

Holtek 32-Bit MCU

HT32 Implementation I

32位元產品應用開發處
應用一部



Overview

- **Software Tools (IDE)**
 - Keil **!! Free MDK editions for Holtek devices.**
 - IAR
- **HT32 Firmware Library**
 - CMSIS
 - USB Device
- **Development Platforms**
- **Play Examples**
- **Flash Programming**
- **Resource**

Software Tool

Keil MDK-ARM

Download:

MDK-Arm Installer: <https://www2.keil.com/holtek/ht-edition/>

Pack Installer: http://mcu.holtek.com.tw/pack/Holtek.HT32_DFP.latest.pack.zip

HT32 Firmware Library

Download:

<https://www.holtek.com.tw/esk32-30501> ，點選HT32 Firmware Library。

HT32_STD_5xxxx_FWLib_vnnn_yyyy ，“nnn”表示版本號。

Installation & Activation

- ▶ For users of Holtek devices, Keil MDK is now available as a **free** edition for programming Holtek's Arm **Cortex-M0+** based microcontrollers.

1. Download MDK Core

- Install MDK-ARM Version after **5.28a**

2. Serial Number

- E-mail receive **free** serial number

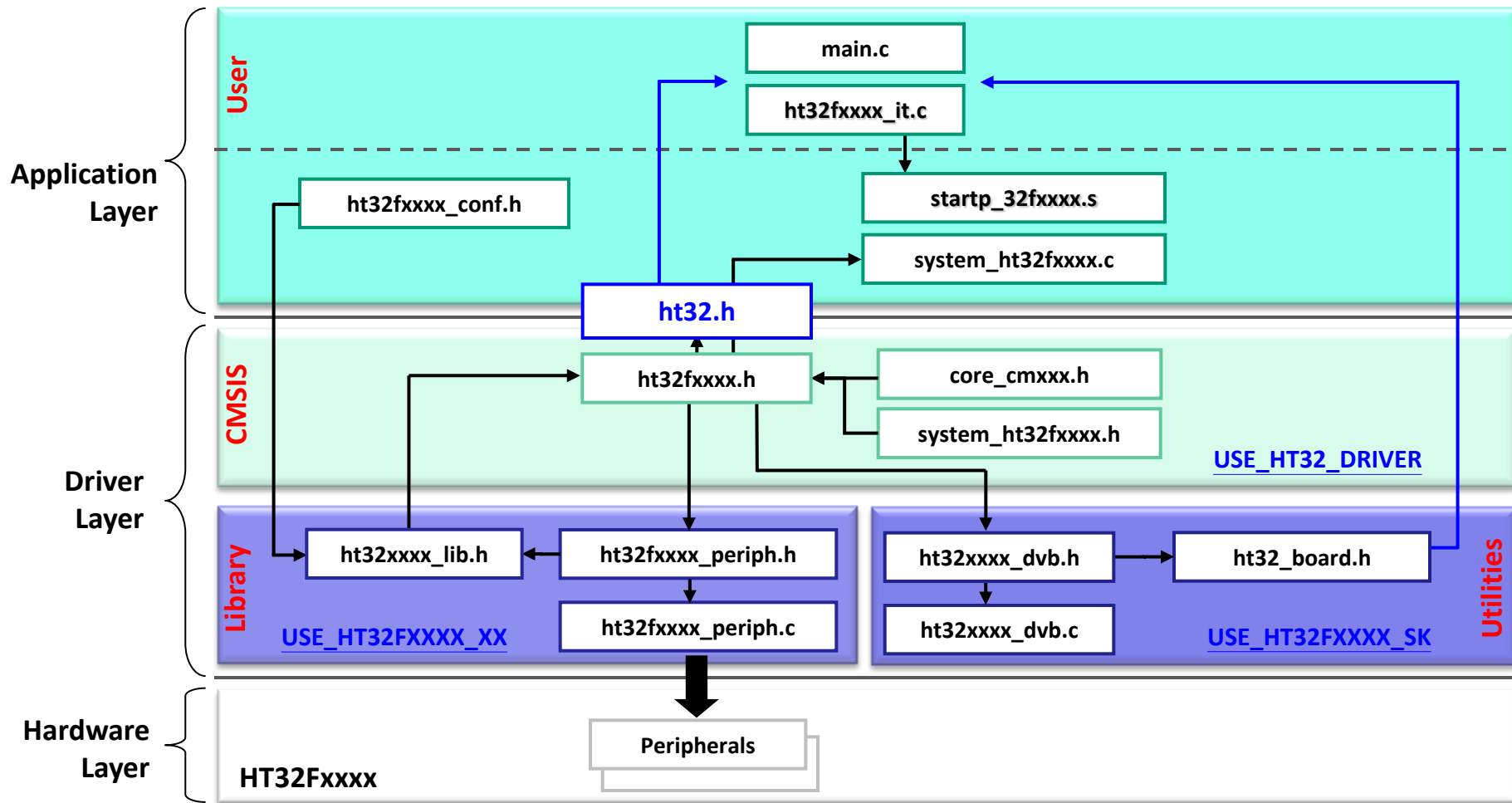
3. License Generation

- Go to Arm Developer Support
- Select Licensing Generate
- Enter **serial number** & **Host ID**
- Download **license file**

4. Activation

- Run MDK-ARM
- Open License Management

FWLib - 架構



FWLib - 資料夾

Examples

- Support for each peripheral
- Running on HT32 Board

Libraries

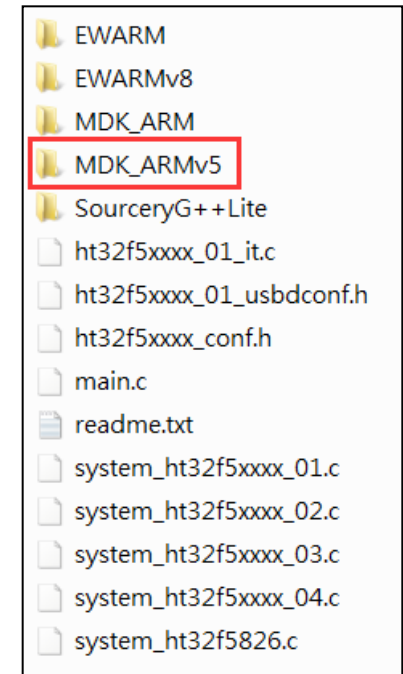
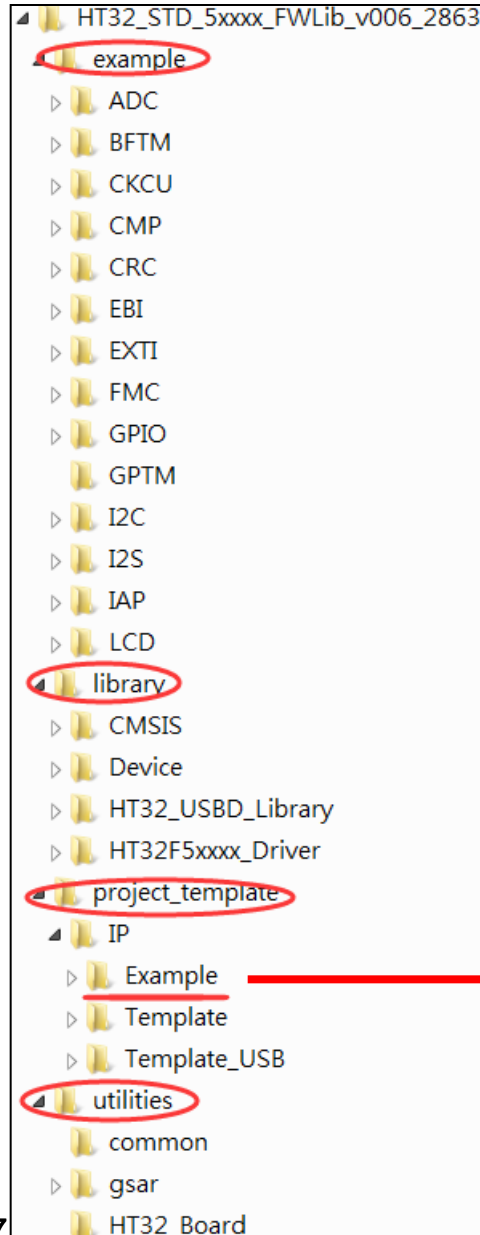
- CMSIS compliant
- Support for all the peripherals

Project Templates

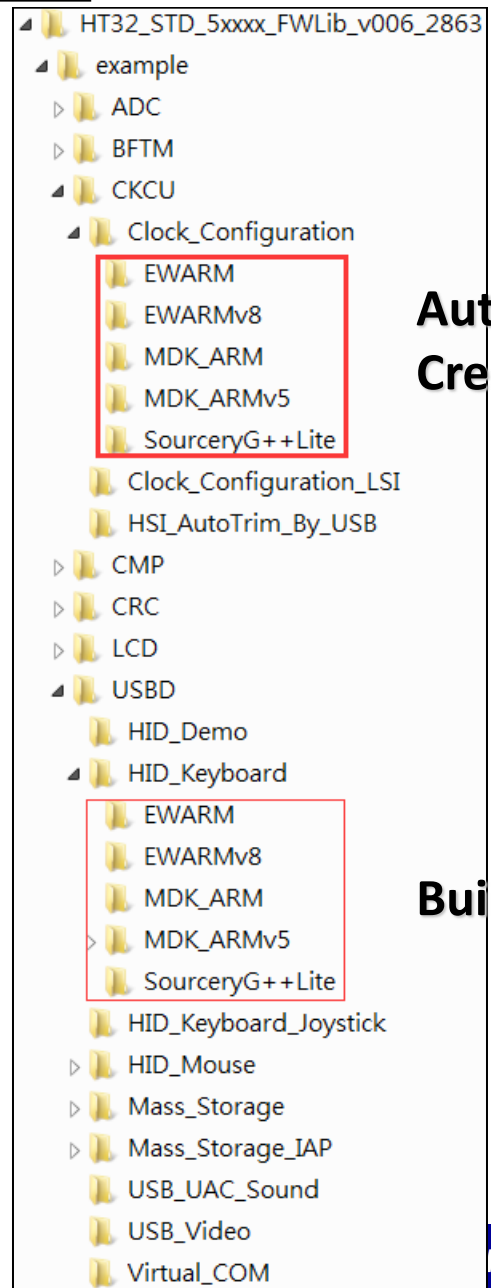
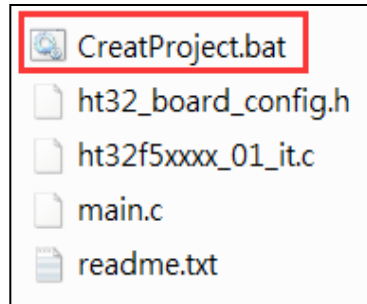
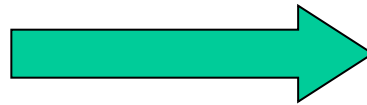
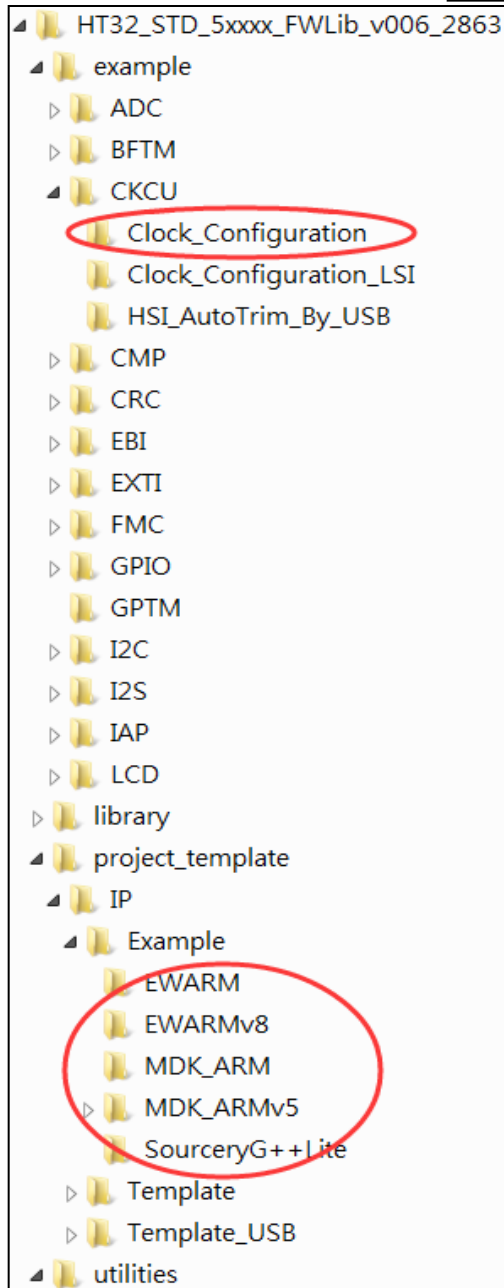
- Empty projects for IDEs
 - EWARM
 - EWARMv8
 - MDK_ARM
 - MDK_ARMv5
 - SourceryG++Lite

Utilities

- HT32 Board configurations



FWLib - 使用




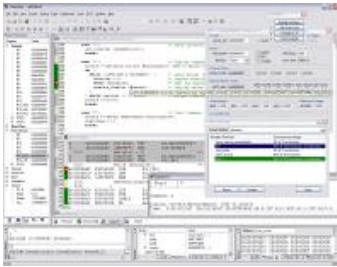
Auto Created

Built-in

Development Platforms

Overview


IDE

Software Development

- Compiler / Linker
- Debugger
- Flash Loader

USB



ICE



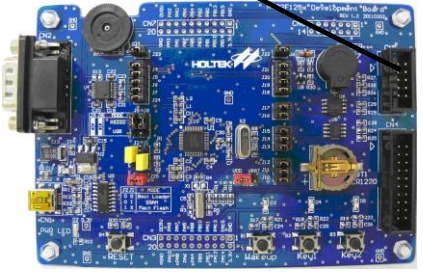
e-Link32 Pro USB Debug Adapter

- Interface between IDE & Board

Starter Kit

- Build-in Debugger

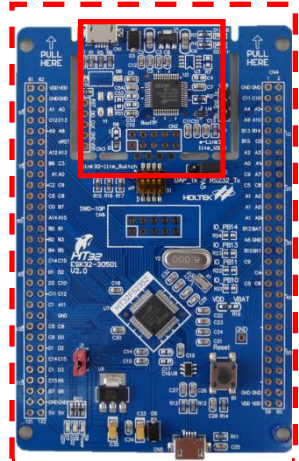
Board



Serial Wire

HT32 Series Development Board

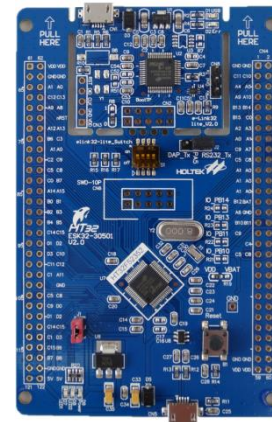
- Low Cost
- Fully Function
- Reference Design



實作環境

• Hardware

- Starter Kit for HT32F52352
 - ESK32-30501
- Expansion Board for HT32 Series
 - ESK32-21001



• Firmware Library

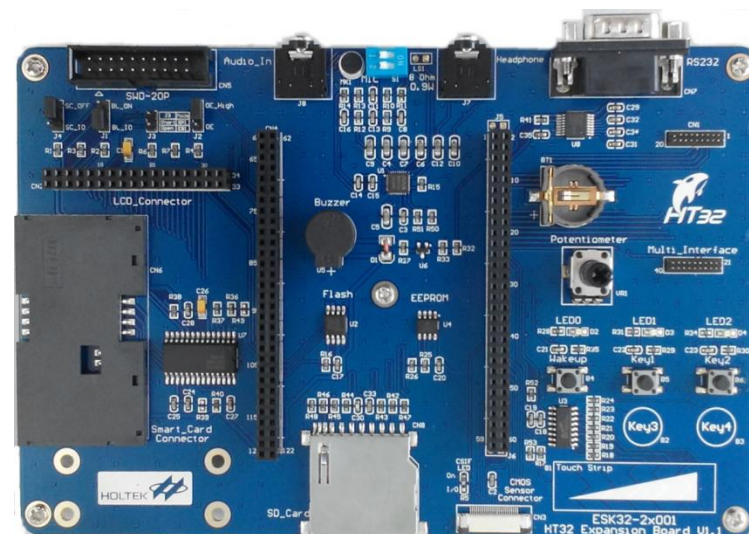
- ESK32-30501 with FWLib_ vnnn_yyyy , “nnn”表示版本號。
- ESK32-30501

0_Start

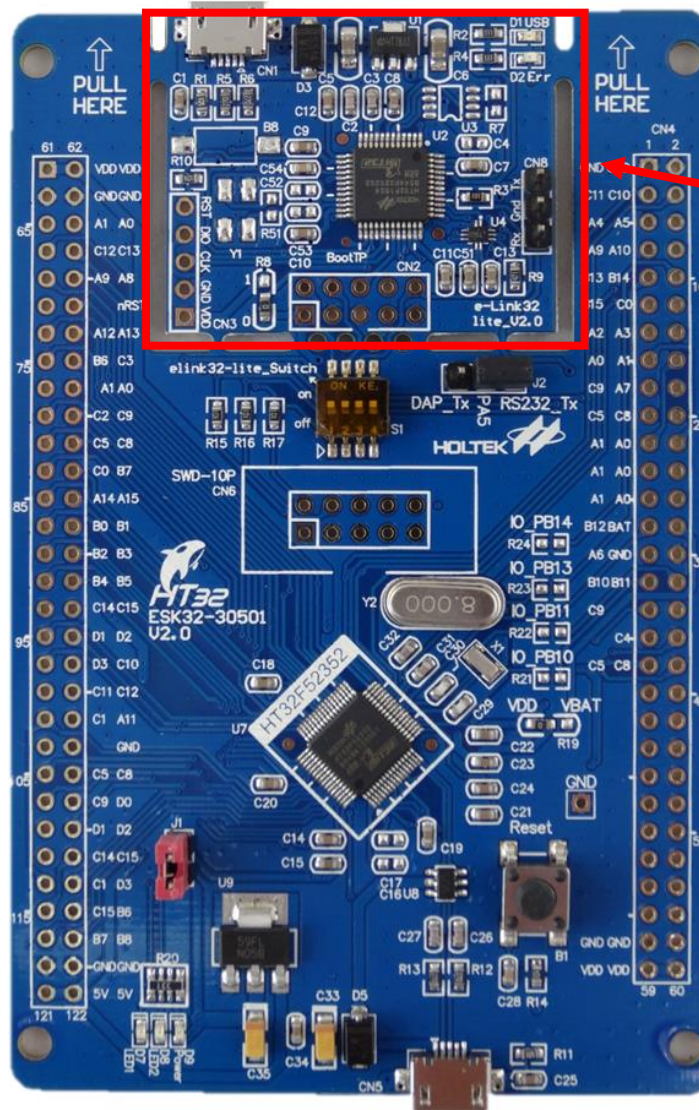
1_GPIO_CKCU

2_Timer

...



ESK32-30501



e-Link32 Lite

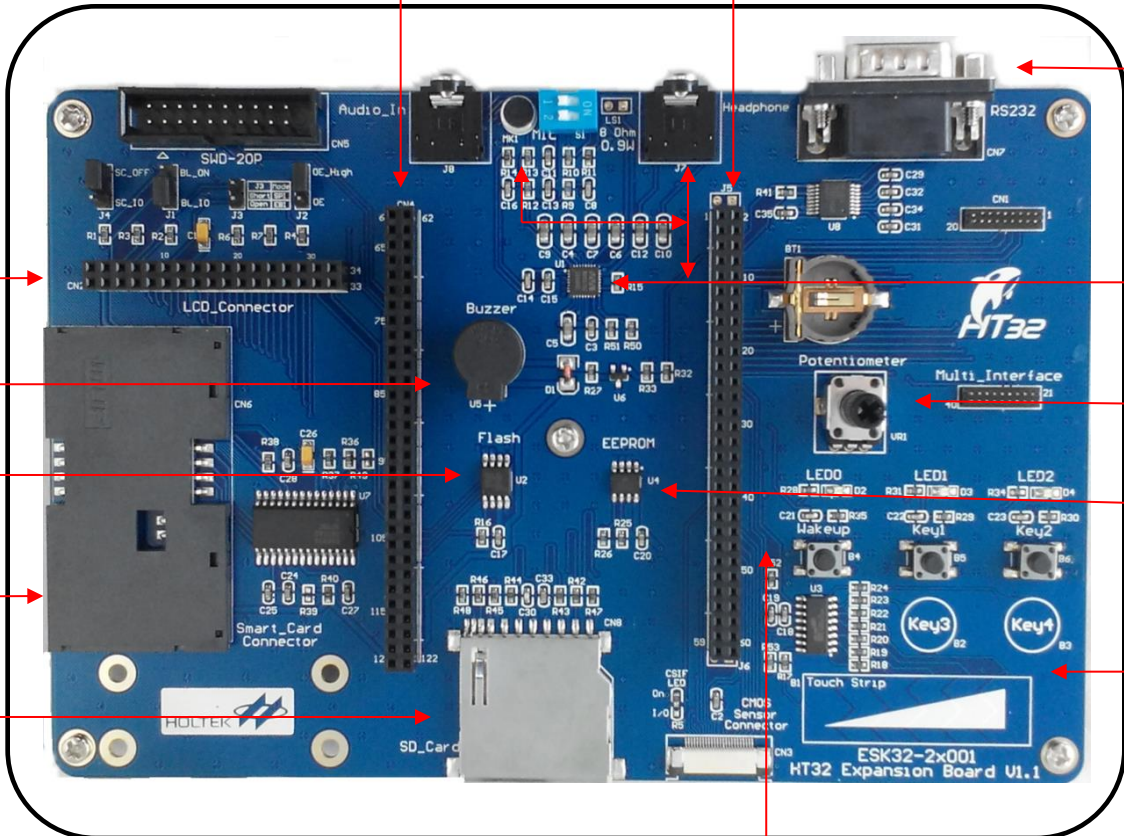
燒錄 / 除錯 / VCP

ESK32-21001

2 DIP Connectors for I/O Extension

62-pin

60-pin



RS232

Codec Mic / Speaker

Potentiometer

NOR Flash

QVGA LCD

Buzzer

NOR Flash

Smart Card

SD Card

SCI

6-pin GPIO PC

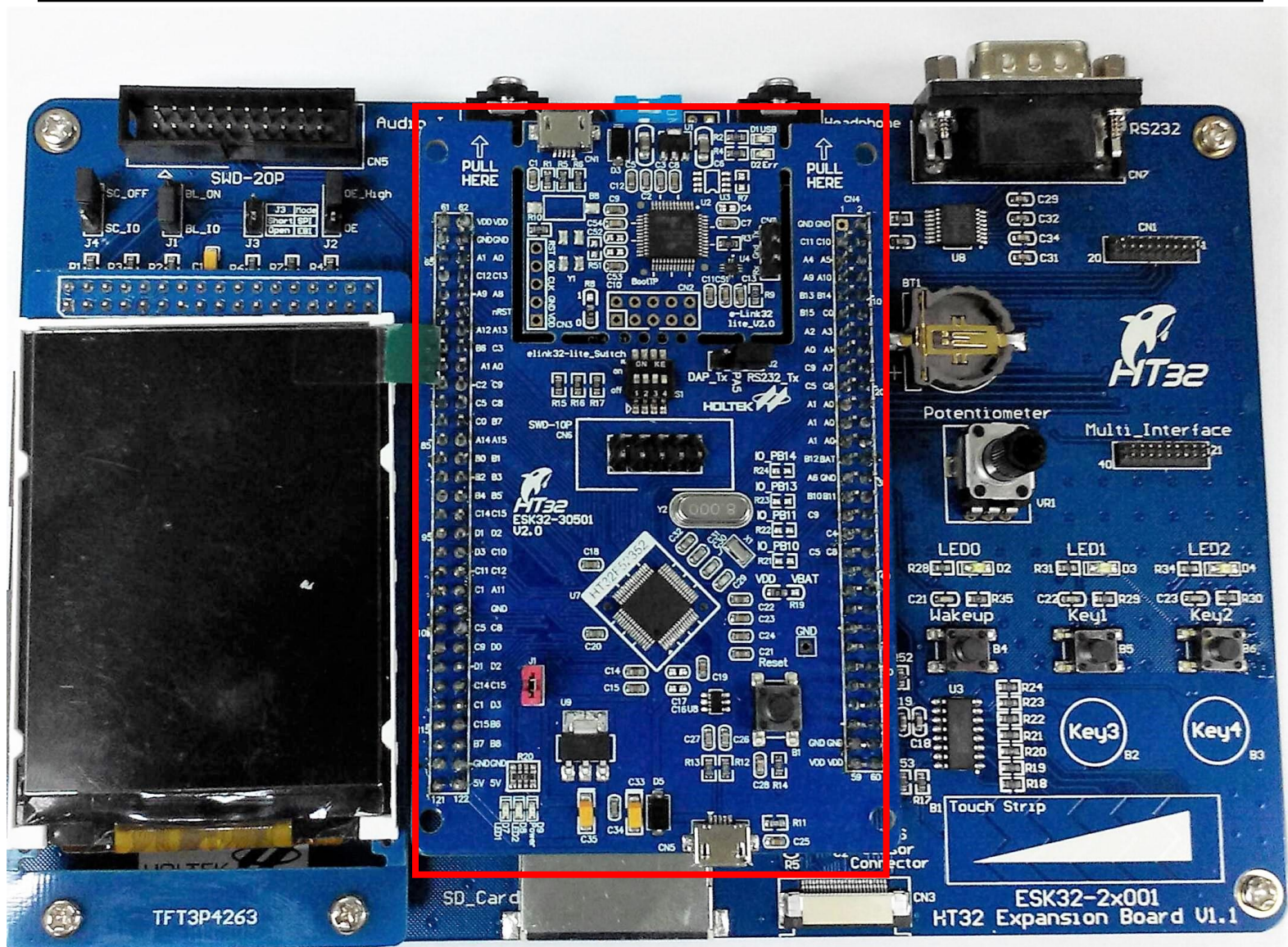
LED x3

Test Key 1 & 2

System Wakeup

Touch Key x 8

ESK32-30501 + ESK32-21001



Play Examples

Download:

ESK32-30501 User Manual: <http://www.holtek.com.tw/ESK32-30501>

ESK32-2x001使用手冊: <http://www.holtek.com.tw/ESK32-20001>

HT32F52352 Peripherals

Property	Peripheral Name
System	FMC, PWRCU, CKCU , RSTCU, PDMA
IO	GPIO, AFIO, EXTI
Functional	ADC , OPA/CMP, I ² S, CRC
Timer	SCTM, BFTM, GPTM, MCTM , RTC, WDT
Communication	I²C , SPI, USART, UART , USB, SCI, EBI

0_Start

Overview

- **目的**

1. 了解 Keil ARM 開發環境
2. 了解 HT32 Firmware Library 基本架構
3. 幫助程式開發過程除錯

- **說明**






1. 在程式開發過程, 與程式做互動
2. FW 設定 Retarget port 為 COM1

- **練習**

1. 連接 PC 端和 (SK) ESK32-30501 e-Link32 Lite USB Port
2. PC 端安裝 HT32_Retarget_VCP.inf 和 tera term 工具
3. Download 範例程式, 執行顯示或輸入訊息

Summary I

- **Keil V5 環境**

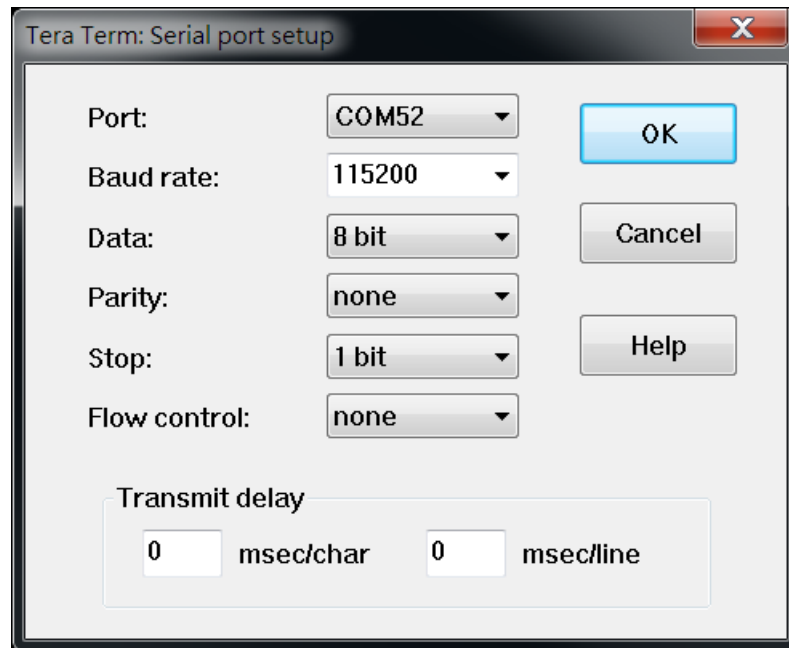
- Build , Rebuild , Download , Options for Target 
(C/C++, Linker, Debug, Utilities, ...)
- Debug mode  (Breakpoints, Reset, Run, Step, View ...)

- **HT32 FWLib 架構 - Keil Project**

- User folder (main.c, ht32f5xxxx_01.it.c),
- Config folder (ht32f5xxxx_conf.h, DebugSupport.ini)
- CMSIS folder (system_ht32f5xxxx_01.c)
- MDK folder (startup_ht32f5xxxx_01.s)

Summary II

- **開發除錯 - Console Tool**
 - 115200 bps, 8-N-1
 - SK Option: J2, DAP_Tx
 - Tera Term configuration: Setup > Serial Port



1_GPIO_CKCU

Overview

• 目的

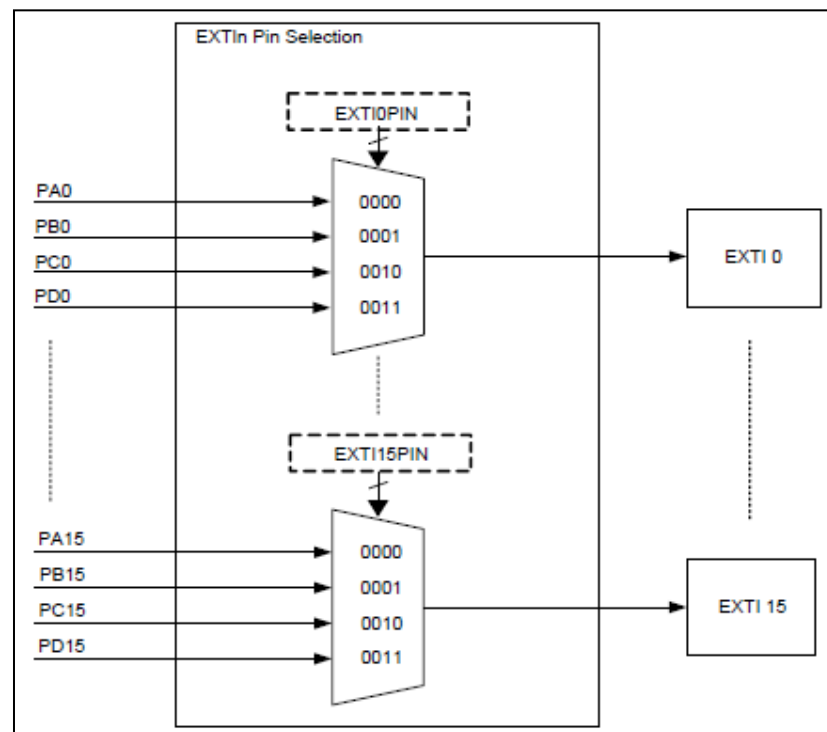
1. 了解 HT32 Firmware Library 基本使用方法
2. 了解 GPIO / AFIO / CKCU / EXTI / NVIC 基本功能

• 說明

1. 控制 LED (Output)
2. 控制 Button (Input)

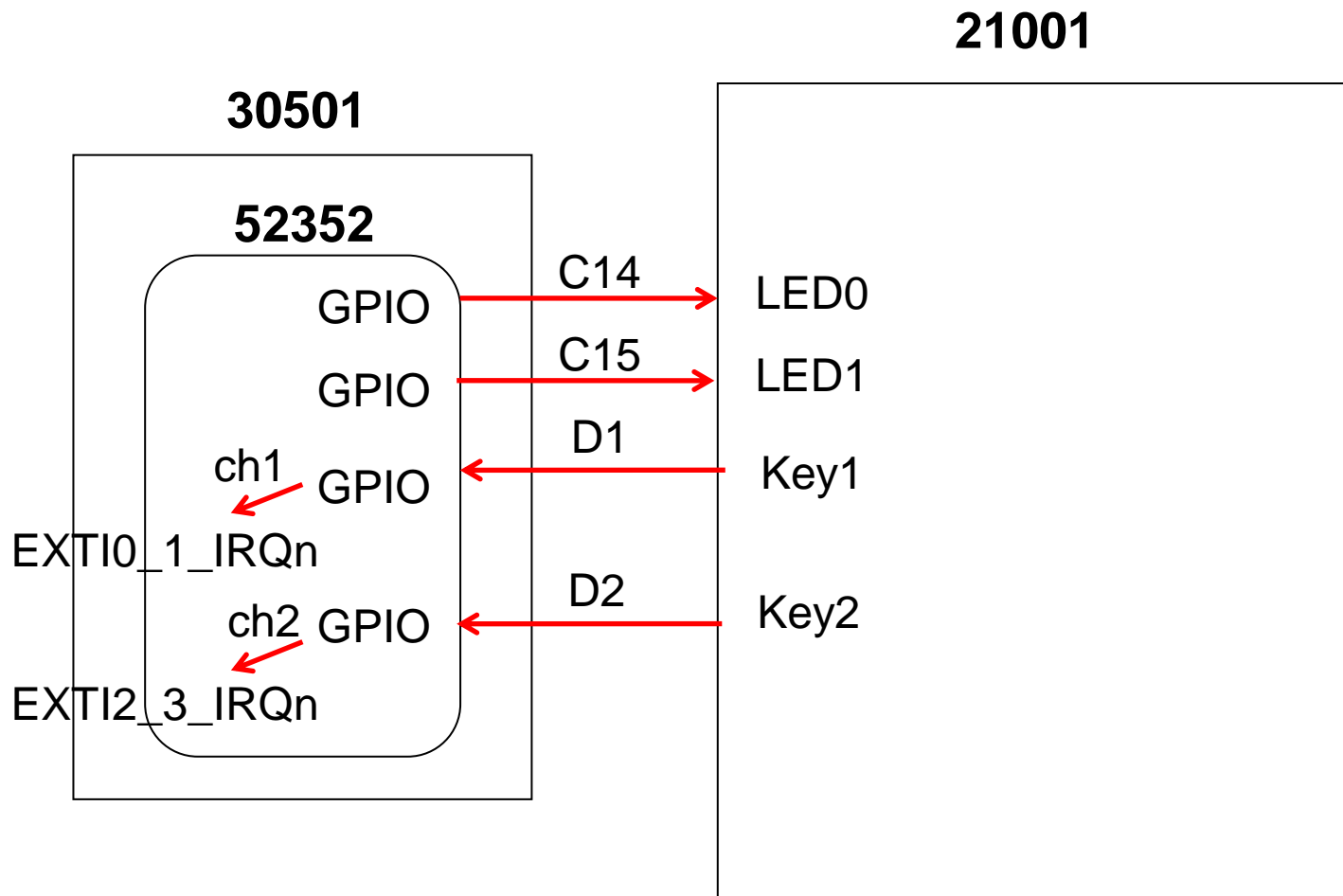
• 練習

- 1_ LED
- 2_ LED_CKCU
- 3_ Key
- 4_ Key_Interrupt



Summary

- Program Configuration



2_Timer

Overview

- **目的**

1. 了解 SysTick 基本功能
2. 了解 BFTM 基本功能

- **說明**

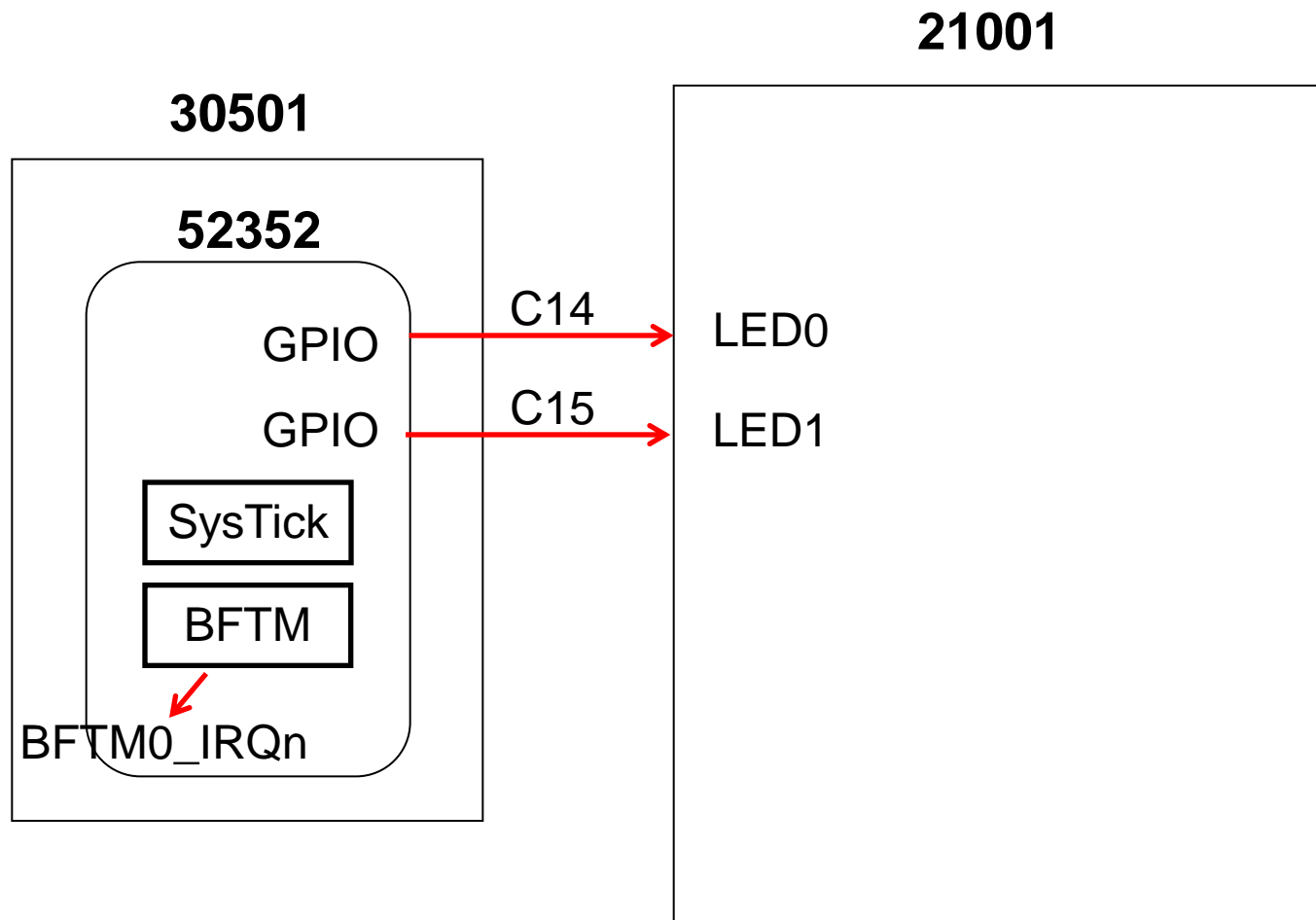
1. SysTick 定時發中斷, 進入SysTick_Handler()
2. BFTM 定時發中斷, 進入BFTM0_IRQHandler()

- **練習**

- 1_SysTick
- 2_SysTick_Event
- 3_BFTM

Summary

- Program Configuration



3_USART

Overview

- **目的**

1. 了解 USART 基本功能

- **說明**

1. 搭配 tera term 做資料傳輸

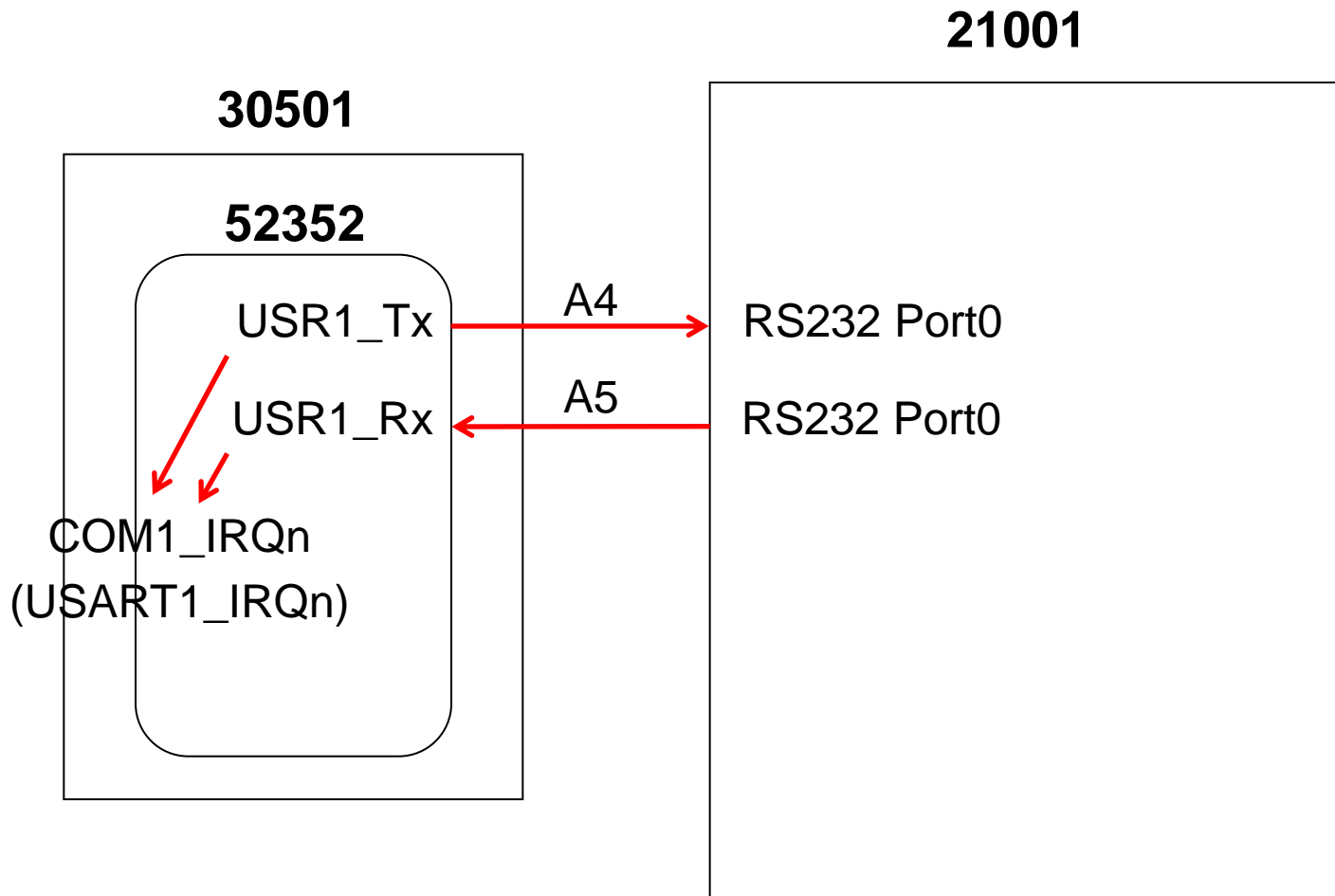
- **練習**

- 1_Polling

- 2_HyperTerminal_TxRx_Interrupt

Summary

- Program Configuration



4_I²C

Overview

- **目的**

1. 了解 I²C 基本功能

- **說明**

1. 搭配 tera term, 讀寫 EEPROM, 24LC16

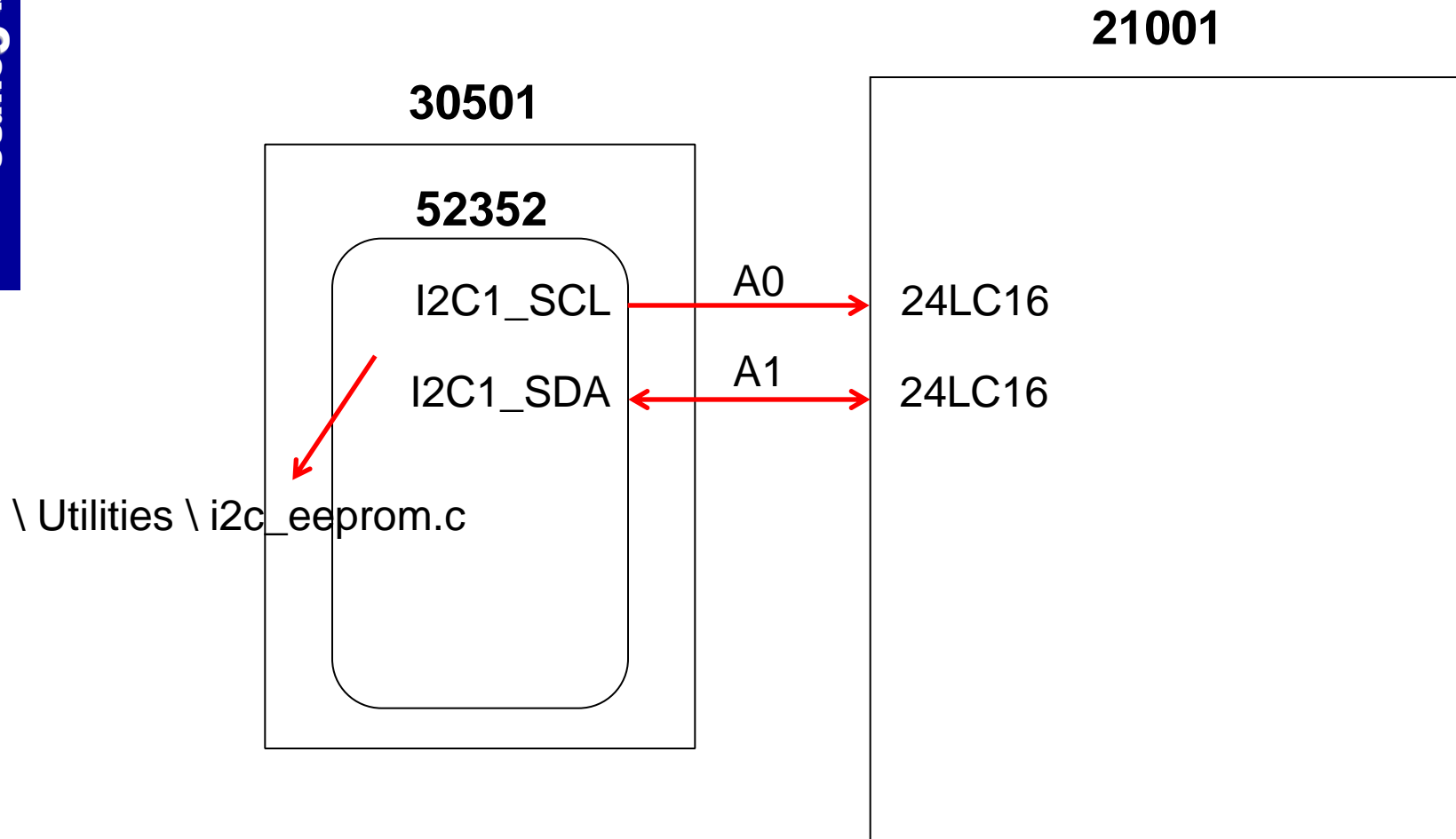
- **練習**

- 1_EEPROM

- 2_TouchKey

Summary

- Program Configuration



5_ADC

Overview

- **目的**

1. 了解 ADC 基本功能

- **說明**

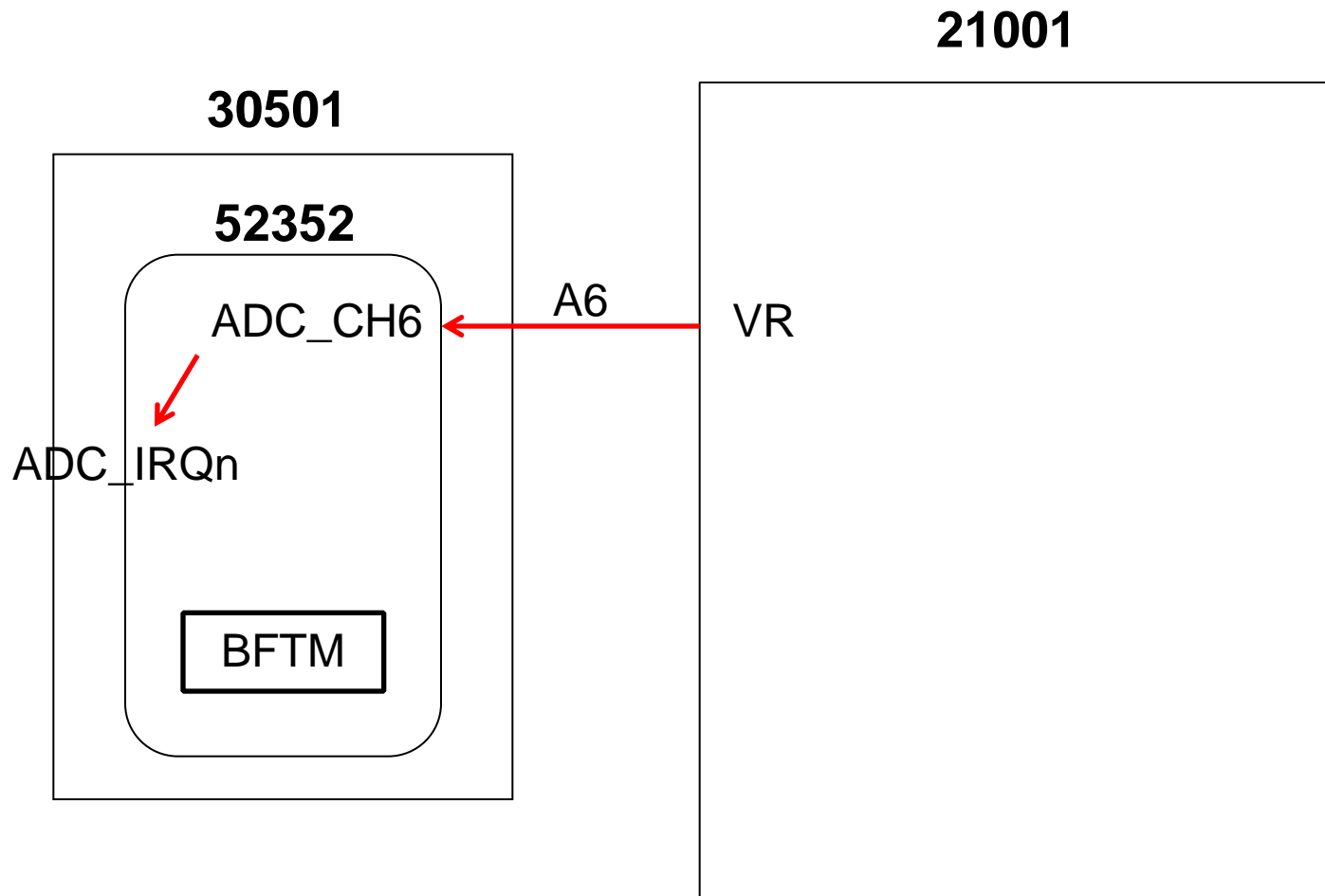
1. 判斷可變電阻(VR)的類比電壓, 作為ADC輸入源
2. 搭配 tera term 顯示 ADC 轉換值

- **練習**

- 1_ADC_Continuous
- 2_ADC_BFTM_Oneshot

Summary

- Program Configuration



6_PWM

Overview

- 目的

- 1. 了解 GPTM / MCTM 基本功能

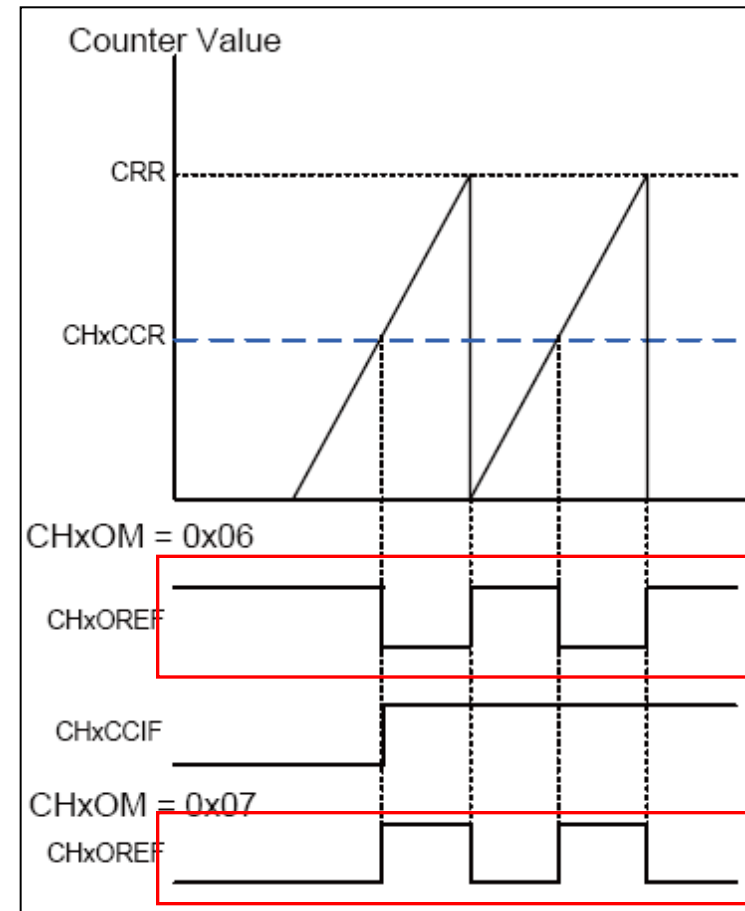
- PWM 訊號輸出

- 說明

- 1. 控制 Buzzer

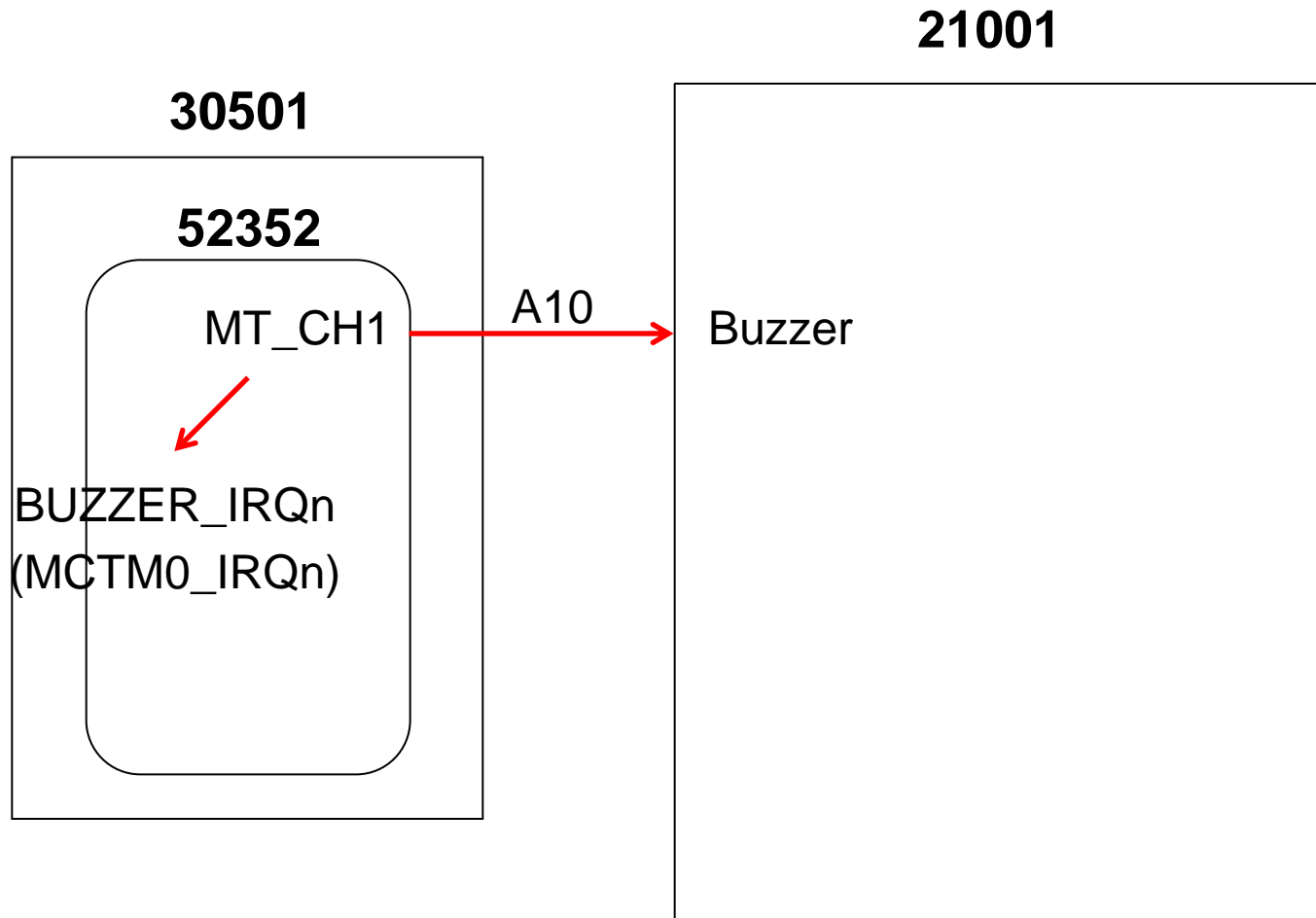
- 練習

- 1_TM_PWMOutput



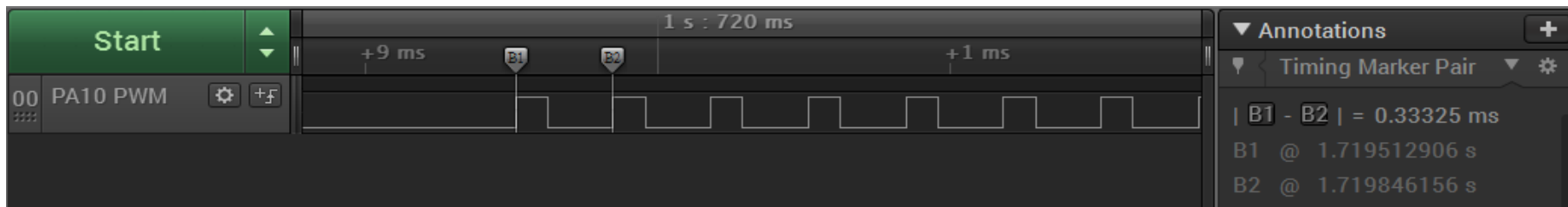
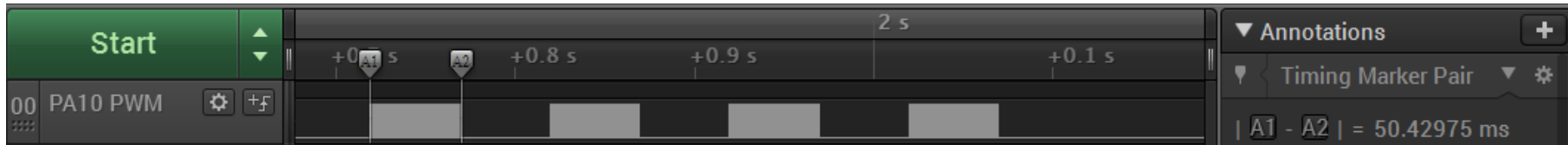
Summary I

- Program Configuration



Summary II

- Waveform



HT32 Flash Programming

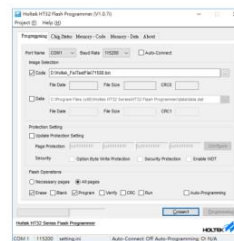
Download:

<https://www.holtek.com.tw/development-kit>

Holtek官網 -> 開發工具首頁 -> 開發工具 -> 開發套件 -> ESK32-305xx -> HT32 Flash Programmer

Overview

	MCU	Firmware	Interface	Target
Writer	Un-mounted	No	Socket	<u>Production</u>
ICP	Mounted	No	Serial Wire	<u>Development Engineering</u>
ISP	Mounted	Boot Loader	UART / USB	<u>Engineering</u>
IAP	Mounted	User AP	Various (USB/UART/I2C/SD)	<u>End User</u>



e-Writer32

- HT32 Family Writer

- For Mass Production
- Programming via socket
- Two operation modes
 - On-line Mode : Connect with PC via USB
 - Off-line Mode : Stand alone operation by click button



e-Socket32

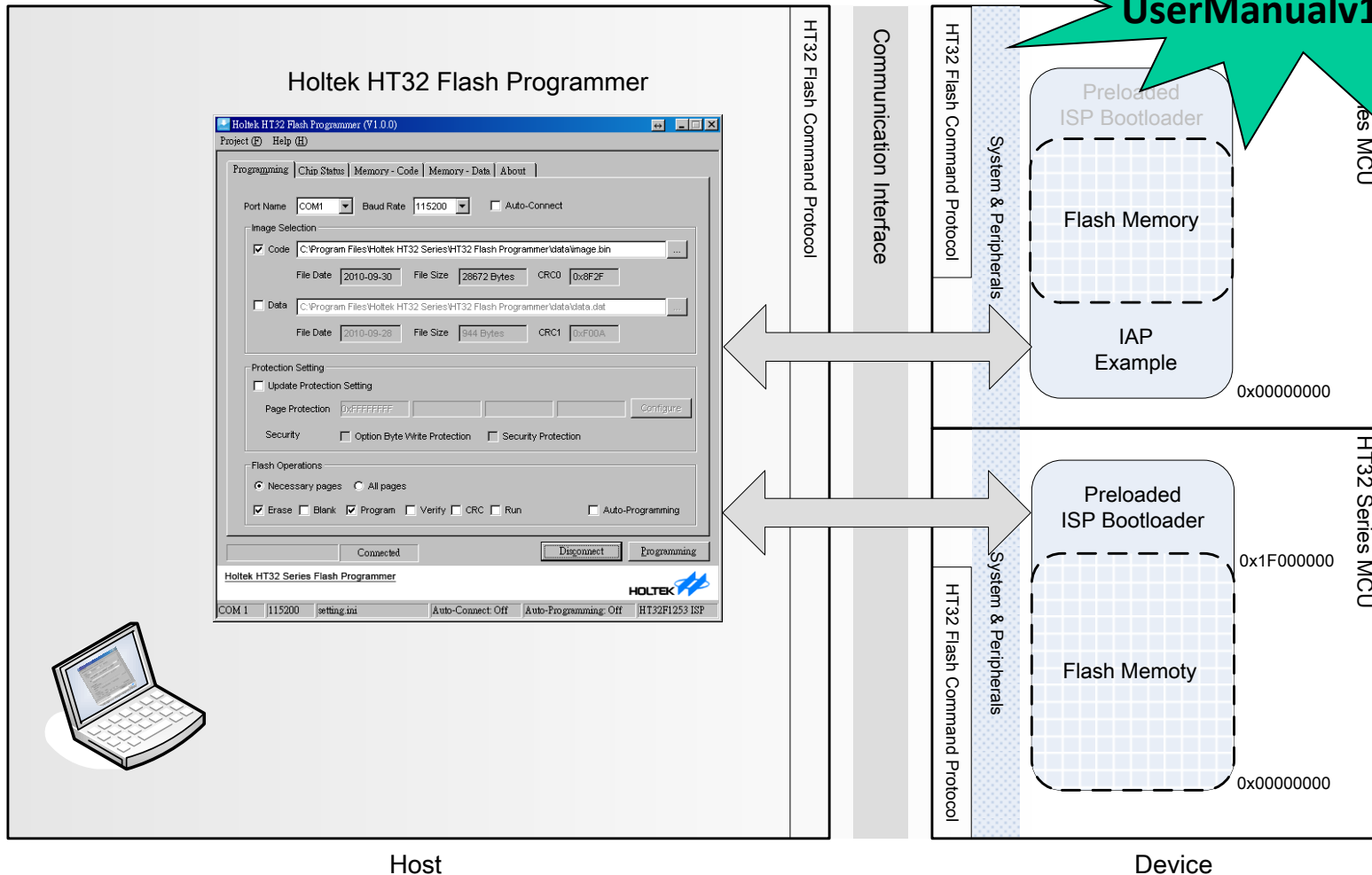
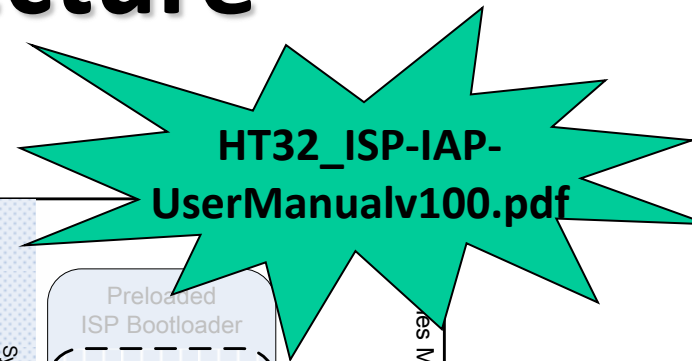


e-Writer32



HOPE3000For32Bit

ISP / IAP Architecture



Host

Device

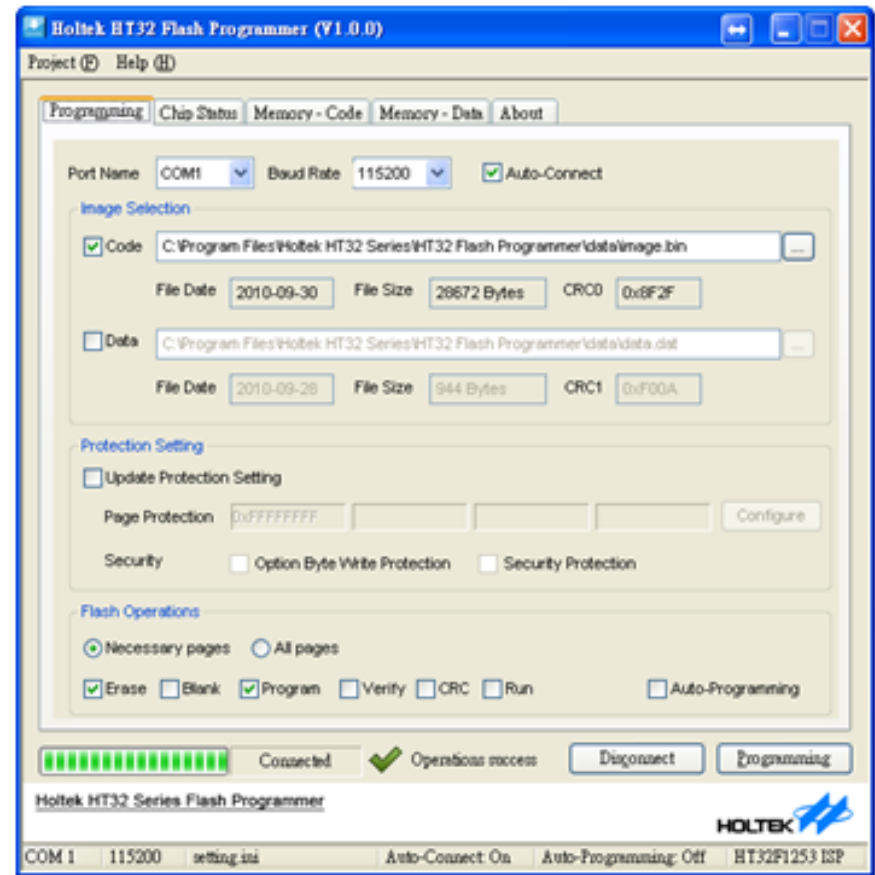
ISP / IAP Flash Programmer

ISP / IAP Standard UI

- Setting
- Programming Firmware
- Checking Status
- Reading Memory
- Interface : UART / USB

SDK

- For customized UI
- ISPCmd.dll DLL API
- Example code in VC++



HT32 Resources

Web or Download:

HT32F5 Series (Cortex-M0+): HT32_M0p_vxxxxxxxx.zip

<http://mcu.holtek.com.tw/ht32/resource/>

Documentation

Type	Item	Description
IC	Datasheet User Manual	IC Brief description IC Detailed description
Firmware	Programmer's Guide	F/W library guide in CHM format
Tools	Starter Kit User Manual Expansion Board User Manual e-Link32 User Manual Quick Start Guide	Starter Kit description Expansion board description e-Link32 installation guide Quick start guide of Keil / IAR
ISP / IAP	ISP / IAP User Manual	ISP / IAP description (UI & FW)
Application	Application Notes	Various application information

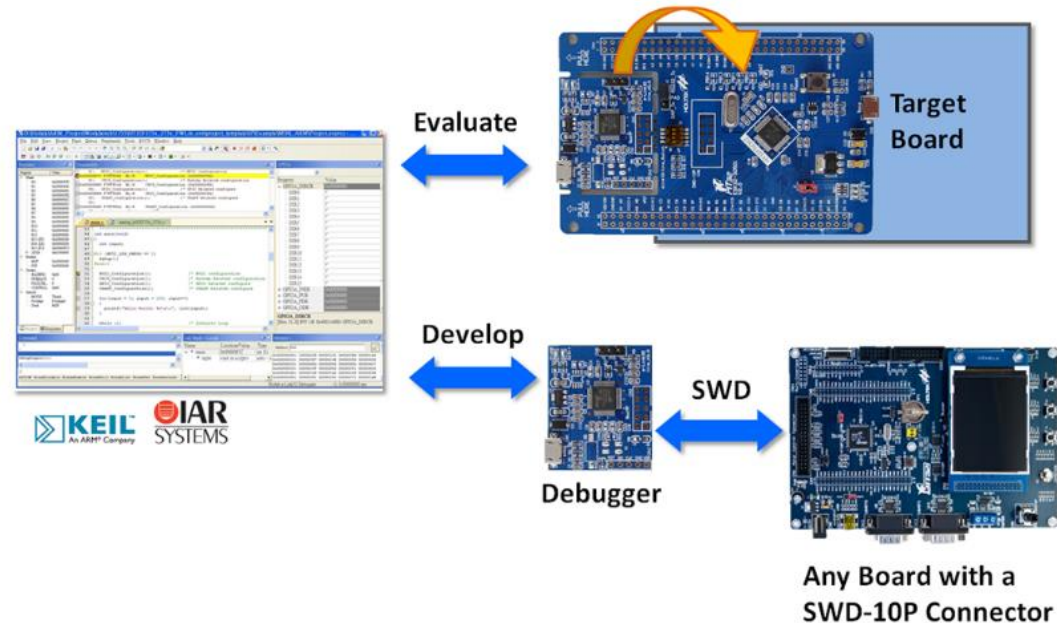
32-Bit Flash MCU

- Home > Products > 32-Bit Flash MCU > General Purpose MCU
 - Cortex-M0+ 32-Bit USB MCU

32-Bit Flash MCU																				
8-Bit Flash MCU																				
High Supply Voltage Flash MCU																				
8-Bit OTP MCU																				
▶ Cortex-M0+ 32-Bit MCU																				
▼ Cortex-M0+ 32-Bit USB MCU																				
Part No.	Max. Freq.	VDD	Flash	SRAM	PDMA	ADC	CMP	DAC	Timers*1	Cap.*2 or PWM	Cpm. PWM*3	RTC	SCI**4	USB*5	EBI*6	I ² S	Interface	Others	I/O	Pack
HT32F52331	48MHz	2.0V	32KB	4KB	--	1 Msps	--	--	BFTM×2	12	3	√	1	√	--	--	USART×1	CRC	24	33QI
HT32F52341		~ 3.6V	64KB	8KB		12-bit ×12			SCTM×4								GPTM×1		MCTM×1	UART×2
HT32F52342	48MHz	2.0V	64KB	8KB	6CH	1 Msps	2	--	BFTM×2	14	3	√	2	√	√	√	USART×2	CRC	26	33QI
HT32F52352		~ 3.6V	128KB	16KB		12-bit ×12			SCTM×2								GPTM×2		MCTM×1	UART×2
HT32F52344	60MHz	1.65V	64KB	8KB	6CH	1 Msps	2	--	BFTM×2	10	3	√	--	√	√	--	UART×2	CRC	26	33QI
HT32F52354		~ 3.6V	128KB	8KB		12-bit ×12			SCTM×2								GPTM×1		MCTM×1	SPI×2
HT32F52357	60MHz	1.65V	128KB	16KB	6CH	1 Msps	2	500Ksps 12-bit×2	BFTM×2	18	3	√	2	√	√	√	USART×2	AES	37	46QI
HT32F52367		~ 3.6V	256KB	32KB		12-bit ×12			SCTM×2								PWM×2		GPTM×1	MCTM×1

Development Kit

- Home > MCU Tools > Hardware > Development Kit



技術支援

- Data Sheet
- User Manual
- Firmware Library
- ESK32-30501 User Manual
- Schematics
- Tool chain Quick Start Guide
 - Keil™ MDK-ARM
 - IAR EWARM
- Keil MDK Holtek Edition (Free) Installation Guide

Software

- Home > MCU Tools > Software
 - ICE Software
 - Programmer Software
 - Development Kit Software

Model	Function	Support Hardware	Download
HT32 Keil Support Package (New release V1.17)	Integrated Keil development software for MCU		
HT32 IAR Support Package (New release V1.11Beta06)	Integrated development software for MCU		
e-Link32 Pro ICP Tool (New release V0.29)	Programmer software for e-Link32 Pro		
e-Link32 Pro Commander (New release V1.00)	Programmer software for e-Link32 Pro		
HT32 Virtual COM Driver (New release V1.10)	HT32 Virtual COM Driver		
	Model	Function	
	HOPE3000 (New release V3.29)	Integrated Writer	
	HOPE3000 For e-Link (New release V1.18)	Engine Flash	
	HOPE3000 For HT8051 (New release V1.64)	e-Writer	
	HOPE3000 For HT32 (New release V2.10)	e-Writer	
	I3000 (New Release V2.56)	HT8 F Programmer Bootloader)	
			to each MCU's datasheet
HT32 Flash Programmer	In-System / In-Application programmer software for HT32 series MCUs. The HT32 Flash Programmer UI uses the UART or USB interface for communication.	ESK32-xxx ESK32-301xx ESK32-305xx	V1.09a
HT32F1xxxx (M3) Standard Peripheral Firmware Library	HT32F1xxxx Standard Peripheral Firmware Library is a software package that contains peripheral driver, API Functions, macros, data types, structure types and examples of HT32F1xxxx peripherals.	ESK32-xxx ESK32-301xx ESK32-2xxxx	HT32_STD_1xxxx_FWLib_v004_2103
HT32F5xxxx (M0+) Standard Peripheral Firmware Library	HT32F5xxxx Standard Peripheral Firmware Library is a software package that contains peripheral driver, API Functions, macros, data types, structure types and examples of HT32F5xxxx peripherals.	ESK32-305xx ESK32-2xxxx	HT32_STD_5xxxx_FWLib_v014_4736

Application Notes

- Home > Technical Support > Application Notes
 - MCU: General
 - MCU: Professional

32-Bit Flash MCU

Part No.	Application Note Description	Associated Files
AN0301E	HT32 Series Crystal Oscillator, ADC Design Note and PCB Layout Guide	--
AN0310E	HT32 Series Microcontrollers PDMA Description	--
AN0464E	HT32 Clock Monitor and Clock Frequency Switch	--
AN0465E	HT32 Series Microcontroller Flash Programming	--
AN0469E	HT32 EEPROM Emulation	.zip
AN0470E	HT32 Series EBI	--
AN0473E	HT32 Low Power Mode	.zip
AN0474E	Online Programming: Dual Image Architecture	--
AN0538EN	HT32 CMSIS-DSP Library User's Guide	--

Appendix ...

Exception

- **目的**

1. 增加程式開發的除錯能力

- **說明**

1. 確認 Build Output window message
2. 搭配 `tera term` 顯示 `ExceptionTest` 範例程式的執行結果

- **練習**

1. Program compiling error
2. Stack Overview: Stack Pointer Register (R13)
3. Hard Fault: Clock is disabled before use
4. Hard Fault: Unaligned memory access



The End