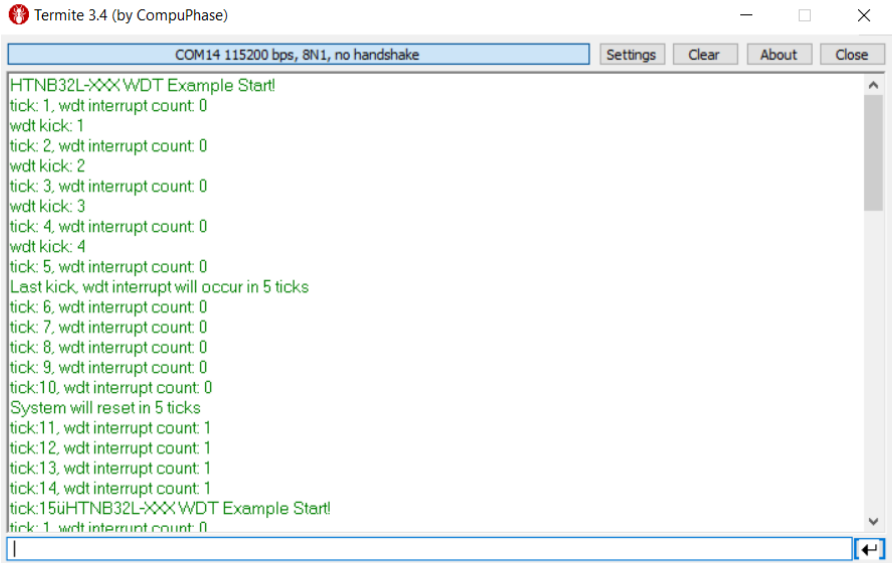

Figure 5: WDT Demo serial monitor.

ABBREVIATIONS

Table 9: Abbreviations

Acronym	Description
ADC	Analog-to-Digital Converter
GPIO	General Purpose Input Output
PCB	Printed-Circuit Board
SDK	Software Development Kit
DEMO	Demonstration
SPI	Serial Peripheral Interface
I2C	Inter-integrated Circuit.
ID	Identifier
WDT	Watch dog timer
FSM	Finite state machine

LIST OF FIGURES

LIST OF TABLES

REVISION HISTORY

Version	Date	Changes	Authors
00	12/06/2023	- Initial draft	HBG
01	17/10/2023	- Watchdog example added	MSZ

CONTACT

HT MICRON SEMICONDUTORES S.A.
Av. Unisinos, 1550 | 93022-750 | São Leopoldo | RS | Brasil
www.htmicron.com.br

DOCUMENT INFORMATION

Document Title:	iMCP HTNB32L-XXX Application Note Driver Example
Document Subtitle:	Driver Example for iMCP HTNB32L-XXX System-in-Package
Classification:	CONFIDENTIAL
Doc. Type:	USER MANUAL
Revision:	v.01
Date:	12/06/2023
Code:	HTNB32L-XXX-AN0002

DISCLAIMER