**GigaDevice Semiconductor Inc.** 

# GD32F1x0 ARM<sup>®</sup> Cortex<sup>™</sup>-M3 32-bit MCU

Application Note AN007



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# 1. Introduction

GigaDevice.GD32F1x0\_DFP.2.0.0.pack is used to support GD32F1x0 series chips.

- Online installation (highly recommended).
- Locally installation.
- Automatically generate GD32F1x0 series MCU and the corresponding feature information list.
- Automatically matching the corresponding flash algorithm to the selected chip.
- This Pack provides a complete set of library and components of GD32F1x0 series chips in the Manage Run-Time Environment (RTE). The users can select the required library files.
- Support checking register status in the Debug mode.
- Support getting documents from the Books Tab.

# 1.1. Versions of Keil

The Pack is suitable for Keil v5.15a and above versions. This note is operated on Keil v5.18a as an example.

Note: For versions Keil v5.13 and Keil v5.14, there are some problems:

- 1. Not supported to get documents from the Books Tab.
- 2. Users can't observe registers in the Debug mode by calling svd file. To solve this problem, the users should change file .svd to .sfr as shown in figure 1-1.

### Figure 1-1. Change file .svd to .sfr

Device     Target     Output     Listing     Vser     C/C++     Asm     Linker     Debug     Vtilities       GigaDevice GD32F150C8     Code Generation     Xtal (MHz):     8.0     ARM Compler:     Use default compler version
GigaDevice GD32F150C8 Xtal (MHz): 8.0 Code Generation Xtal (MHz): 8.0
Xtal (MHz): 8.0 ARM Compiler: Use default compiler version
Operating system: RTX Kernel
System Viewer File: Use Cross-Module Optimization
JaDevice\GD32F1x0_DFP\2.0.0\SVD\GD32F1x0.SFR
V Use Custom File
Read/Only Memory Areas
default off-chip Start Size Startup default off-chip Start Size Nolnit
□ ROM1: □ C □ RAM1: □ □
□ ROM2: □ RAM2: □ □
□ ROM3: □ □ RAM3: □ □
on-chip on-chip
IROM1:         0x8000000         0x10000         IROM1:         0x20000000         0x2000
□ IROM2: □ IRAM2: □ □
OK Cancel Defaults Help

3. Schema check to the pack, there will be an error, shows in figure 1-2.



# Figure 1-2. Schema check error

Pack Insta	aller
	PDSC Schema Check failed: C:\Keil_v5\ARM\PACK\GigaDevice\GD32F1x0_DFP\2.0.1\GigaDevi ce.GD32F1x0_DFP.pdsc(33,64): Error parsing node '#text' :value 'GigaDevice:123' not in enumeration C:\Keil_v5\ARM\PACK\GigaDevice\GD32F1x0_DFP\2.0.1\GigaDevi ce.GD32F1x0_DFP.pdsc(503,65): Error parsing node '#text' :value 'GigaDevice:123' not in enumeration C:\Keil_v5\ARM\PACK\GigaDevice\GD32F1x0_DFP\2.0.1\GigaDevi ce.GD32F1x0_DFP.pdsc(565,86): Error parsing node '#text' :value 'GigaDevice:123' not in enumeration C:\Keil_v5\ARM\PACK\GigaDevice\GD32F1x0_DFP\2.0.1\GigaDevi ce.GD32F1x0_DFP.pdsc(566,89): Error parsing node '#text' :value 'GigaDevice:123' not in enumeration
	确定



2.

# How to download and Install Pack by Pack Installer

To create a new Keil5 project, GigaDevice.GD32F1x0\_DFP.2.0.0.pack should be downloaded and installed first.

1. Let's open the Keil5, and select the Pack Installer, as shown in figure 2-1.

### Figure 2-1. Pack installer step 1

🐺 C:	\Keil_	v5\ARM	I\Pack\Gi	gaDevi	ce\GD32	F1x0_DFP\2.	0.0\Boa	ards\Gig	aDevice\@	GD32150C	-START\Blinky\Blinky.u\	projx[Re	ad Only]	- µVision			
Eile	Edit	<u>V</u> iew	Project	Fl <u>a</u> sh	<u>D</u> ebug	Peripherals	Tools	<u>s</u> vcs	Window	Help							
l 🗋	2	2 🥔	X G		26	$\Leftarrow \Rightarrow \mid p$	172	图 图		//#//#	2 <b>4</b> 2	-	k 🌾 🛛 🧕	<b>≥   ●</b> ○	O 🚓	🖃 🔧	
0		🖄 🥩	📖   🙀	GD32	F150C8 R	AM 💌	\$	<b>-</b>	🔶 🔶 🙋								
Projec	:t				<b>д (</b>	3			Γ	🛞 Pack In	staller						
	S Pro	ject: Blin GD32F15	iky 50C8 RAN	I						Install contair	or update Software Packs t Software Components	hat					

2. Click on the Pack Installer button to enter the interface as shown in figure 2-2. Click the refresh button before downloading the latest Pack.

### Figure 2-2. Pack installer step 2

🚳 Pack Installer - C:\Keil_	Pack Installer - C:\Keil_v5\ARM\PACK									
<u>File Packs Window H</u>	<u>l</u> elp									
Device: All Devices										
Devices Boards	4									
Search:	• ×									
Device 🖊	Summary									
⊡ All Devices	3465 Devices									
🕀 🔗 ABOV Semico	5 Devices									
🕀 🔍 Ambiq Micro	8 Devices									
🗄 🍳 Analog Devices	16 Devices									
🗄 🗠 🔗 ARM	18 Devices									
🕂 🖓 Atmel	260 Devices									
🗄 🔗 Cypress	381 Devices									
🕀 🖓 Freescale	242 Devices									

3. As shown in figure 2-3, find out and then choose GD32F1x0 Series in Devices Tab.



## Figure 2-3. Pack selection

Pack Installer - C:\Keil_v5\ARM\P	АСК					
<u>File Packs Window H</u> elp						
Device: GigaDevice - GD32F1x0	Series					
d Devices Boards						
Search:	X					
Device /	Summary					
🖃 🍕 All Devices	3209 Devices					
🗄 🔗 🖉 ABOV Semiconductor	4 Devices					
🗄 🔗 Ambiq Micro	8 Devices					
🗄 🔍 🐓 Analog Devices	13 Devices					
🗄 ···· 🔗 ARM	18 Devices					
🗄 🗝 Atmel	260 Devices					
🕂 🔍 🔗 Cypress	381 Devices					
🕂 🔍 🗭 Freescale	232 Devices					
🖃 🍳 GigaDevice	67 Devices					
GD32F1x0 Series	40 Devices					
🕀 🍄 GD32F2 Series	27 Devices					
🗄 🖓 🔶 Holtek	11 Devices					
🗄 🔗 Infineon	93 Devices					
🗄 🖓 🖉 Maxim	4 Devices					
🛨 🔗 Microsemi	6 Devices					
🗄 🔗 Nordic Semiconductor	7 Devices					
🗄 🗠 🔗 Nuvoton	399 Devices					
€ NXP	270 Devices					
🕀 🔶 Renesas	2 Devices					
🗄 🔍 🔗 Silicon Labs	357 Devices					
🗈 🔍 SONIX	49 Devices					
STMicroelectronics	602 Devices					
🗄 🔗 Texas Instruments	341 Devices					
主 🗝 🗸 Toshiba	85 Devices					

 Correspondingly it will show GigaDevice::GD32F1x0\_DFP in drop-down menu of Device Specific in figure 2-4. Click on the Install button behind GigaDevice::GD32F1x0\_DFP to download the Pack of GD32F1x0 series.

The Pack will then be downloaded to the directory (.\Keil\_v5\ARM\Pack\.Download), and then the installation will be done.

#### Figure 2-4. Pack download

	Packs         Examples			⊳
	Pack	Action	Description	
I	□ Device Specific	1 Pack	GD32F1x0 Series selected	
I	⊡ GigaDevice::GD32F1x0	🚸 Install	GigaDevice GD32F1x0 Series Device Support and Examples	
	2.0.0 (2016-03-01)	🖄 Unpack	GigaDevice GD32F1x0 Series Device Support and Examples	

5. If you want to remove the Pack from Keil5, Click on the Remove button, but this operation will not clear the executable file in the directory of Keil5. Thus if you has not manually deleted the executable file, re-install the Pack can be done off-line without the download process.

#### Figure 2-5. Remove pack

	1 Packs Examples			Þ
ſ	Pack	Action	Description	
ľ	Device Specific	1 Pack	GD32F1x0 Series selected	
I		💠 Up to date	GigaDevice GD32F1x0 Series Device Support and Examples	
	2.0.0 (2016-03-01)	🗶 Remove	GigaDevice GD32F1x0 Series Device Support and Examples	



When the Pack installation is completed, the related GD32F1x0 components will be added to the RTE (as shown in figure 2-5) interface, as shown in figure 2-6.

## Figure 2-6. MCU lists of GD32F1x0 series

Options for Target 'GD32F150C8 RAM'	
Device Target Output Listing Vser	C/C++ Asm
Software Packs Vendor: GigaDevice Device: GD32F150C8 Toolset: ARM	So
Search:	
GigaDevice     GigaDevice     GJ32F1x0 Series     GJ32F130     GJ32F150     GJ32F170     GJ32F190     GJ32F190C4     GJ32F190C6     GJ32F190C8     GJ32F190R4     ✓	GD32 is a new universal micro core,which tan GD32 family in customers wid MCU portfolios GD32 family in line currently. GD32F150 - A Frequer Flash a Single-c NVIC su priority levels

Click the button shows in figure 2-7 to open RTE(Manage Run-Time Environment).

#### Figure 2-7. Manage run-time environment

🐺 C:\	Keil_\	∕5\ARM	I\Pack\Gi	gaDevic	e\GD32F	1x0_DFP\2.0	0.0\Boa	ards\Gig	aDevice\@	D32150	C-STA	RT\Blinky	\Blinky.u
File	Edit	View	Project	Flash	Debug	Peripherals	Tools	SVCS	Window	Help			
	<b>2</b>	2	8 B		0 0 0	← →   №	12	PA 192		//= // <sub>R</sub>	2		
۲		🖄 🥪		GD32	F150C8 RA	M 💌	<u> </u>	6 6 6	🔶 🔶 🔞	2			
Projec	t		д 📧						🚸 Mana	ige Run-	Time En	vironment	
	Proj	ect: Blin	iky						Selec	t Softwar	e Comp	onents for	the
		GD32F1	50C8 RAN						proje	α			

In figure 2-8, users can see the related components of GD32F1x0.



## Figure 2-8. RTE interface



**Note:** If the corresponding chip selection is still unavailable after the Pack installation, you may reopen the project to loading Pack.



# 3. Structure of GD32Fxxx pack

After the installation of GigaDevice.GD32F1x0\_DFP.2.0.0.pack, the folder directory can be seen in directory of Keil5 (.\Keil\_v5\ARM\Pack\GigaDevice\GD32F1x0\_DFP\2.0.0), as shown in figure 3-1.

## Figure 3-1. Structure of Pack

길 Boards	2016/3/29 14:29	文件夹	
퉬 Device	2016/3/29 14:29	文件夹	
Documents	2016/3/29 14:29	文件夹	
퉬 Flash	2016/3/29 14:29	文件夹	
\mu svd	2016/3/29 14:29	文件夹	
GigaDevice.GD32F1x0_DFP.pdsc	2016/3/28 14:50	PDSC 文件	51 KB

- Boards folder includes available evaluation board resources, currently only provide GD32150C-START evaluation board, shows in figure 3-2, the contents of the folder are shows below:
  - Blinky folder contains the Keil general demo.
  - The Common folder contains Button.c and LED.c, which are used to realize operations about flashing lights and keystrokes in demo.
  - The Documents folder provides GD32150C-START evaluation board schematic diagram.
  - RTX\_Blinky folder contains the Blinky demo which is based on the operating system.

### Figure 3-2. Structure of Boards Folder



- 2. Device folder contains the content as shown in figure 3-3:
- Firmware folder contains the GD32F1x0 peripherals library.
- Include folder contains the global header file gd32f1x0.h and the system header file system\_gd32f1x0.h.
- Source folder contains the system C file system\_gd32f1x0.c and the startup file startup\_gd32f1x0.s.
- Template folder contains a template project.
- Utilities folder contains gd32f1x0\_eval.c and gd32f1x0\_eval.h.



## Figure 3-3. Structure of Device Folder

鷆 Firmware	2016/3/30 16:05	文件夹
퉬 Include	2016/3/30 16:05	文件夹
🐌 Source	2016/3/30 16:05	文件夹
퉬 Template	2016/3/30 16:38	文件夹
📗 Utilities	2016/3/30 16:05	文件夹

3. Documents folder contains the documents for Books Tab, as shown in figure 3-4.

#### Figure 3-4. Documents Folder content

🔁 dui0552a_cortex_m3_dgug.pdf	2014/10/13 11:05	Adobe Acrobat	1,333 KB
🔁 GD32F1x0_User_Manual.pdf	2016/1/18 17:23	Adobe Acrobat	13,002 KB
🔁 GD32F130xx_Datasheet.pdf	2014/11/11 13:07	Adobe Acrobat	686 KB
🔁 GD32F150xx_Datasheet.pdf	2014/11/11 13:07	Adobe Acrobat	715 KB
🔁 GD32F170xx_Datasheet.pdf	2016/2/24 16:06	Adobe Acrobat	760 KB
🔁 GD32F190xx_Datasheet.pdf	2016/2/24 16:06	Adobe Acrobat	861 KB

4. Flash folder contains algorithms of flash, as shown in figure 3-5.

### Figure 3-5. Flash Folder content

GD32F1x0	2016/3/30 16:05	文件夹	
🗈 FlashOS.h	2014/10/13 11:05	C/C++ Header	4 KB
GD32F1x0_16.FLM	2016/3/17 16:52	FLM 文件	11 KB
GD32F1x0_32.FLM	2014/11/3 16:20	FLM 文件	11 KB
GD32F1x0_64.FLM	2014/11/3 16:20	FLM 文件	11 KB
GD32F1x0_128.FLM	2014/11/3 16:20	FLM 文件	11 KB
GD32F1x0_OB.FLM	2016/3/17 9:41	FLM 文件	12 KB

- 5. SVD (System View Description) file.
- 6. PDSC (Pack Description) file.



# 4. How to play demo

After installing GigaDevice.GD32F1x0\_DFP.2.0.0.pack, the users can use the two Demos based on GD321x0C-START board in the Pack, one is called Blinky without operating system, the other is RTX\_Blinky based on RTX Kernel operating system.

The steps of opening the Demo Blinky:

1. Open Keil5 and then open the Pack Installer.



- 2. In the open dialog, find GigaDevice in Devices Tab and select GD32F1x0 Series, then the Demos will be shown in the Examples Tab. As shown in figure 4-1, choose Blinky and click Copy.
- 3. Select store path in the pop-up dialog. The default store path is the new folder named Boards in D:\Documents. Click OK and the Project will open.

### Figure 4-1. Blinky select

A Pack Installer - C:\Keil_v5\A	RM\PACK			
File Packs Window Help				
Device: GigaDevice - GD32	P1x0 Series			
Devices Boards	4	d Packs Examples		4
Search:	• ×	Show examples from installed Packs only		
Device 🛆	Summary	Example	Action	Description
E 🌱 All Devices	2949 Devices	RUDRY (GD32150C-START)	🚸 Сору	Blinky example
	5 Devices	CMSIS-RTOS Blinky (GD32150C-START)	🚸 Сору	CMSIS-RTOS base
🗉 🔗 Ambiq Micro	8 Devices			
🗉 🄗 Analog Devices	16 Devices			
🕀 🔗 ARM	18 Devices			
🖭 🔗 Atmel	260 Devices			
🗉 🤗 Cypress	381 Devices			
+ 🖉 Freescale	236 Devices			
🖃 🔗 GigaDevice	40 Devices			
E GD32F1x0 Series	10 Devices			
+ 🖉 Holtek	19 Devices			
🔹 🌳 Infineon	144 Devices			
🗉 🔗 Maxim	4 Devices			
🗉 🌳 Mediatek	1 Device			
🗉 🔗 Microsemi	6 Devices			
🗉 🤗 NXP	275 Devices			
+ 🔗 Renesas	2 Devices			
🔹 🌳 Silicon Labs	357 Devices			
🗉 🤗 SONIX	40 Devices			
+ 🖌 STMicroelectronics	709 Devices			
🔹 🌳 Texas Instruments	340 Devices			
🗉 🔗 Toshiba	88 Devices			
				•
L				
Output				Φ×
Refresh Pack descriptions				
Baady				ONUTINE
Ready				UNLINE

Open the project, unfold the folders in the Project Tab, as shown in figure 4-2, it includes the following documents:

- Source Files
- Documentation
- Board Support Components
- CMSIS Components



### Device Components

Select the components in Manage Run-Time Environment:

- Source Files folder includes the Blinky.c which is the source file of Demo.
- Documentation folder includes the demo instructions.
- Board Support components include two parts: Buttons provides Buttons.c and related header files, LED provides LED.c and related header files, they are used for test on GD321x0C-START board.
- CORE in CMSIS components provides the required functions and variables of core.
- Device components include three parts: GD32F1x0\_Conf provides module configuration of project, Startup provides startup\_gd32f1x0.s, System\_GD32F1x0 provides system\_gd32f1x0.c and related header files.

Figure 4-2. Structure of Blinky



To open the Demo CMSIS-RTOS Blinky, the procedure is similar to Blinky.

Open the project, unfold the folders in the Project Tab, as shown in figure 4-3, it includes the following documents:

- Source Files
- Documentation
- Board Support components
- CMSIS components
- Device components

Select the components in Manage Run-Time Environment:

- CORE in CMSIS components provides the required functions and variables of core.
   Components RTOS provides RTX\_CM3.lib and RTX\_Conf\_CM.c.
- The remained steps are similar to Blinky.



Figure 4-3. Structure of CMSIS-RTOS Blinky





# 5. How to create a new project

Download the Pack and install it, then you can create a new project.

The detailed steps are below:

1. Create a new folder, named such as Project, to save the new created project. As shown in figure 5-1, put the application program in the Project folder, and create another new folder named such as Driver, put in the related driver files.

Figure 5-1. Content of new project



2. Open Keil5, shows in Figure 5-2, select New uVision Project in the Project menu.

Figure 5-2. Menu of create a new project



3. Select the new created folder Project as target location in the pop-up dialog, and name it test, as shown in figure 5-3. The driver files are stored in the folder called Driver.



Figure 5-3. Save the new projrect

🔣 Create New Project	1000				×
🕞 🖓 - 🚺 🕨 Proje	ct 🕨	<b>- 4</b> ∱	搜索 Project		٩
组织 ▼ 新建文件夹	E			• N • N	2
Driver					
文件名( <u>N</u> ): tes	st				•
保存类型(I): Pro	oject Files (*.uvproj; *.uvprojx)				-
▲ 隐藏文件夹			保存(S)	取消	

4. After clicking save, a dialog will pop out for project configuration and chip selection. In this test, we select GD32F150R8, click OK.

### Figure 5-4. Selection of Devices

Select Device for Target 'Target 1'	×
Device	
Software Packs	•
Vendor: GigaDevice Device: GD32F150R8 Toolset: ARM	_
Search:	Description:
	<ul> <li>GD32 is a new 32-bit high performance, low power consumption universal microcontroller family powered by the ARM Cortex-M3 RISC core, which targeted at various MCU application areas.</li> <li>GD32 family integrates features to simplify system design and provide customers wide range of comprehensive and superior cost effective MCU portfolios with proven technology and great innovation.</li> <li>GD32 family includes entry line, performance line and connectivity line currently.</li> <li>GD32F150 - ARM Cortex-M3 Core Frequency up to 72 MHz Rash access zero wat state Single-cycle multiplier and hardware divider NVIC support 16 internal, 52 external interrupts, each has 16</li> </ul>
	OK Cancel Help

5. Then the RTE will pop out, users can select the required modules.

The components which must be selected are CORE in CMSIS components, Startup, System\_GD32F1x0, GD32F1x0\_Conf in Device components.

If the EVAL related functions have been used in the project, then add GD32F1x0\_EVAL in Device components. Finally, add the required modules according to the warnings.



# Figure 5-5. Warnings

oftware Component	Sel.	Variant	Version	Description
- Board Support		GD32150C-START	2.0.0	GigaDevice GD32150C-START Board Support
				Cortex Microcontroller Software Interface Components
CORE	<b>I</b>		4.3.0	CMSIS-CORE for Cortex-M, SC000, and SC300
DSP			1.4.6	CMSIS-DSP Library for Cortex-M, SC000, and SC300
🗉 🚸 RTOS (API)			1.0	CMSIS-RTOS API for Cortex-M, SC000, and SC300
-💠 CMSIS Driver				Unified Device Drivers compliant to CMSIS-Driver Specifications
- � CMSIS Driver Validation		API	1.0.0	Run API test for enabled drivers
- 💠 CMSIS RTOS Validation				CMSIS-RTOS Validation Suite
🔶 Compiler				ARM Compiler Software Extensions
🚸 Device				Startup, System Setup
GD32F1x0_Conf	<b>I</b>		2.0.0	Configuration file
GD32F1x0_EVAL	<b>I</b>		2.0.0	Firmware functions to manage Leds, Keys, COM ports
Startup	<b>F</b>		2.0.0	System Startup for GigaDevice GD32F1x0 Devices
System_GD32F1x0	<b>I</b>		2.0.0	Cortex-M3 Device Peripheral Access Layer System Source File for GD32F1x
🗄 💠 GD32F1x0_StdPeripherals				
alidation Output		Description		
GigaDevice::Device:GD32F1x0_EVAL		Additional s	oftware con	nponents required
erequire Device:GD32F1x0_StdPeriph	erals:GPIC	) Select comp	onent from	list
GigaDevice::Device:GD32F1:	@_StdPeri	iphera General-pur	pose and Al	ternate-function I/Os (GPIO) driver for GD32F1x0 Devices
erequire Device:GD32F1x0_StdPeriph	erals:EXTI	Select comp	onent from	list
GigaDevice::Device:GD32F1:	0_StdPeri	phera External Inte	errupt/Event	(EXTI) driver for GD32F1x0 Devices
erequire Device:GD32F1x0_StdPeriph	erals:USA	RT Select comp	onent from	list
GigaDevice::Device:GD32F1:	0_StdPeri	iphera Universal Sy	nchronous A	Asynchronous Receiver Transmitter (USART) driver for GD32F1x0 Devices
erequire Device:GD32F1x0_StdPeriph	erals:SYS0	CFG Select comp	onent from	list
GigaDevice::Device:GD32F1:	0_StdPeri	iphera System Con	figuration (S	VSCFG) driver for GD32F1x0 Devices

As shown in figure 5-6, when there is no warning, click OK.



## Figure 5-6. Selection of components

oftware Component	Sel.	Variant	Version	Description
🚸 CMSIS				Cortex Microcontroller Software Interface Components
CORE	<b>v</b>		4.3.0	CMSIS-CORE for Cortex-M, SC000, and SC300
DSP			1.4.6	CMSIS-DSP Library for Cortex-M, SC000, and SC300
🗈 💠 RTOS (API)			1.0	CMSIS-RTOS API for Cortex-M, SC000, and SC300
💠 CMSIS Driver				Unified Device Drivers compliant to CMSIS-Driver Specifications
CMSIS Driver Validation		API	1.0.0	Run API test for enabled drivers
CMSIS RTOS Validation				CMSIS-RTOS Validation Suite
💠 Compiler				ARM Compiler Software Extensions
💠 Device				Startup, System Setup
GD32F1x0_Conf	<b>I</b>		2.0.0	Configuration file
GD32F1x0_EVAL	<b>I</b>		2.0.0	Firmware functions to manage Leds, Keys, COM ports
Startup	<b>I</b>		2.0.0	System Startup for GigaDevice GD32F1x0 Devices
System_GD32F1x0	<b>I</b>		2.0.0	Cortex-M3 Device Peripheral Access Layer System Source File for GD32F1x0 Devices
GD32F1x0_StdPeripherals				
ADC			2.0.0	Analog-to-digital converter (ADC) driver for GD32F1x0 Devices
CAN			2.0.0	Controller Area Network (CAN) driver for GD32F1x0 Devices
CEC			2.0.0	Consumer Electronics Control (CEC) driver for GD32F1x0 Devices
CMP			2.0.0	Comparator (CMP) driver for GD32F1x0 Devices
CRC			2.0.0	Cyclic Redundancy Check (CRC) driver for GD32F1x0 Devices
- OAC			2.0.0	Digital-to-analog converter (DAC) driver for GD32F1x0 Devices
DMA			2.0.0	Direct Memory Access (DMA) driver for GD32F1x0 Devices
exti			2.0.0	External Interrupt/Event (EXTI) driver for GD32F1x0 Devices
- FMC			2.0.0	Flash Memory Controller (FMC) driver for GD32F1x0 Devices
GPIO	<b>I</b>		2.0.0	General-purpose and Alternate-function I/Os (GPIO) driver for GD32F1x0 Devices
			2.0.0	Inter-integrated Circuit (I2C) driver for GD32F1x0 Devices
IVREF			2.0.0	Programmable Current and Voltage Reference (IVREF) driver for GD32F1x0 Devices
IWDG			2.0.0	Independent Watchdog (IWDG) driver for GD32F1x0 Devices
LCD			2.0.0	LCD Controller (LCD) driver for GD32F1x0 Devices
MCUDBG			2.0.0	MCU Debug (MCUDBG) driver for GD32F1x0 Devices
MISC			2.0.0	MISC driver for GD32F1x0 Devices
OPAMP			2.0.0	Operational Amplifiers (OPAMP) driver for GD32F1x0 Devices
✓ PWR			2.0.0	Power Control (PWR) driver for GD32F1x0 Devices
	<b>Z</b>		2.0.0	Reset and Clock Control (RCC) driver for GD32F1x0 Devices
🔷 RTC			2.0.0	Real-time Clock (RTC) driver for GD32F1x0 Devices
			2.0.0	Serial Peripheral Interface / Inter-IC Sound (SPI_I2S) driver for GD32F1x0 Devices
SYSCEG	<b>I</b>		2.0.0	System Configuration (SYSCFG) driver for GD32F1x0 Devices
TIMER			2.0.0	TIMER driver for GD32F1x0 Devices
TSI			2.0.0	Touch Sensing Interface (TSI) driver for GD32F1x0 Devices
USART			2.0.0	Universal Synchronous Asynchronous Receiver Transmitter (USART) driver for GD32F1x0 D
WWDG			2.0.0	Window Watchdog (WWDG) driver for GD32F1x0 Devices
lidation Output		Descrip	tion	

6. Add the source files, as shown in figure 5-7. In the new created project test, there is no need to add the header file include path, shown as figure 5-8.

Figure 5-7. Add source files





### Figure 5-8. Header file include path

rice   Target   Output   Listing   Vser	C/C++ Asm Linker Debug	Utilities
Preprocessor Symbols		
Define:		
Undefine:		
Language / Code Generation		
Execute-only Code	Strict ANSI C	<u>W</u> amings:
Optimization: Level 0 (-00) 🔻	Enum Container always int	All Warnings 🔹
Optimize <u>f</u> or Time	Plain Char is Signed	🗖 Thum <u>b</u> Mode
Split Load and Store Multiple	Read-Only Position Independent	No Auto Includes
✓ One <u>ELF</u> Section per Function	<u>R</u> ead-Write Position Independent	C99 Mode
Include		

7. Compile the project, the result is shown in figure 5-9. If there is any error, maybe you have added modules incompletely. Add the related modules according to the error, then compile the project again.

### Figure 5-9. Compling result



8. Select a debug tool, then you can download program or debug online.



6.

# How to turn to the related documents by Books Tab

Open the Keil5 project, switch to the Books Tab, as shown in figure 6-1. Click on the book you want to check to turn to the corresponding document or web page.

# Figure 6-1. Books Tab





# 7. How to check register status in Debug mode

Click the debug button to enter the Debug mode, Keil5 supports the use of a graphical interface to view all register status in real time.

Steps shown as below:

1. As shown in figure 7-1, click the System Viewer Windows button, select the register you want to observe. An example, to observe the DOR of GPIOC register.

### Figure 7-1. System Viewer Windows



2. The Periodic Windows Update in View menu is selected, then the corresponding registers will refresh periodically. You can observe changes of the IO ports status and other register status.

#### Figure 7-2. Register status window





# 8. How to open Keil4 project in Keil5

The information of devices, peripherals, tools, chains and others which called in Keil5 project are all included in Pack, but the call to related file path in Keil4 is different from Keil5, in this circumstance, it's necessary to do the compatible process and there are two methods to realize the process:

Method 1: Change the project property setting, this method is recommended.

Note: Once the project property setting is changed, it can't be opened and built in Keil4.

Method 2: Install GigaDevice patches Keil4\_GD32F1x0\_ADDON.exe to load related documents.

Note: The project property setting is not changed, it can still be opened and built in Keil4.

# 1.2. Compatible method 1

- 1. Using Keil5 to open a project created in Keil4.
- Select the Manage menu in the Project menu, click on the Migrate to Version 5 Format.. menu, as shown in figure 8-1, then a prompt information will pop out, as shown in figure 8-2.

# Figure 8-1. Change Project Property Setting



# Figure 8-2. Prompt Information

Migrate to Device Pack	×
Migration completed, Project saved as: Project.uvprojx	
Note: Target memory / Debugger setup may have been change check and update !	ed - please
	确定



 Click the OK button, then a CMSIS component will be added to the Project Tab, also the Build Output window will print the information to declare that Keil4 related support of project has been updated to Keil5 Pack support, as shown in figure 8-3.

Figure 8-3. Project after Compatibility



4. Compile the project.

**Note:** For versions of Keil v5.13 and Keil v5.14, after migrate to Version 5 format, it needs to enter RTE environment, to select the CORE in CMSIS components, as figure shows below,

Figure 8-4. Select CMSIS CORE

Software Component	Sel.	Variant	Version	0
Board Support		GD32150C-START	2.0.0	G
CMSIS				S
- CORE	12		4.3.0	2
- Ø DSP	E		1.4.6	2
🗉 💠 RTOS (API)			1.0	2
CMSIS Driver				U

Then compile the project.

# 1.3. Compatible method 2

 Download file Keil4\_GD32F1x0\_ADDON.exe on GigaDevice official website (http://gd32mcu.21ic.com/documents), as shown in figure 8-5. Install the executable file in Keil\_v5 installation directory, as shown in figure 8-6.

#### Figure 8-5. GD32F1x0\_ADDON executable File





### Figure 8-6. GD32F1x0\_ADDON installation

Setup GigaDevice GD32F1x0 Device AddOn Package to Keil MDK-ARM		
Folder Selection Select the folder where SETUP will install files.	ARM <sup>®</sup> KEIL <sup>®</sup> Microcontroller Tools	
This Add-On will install into the following product folder. To install to this folder, press 'Next'. To install to a different folder, press 'Browse' and select another folder.		
Destination Folder	Browse	
— Keil MDK-ARM Setup	<< Back Next >> Cancel	

 Using Keil5 to open a project created in Keil4. Select GigaDevice GD32F1x0 Devices in Option for the Target Device, then GigaDevice GD32F1x0 series product selection will be listed in the table, as shown in figure 8-7, select your required device.

### Figure 8-7. Product Series Selection

🕅 Options for Target 'GD32F170_190'		×
Device   Target   Output   Listing   User   C/C++   Asm   Linker   Debug   Utilities		
GigaDevice GD32F1x0 Devices	<b>•</b>	
Vendor: GigaDevice		
Device: GD32F190R8		
Toolset: ARM		
Search:		
GigaDevice       ▲         GD32F130C4       ▲         GD32F130C6       ↓         GD32F130C8       ↓         GD32F130C4       ↓         GD32F130C4       ↓         GD32F130C8       ↓         GD32F130C4       ↓         GD32F130C4       ↓         GD32F130G6       ↓         GD32F130G8       ↓         GD32F130G8       ↓         GD32F130R8       ↓         GD32F150C4       ▼	Core: ARM 32-bit Cortex-M3 Microcontroller, (72 MHz max) Memories: - 64 Kbytes of Rash memory - 8 Kbytes of SRAM with HW parity checking - CRC calculation unit - Calendar RTC with alam and periodic wakeup from Stop/Stand - Low power Sleep, Stop, and Standby modes - VBAT supply for RTC and backup registers - 7-channel DMA controller - 18 capacitive sensing channels - 1* 12-bit ADC (16-channel) <	by •
OK	Cancel Defaults He	lp

 Compile the project, there may be a lot of errors, as shown in figure 8-8. The cause is that path of core\_cmInstr.h is different in Keil5 and Keil4, so it is necessary to add the file path of core\_cmInstr.h to C/C++ in Option for Target, as shown in figure 8-9.

#### Figure 8-8. Compile Result Error

```
..\..\Firmware\CMSIS\core_cm3.h(147): error: $5: cannot open source input file "core_cmInstr.h": No such file or directory
finclude <core_cmInstr.h> /* Core Instruction Access */
...\Firmware\Pertpherals\src\gd32f1x0_fmc.c..
...\..\Firmware\CMSIS\core_cm3.h(147): error: $5: cannot open source input file "core_cmInstr.h": No such file or directory
finclude <core_cmInstr.h> /* Core Instruction Access */
...\.Firmware\Pertpherals\src\gd32f1x0_fmc.c: 0 warnings, 1 error
```



## Figure 8-9. Add File Path





# 9. Version history

# Table 9-1. Version history

Version number	Description	Date
1.0	Initial Release	Apr.6, 2016