

# **CMOSTEK**

# AN210

## CMT2380F16 OCD ICE User Guide

## **Overview**

This document provides the user guide for CMT2380F16 OCD debugger. Employed a 8051 core, the CMT2380F16 is a high performance transceiver integrated wireless MCU. The product is part of the CMOSTEK NextGenRF<sup>™</sup> product family which covers a complete product line consisting of transmitters, receivers, transceiver, etc. suitable for short-range wireless communication applications.

The product models covered in this document are shown in the below table.

Product Model	Frequency Range	Modulation Type	Tx Power	Sensitivity	Chip Properties	Packaging
CMT2380F16	127 - 1020 MHz	OOK/(G)FSK	+20 dBm	-120 dBm	Wireless MCU	QFN48

#### Table1. Product Models Covered in This Document

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## **1** Introduction

### 1.1 Features

- Support of OCD (On-Chip-Debug) function
- Built-in real-time debugging circuit in the 8051 core of the CMT2380F16
- Dedicated 2-pin serial interface for OCD, no system pin occupied
- Being compatible with Keil debug and simulation IDE interface for 8051
- Connecting to host PC via USB
- Supports of debug functions such as reset, full speed run, stop, step run, etc.
- Programmable breakpoints, up to 4 breakpoints can be inserted simultaneously
- Powerful debug windows such as register window, disassembly window, variable watch window and memory watch window

window.

## 1.2 Description

The OCD ICE for CMT2380F16 is a powerful development tool providing built-in real-time debug functions through using the on-chip-debug technique. Users perform development and debug directly in OCD ICE with no need for development boards or extra adapters as required in the traditional 8051 ICE. Users just need to reserve a 5-pin connector (VCC, OCD\_SDA, OCD\_SCL, RST and GND) used by the dedicated OCD interface:

Moreover, it offers direct access to Keil 8051 IDE software UI for user program debug with the utilization of the dScope-Debugger of Keil IDE, gaining full Keil IDE advantages.

#### Notes:

1. Keil is the trade mark of *Keil Elektronik Gmbh and Keil Software, Inc.*, and Keil 8051 IDE software is popular software used in embedded system development.

## 2 Hardware Setup

When debugging, users need to connect the target system to a PC via the ICE adapter, as shown in the below figure. The ICE adapter is a bus-powered USB device with no need for power adapter.



Pin numbers of the OCD ICE interface are as follows.

#### Table 2. Pin Numbers of OCD ICE Interface

Product Model	Package	OCD_SCL	OCD_SDA	RST
CMT2380F16	QFN-48	10	11	38

C

## 3 Software Setup

This chapter discusses the software settings before using the OCD ICE.

### 3.1 Driver Installation for ICE Adapter

Plug-in the ICE adapter into any USB port of a host PC directly with no need for driver installation.

## 3.2 Add CMT2380F16 Chip Information in Keil 8051 IDE

Plug-in the ICE adapter into the USB port of a host computer then execute *Setup.exe* in the folder *Database Installer* to add the chip information of CMT2380F16 into the Keil 8051 IDE µVision2, µVision3 or µVision4.

In the Database Installer window, perform Add operation following the steps as below.

Step 1, click Browse button to specify the Keil installation folder (default as C:\KEIL) in the target PC.

Step 2, click Install button to start installing the CMT2380F16 chip information into the Keil software.

The installation procedure is shown in the below figure.

ACMOSTEK 8051 Database Installer	×
Where has the µVision been installed?	Install Uninstall Exit
Database Installer	
确定	]

**Figure 2. Installation Procedure** 

## 4 Keil IDE Setup

Before using the dScope-Debugger function of Keil IDE, users need to have some related settings. Open the µVision project to be debugged, right click the button inside the red circle in the below figure, then click the *Target Options* menu as shown in the below figure.



Figure 3. Keil IDE Setup

## 4.1 Device Settings

In the Device tab, select CMOSTEK Device Database and the target product model as shown in the below figure.



Figure 4. Device Settings

### 4.2 Target Settings

Tick on Use on-chip ROM and Use on-chip XRAM as shown in the below figure.

ſ	V Options for Target 'Target 1'
	Device Target Output Listing User   C51   A51   BL51 Locate   BL51 Misc   Debug   Utilities
	CMOSTEK CMT2380F16 Enable
	Memory Model:     Small: variables in DATA       Code Rom Size:     Large: 64K program
	Operating system: None
$\bigcirc$	Off-chip Code memory           Start:         Size:         Off-chip Xdata memory           Eprom          Ram
	Eprom Ram Ram Ram
	Code Banking Start: End: Banks: Banks: Banks: Banks: Banks: Code Banking Banks: Code Bank
	OK Cancel Defaults Help

#### Figure 5. Target Settings

## 4.3 Output Settings

Tick on *Debug Information* as shown in the below figure to make sure an OMF file (Object Module Format) for source-level debugging being generated for ICE debug.

V Options for Target 'Target 1'	
Device   Target Output Listing   User   C51   A51   BL51 Locate   BL51 Misc   Debug   Utilities	
Select Folder for Objects Name of Executable: CMT2380F16_8bit_PWM	
Crgate Executable: .\Objects\CMT2380F16_8bit_PWM	
✓         Debug Information           ✓         Browse Information	
Create HEX File HEX-80	
C Create Library: .\Objects\CMT2380F16_8bit_PWM.LIB	
UK Lancel Defaults help	

Figure 6. Output Settings

## 4.4 C51 Settings

Disable the code optimization by selecting 0: Constant folding in textbox Level. Refer to Chapter 6.3 for more details.

Notes:

1. This setting is optional.

Options for     Device Targe     Preprocesso     Define:     Undefine:     Code Optimiz     Level:     Emphasis:     Include     Paths     Misc     Controls     Compiler     control     string	Target 'Target 1'         t       Output Listing User       C51       A51       BL51 Locate       BL51 Misc       Debug       Utilities         r Symbols	3
	OK Cancel Defaults Help	

Figure 7. C51 Settings

## 4.5 Debug Settings

Select On-Chip-Debug Drive and tick on Load Application at Startup as well as all the cache option related parameters as shown in the red rectangle in the below figure.

Options for Target 'Target 1'         Device   Target   Output   Listing   User   C51           C Use Simulator         Settings         Limit Speed to Real-Time         select OCD         V Load Application at Statup	A51 BL51 Locate BL51 Misc Debug Utilities Use CMOSTEK On-Chip-Debug Driv Settings Keil Monitor-51 Driver Keil ISD51 In-System Debugger WON390: Dallas Contiguous Mode main()
Initialization File: Restore Debug Session Settings Breakpoints Toolbox Watch Windows & Performance Analyzer Memory Display	Initializatic ST-u-PS0 Er M Emblator/ Programmer Infineon XC800 ULINK Driver ADI Monitor Driver Infineon DAS Client for XC800 NXP LPC95x ULINK Driver Infineon SP4x Target Driver Infineon SP4x Target Driver Infineon SP4x Target Driver Infineon SP4x Target Driver
CPU DLL: Parameter: S8051.DLL	Driver DI S8051.0 Cache Data Cache Xdata Cache Code
Dialog DLL: Parameter: DP51.DLL p54 OK Ca	Dialog D Enabled CMOST OK Cancel

Figure 8. Debug Settings

### 4.6 Utilities Settings

Always tick off *Update Target before Debugging* as *Load Application at Startup* has been ticked on as shown in Figure 8 in Chapter 4.5. The driver displayed in *Use Target Driver for Flash Programming* may be different from *Silicon Laboratories C8051Fxxx uVision* due to users' installation of different drivers. Users can select any item in the drop-down list of *Use Target Driver for Flash Programming or* just leave it empty.

Notes:

1. These settings are not applicable to  $\mu$ Vision2.

ce   Target   Output   Lis	ting   User   C51	A51 BL51	Locate   BL51 Misc   leed to set)	Debug Utilit:
onfigure Flash Menu Comman	d			!!Disable
Use Target Driver for Flash	rogramming 📕	Settings	Use Debug Driver	re Debugging
Init File:	······	Joettings	Edit	Sie Debugging
C Use External Tool for Flash	n Programming			
Command:				
Arguments:				
🗖 Run Indepe	ndent			
Run Indepe onfigure Image File Processin Dutput File:	ndent g (FCARM):	Add Output F	le to Group:	
Run Indepe onfigure Image File Processin Output File:	ndent g (FCARM):	Add Output F	le to Group:	
Run Indepe onfigure Image File Processin Output File: mage Files Root Folder:	ndent g (FCARM):	Add Output F	le to Group: 5 1 Generate Listing	<b>_</b>

## 5 Start Debug

Users can start debug in  $\mu$ Vision after the settings in chapter 2, 3 and 4 complete.

## 5.1 Start dScope-Debugger Function

After completing project settings successfully, click *dScope* button to access the Keil IDE debug mode. When clicking *dScope* button, the user program will be downloaded into the CMT2380F16 as shown in the below figure, which will take some time.

![](_page_10_Figure_5.jpeg)

Figure 10. Start dScope-Debugger Function

## 5.2 Debug Environment Introduction

Generally 4 basic windows are used in the debug environment including register window, disassembly window, variable watch window and memory watch window, which are described as follows.

Register window

This window shows the current register values (R0~R7), the system register values (A, B, SP, DTPR and the Program Counter) and the program status word (PSW). The blue background display of a register represents the register value now being changed by the instruction executed currently.

Disassembly window

This window is opened by default when users accessing the debug mode. It shows the corresponding assembly code of the current program.

• Variable watch window

When *Locals* tab is selected, the window shows the local variables declared in the main() function. As for global variables, click Watch #1 or Watch #2, press <F2> key, then enter the variable name to view them. The blue background display of a variable represents the variable value now being changed by the instruction executed currently.

• Memory watch window

This window shows the contents in the memory located in the data/idata/xdata/code memory space. The available commands includes d:0x00~d:0xFF, i:0x00~i:0xFF, x:0x0000~x:0xFFFF and c:0x0000~c:0xFFFF. Users can view contents of any of these 4 types of memory spaces by entering the corresponding command.

🏆 test - 猩ision3 - [Disassembly]		
🕵 Eile Edit View Project Debug Flash Per	pherals Iools SVCS Window Help	_ B ×
🎦 😂 🖬 🗿 👗 🖻 🛍 🏼 으 오 ( 建 建 )	الله الله الله الله الله الله الله ال	
👫 🖹 😫 🔭 🔂 🖓 🖓 🖓	W 🕊 🖻 E 📟 🖪 🗡	
Project Workspace 🔺 🗙	31: void main(void)	
Register Value	32: { Disass	embly
	33: char L_var1,L_var2,L_var3; //local variables Windo	w
r0 0x00	34: int L_var4,L_var5; //	
-r1 0x00	36: char xdata X yar1.X yar2: //local yariables. in 'xdata' me	morv spa
-r2 0x00	37:	mory ope
r3 0x00 Register	38: LED_blinking();	
r4 <sup>0x00</sup> Window	39:	
-r5 0x00	40. I usp1=0vEA.	
rb UxUU	40: L_Vari=0x5A; C·Ov02F2 75085A MOV Ov08 #0v5A	
	41: L_var2=0x5B;	
	C:0x02F5 75095B MOV 0x09,#0x5B	
-b 0x00	42: L_var3=0x5C;	
sp 0x13	C:UXU2F8 75UA5C MOV UXUA,#UX5C	
dptr 0x0000	43: L_Var4=0x1234; C.Ox02FB 750B12 MOV 0x0B #0x12	
PC \$ 0x02ef	C:0x02FE 750C34 MOV 0x0C,#0x34	
	44: L_var5=0x5678;	
🖹 Files 🛛 Regs 🔑 B 😽 Fu 🔍 Te	45.	>
Symbols * ×	Main.C 🖳 Disasse	
* Load "C:\\tmp\\test\\test"	X Name Value Address: X-0x0000	
' WS 1, `G_var1		
WS 1, 'G_var2	L_var2 0x00 X:0x000000; BB 71 7	7 FD
	L_var3 Watch 0x00 X:0x0000000. DD Memory 9F 0	19 14
	L_var4 Window 0x0000 X:0x000018: D2 Window 1D 3	31 C7
	L_var5 0x0000 X:0x000020: F6 EA A	vA 5B
op >	X_var1 0x00 X:0x000028: CD 19 39 CF F7 1B F	'9 49
ASM ASSIGN BreakDisable	X_var2 0x00 X: UXUUUU3U: D7 AB D4 65 7F DB 7	
	Watch #1 Watch #1 Watch #1 Watch #1 Watch #1 Memory #1 Memory #2	Memory 4
Ready	Megawin On-Chip-Debug Driver tl: 0.00000000 sec	R/W

Figure 11. Debug Environment

### 5.2.1 Reset, Run, Stop, Step and Run-to-Cursor

Reset, Run, Stop, Step and Run-to-Cursor are the basic debug actions. Users can run these actions by clicking the short-cut buttons in the debugger GUI as shown in the below figure.

<mark>W</mark> test - 猩isi	on3 - [Disassembly		- 7 🗙
😫 Eile Edit 1	<u>L</u> iew <u>P</u> roject <u>D</u> ebug	Flash Peripherals Iools SVCS Window Help	_ & ×
12 😂 🖬 🍘	X 🖪 🖻 🗅 으	拝拝 ⊿ % % % % ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●	
RST 📃 🛛 🖓	) (}+ (}+ *() ⇒ ≝≛		
Register	Reset/Run/S 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x	<pre>typic typic type: typ: typ: typ: typ: typ: typ: typic typic type: typic typic type: typic type: t</pre>	
IO F7 Sys a b sp −b sp −b r7 PC \$ ®−psw	0x00 0x00 0x00 0x8f 0x0000 0x02ef 0x00	<pre></pre>	~
Ē	🕼   🍕 F   👼 T	Main.C R Disasse	

Figure 12. Debug Actions

#### 5.2.2 Source-Level Debug

Open the source file in *Files* tab to perform the source-level debug and return to the register window by clicking *Regs* tab if needed, as shown in Figure 12.

#### 5.2.3 Breakpoint Settings

It supports setting up to 4 breakpoints simultaneously during debugging.

#### • Insert/remove breakpoint

Move the cursor to an instruction line where users need have breakpoint operation, right click then select *Insert/Remove Breakpoint* to insert or remove the breakpoint as shown in the below figure.

![](_page_12_Figure_7.jpeg)

Figure 13. Insert/Remove Breakpoint

#### • Enable/disable breakpoint

Move the cursor to an instruction line, right click and then select *Enable/Disable Breakpoint* to enable or disable the breakpoint if this line already has a breakpoint inserted previously.

🏆 test - 猩ision3 - [C:\t	tmp\test\Main.	C]					Ð	×
Eile Edit View Projec	t <u>D</u> ebug Fl <u>a</u> sh	Peripherals	Iools SVCS Window Help			_	8	×
1 🖆 😂 🖬 🕼 👗 🛍 🛍	120 #	∉ <b>∧</b> % %	z 16 🙀		2	<u>U</u> ndo Pada		
👫 🗄 🔕 🔁 🖓 🖓	}   \$ ₩\$ 0\$	Q 💭 🏹 🖁	s 🔲 🗄 🔤 📭 🥕				_	
Project Workspace           Register         Value	× x	042 uns 043 044 045	igned char i; //LED_blinking(); L war1=0x5A:		х Ра П	Cut <b>Copy</b> Paste		-
r1 0v00 -r2 Right -r3 - -r4 0x00 -r5 0x00 -r6 0x00	t clicking	047 ] 048 ] 049 ] 050 ] 051 052 ] 053 ]	L_var2=0x5B; L_var3=0x5C; L_var4=0x1234; L_var5=0x5678; L_var5=0x38; //! Note: L_var1=0x28; //! Note:	this statement may		Select All Show Disassembly at 0xFF0002FE Set Program Counter Insert '#include <reg_mpc82g516.h>'</reg_mpc82g516.h>		
□-Sys □-a 0x00		054 055 3 056 3	X_var1=0xÅ1; X_var2=0xÅ2;		7{}	Run to Cursor line		
b 0x00 sp 0x8f dptr 0x0000 PC \$ 0x02ef		058 0 059 0 060 0 061 1	G_var1=0x98; G_var2=0xABCD; L_var1=G_var1;		0	Go To Line Insert/Remove Breakpoint Enable/Disable Breakpoint		
B B Q O		062 ) 063 064 1	X_var1=(char)&_var2; for(i=0;i<16;i++) & ar:	ray1fi]=i+0x60;		Clear complete Code Coverage Info Outlining Advanced	Ŀ	•

#### Figure 14. Enable/disable Breakpoint

#### 5.2.4 View/Edit Contents of Peripheral Registers

Peripherals' registers cannot be viewed in the register window. They can be viewed by selecting a specific peripheral item and ticking on the registers for view in the sub-menu as shown in the below window.

₩ test - 猩ision3 - [C:\tmp\test\Main.	C]	(Interrupt)
Eile Edit View Project Debug Flash	Peripherals Tools SVCS Window Help	
[웹 🗲 🖬 🕼 👗 🐚 🖻 의 오의 (幸)	Rst Reset CPU	<b></b>
👫 🗉 🛛 🔁 🖓 🖓 🖓	Pli Ox FF	POMO: 0x 00 POM1: 0x 00
Project Workspace v x	✓ I/O Ports	
Register Value	✓ Timer P2: 0x FF	P2M0: 0x  00 P2M1: 0x  00
- Kegs	Serial Port P3: 0x FF	P3M0: 0x 00 P3M1: 0x 00
-r1 0x00	A/D Converter ar2,L_var3; //local	
-r2 0x00	Keypad Interrupt	14MO. OX   *** P4MII: OX   **
-r3 0x00	SPI r1,X_var2; //local variables, in xda	ta memory nonini ox oo
-r4 0x00	PCA ():	TCON: 0x 00
-r5 0x00	XRAM	
-ro 0x00	Others Timer/	Counter
E-Svs	ISP	
Select any peripheral you	Target Settings 4 ; TMC	D: 0x 00 TCON: 0x 00
want to check or edit	044 <u>b_varb=oxboro</u> ; These peripherals have been <sub>T2M</sub>	IOD: 0x 00 T2CON: 0x 00
	046 L_var1=0x38; //! opened for checking	P2H: 0. 00 PCAP2L: 0. 00
- dptr 0x0000	047 L_var1=0x07;	
FC & UXUZEI	049 X_var1=0xA1;	= 0x  00  TL0: 0x  00
⊡ psw 0x00	050 X_var2=0xA2; TH1	: 0x 00 TL1: 0x 00
	TH2	: 0x 00 TL2 0x 00
	- Manie	
* Load "C:\\tmp\\test\\test"	Address: x:0	x0000
WS 1, G_var1	L_var1 0x00 X:0x00000	: 00 00 DE E0 6B 71 77 ED
10 1, <u>0_</u> 012	L_var2 0x00 X:0x000008	: BB 1A 3C D7 AE 73 5C 38
	L_var4 0x0000 X:0x00010	: DC E7 39 B5 F6 9F C9 14
3	-L var5 0x0000 X:0x000018	: D2 ED AF EF FA ID 31 C7 : F6 4F 30 DE 8E EA AA 5B
<sup>8</sup> P →		: CD 19 39 CF F7 1B F9 49
ASM ASSIGN BreakDisable	▼ <u><u>v</u> −X_var2 0x00 X:0x000030</u>	: D7 AB D4 65 7F DB 77 B7
	Kernel And	Memory #1 / Memory #2 / Memory
	Megawin On-Chip-Debug Driver t1: 0.00000000 sec L:40 (	C:37 R/W

Figure 15. View/Edit the Contents of Peripheral Registers

#### 5.2.5 View Disassembly Window

Disassembly window displays the corresponding assembly code of the source-level code. To open this window, select *View* in the main menu, then select *Disassembly Window* in its sub-menu as shown in the below figure.

📅 test – 猩ision3	
Eile Edit View Project Debug Flash Peripherals	Tools SVCS Window Help
音 🔓 🖃 🗹 Status Bar	浅苑 隣
File Toolbar	
Project Worksp V Debug Toolbar	
Register	🕐 Disassembly
E-Reg	31: void main(void)
TI Dutput Window	32: { 33: char I var1 I var2 I var3: //local variables Window
r2 I Source Browser	34: int L_var4,L_var5; //
r4 Disassembly Window	35: 36: char xdata X var1.X var2: //local variables, in 'xdata' me
-r5 🔛 Watch & Call Stack Window	37:
r6 Memory Window	38: LED_DIINKING(); 39:
Sys Code Coverage Window	⇒C:0x02EF 120357 LCALL LED_blinking(C:0357)
a Ferformance Analyzer Window	C:0x02F2 75085A MOV 0x08,#0x5A
sp III Symbol Window	41: L_var2=0x5B; C:0x02F5 75095B MOV 0x09.#0x5B
dptr 😹 Serial Window #1	42: L_var3=0x5C;
PC 😹 Serial Window #2	43: L var4=0x1234;
Serial Window #2	C:0x02FB 750B12 MOV 0x0B,#0x12
Loolbox	44: L_var5=0x5678;
Periodic Window Update	45:
Include File Dependencies	
🖹 - 📃 🛄 - 👎 🖓 📔 🤗 Disasse	

![](_page_14_Figure_2.jpeg)

The maximized *Disassembly* window is shown in the below figure.

![](_page_14_Figure_4.jpeg)

Figure 17. Maximized Disassembly Window

#### 5.2.6 View Watch Window

The watch window helps users to check either local variables or global variables as shown in the below figure.

test - 猩ision3 - [Disassembly]	
▼ test       → Hision 3 - [Disassembly]         ● Eile Edit View Project Debug Flash Peripher:         ● Eile Edit View Project Debug Flash Peripher:         ● Eile Edit View Project Debug Flash Peripher:         ● Eile Toolbar         Build Toolbar         Project Window         −r1         ● Conce Browser         −r3         −r4         ● Disassembly Window         −r5         ← Conce Browser         −r3         ● Memory Window         −r5         ← Concarage Window         −r6         ● Memory Window         −r5         ← Concarage Window         −r6         ● Sys         ● Sysmold Window	LED_blinking(); 38: LED_blinking(); 38: LED_blinking(); 39: LED_blinking(); 30: Char xdata X_var1,X_var2; //local variables, in 'xdata' memory spa 37: LED_blinking(); 38: LED_blinking(); 38: LED_blinking(); 38: LED_blinking(); 39: LED_blinking(); 39: LED_blinking(); 39: LED_blinking(); 30:
→ dpt → Serial Window #1 → Files → Serial Window #2 → Serial Window #2 → Icolbox	0x02FB 750B12 MOV 0x0B,#0x12 0x02FE 750C34 MOV 0x0C,#0x34 44: L_var5=0x5678; 45:
Mask: *	Main.C R Disasse
Version Contract Cont	Name         Value           Image:
ASM ASSIGN BreakDisable	L_var3       0x00         L_var3       0x00         L_var3       0x00         L_var4       0x0000         L_var5       0x000         X_var1       0x00         X_var2       0x00         L_var5       0x000         X_var2       0x00         K       0x004C98: FF CD         K       K         K       K         K       K         K       K         K       K         K       K         K       K         K       K         K       K

Figure 18. View Watch Window

To check global variables, click *Watch #1* or *#2*, then press <F2> key to enter the variable name.

Project Workspace - × Register Value	024 void test_SFR(void); 025 void reset_SFR(void);
Register     value       → Regs	010       For for for the formal formation of the formal
<pre>* Load "C:\\tmp\\test\\test\ 'WS 1, 'G_var1 WS 1, 'G_var2 &gt; ASM ASSIGN BreakDisable if 4 &gt; NAcc 4</pre>	Name         Value         Address:         x:0x0000           G var2         0x000         X:0x00000:         00 00 DF E0 6B 71 77 FD           G var2         0x0000         X:0x000008:         BB 1A 3C D7 AE 73 5C 38 <ul> <li>(type F2 to edit)</li> </ul> Press <f2> key to enter global variable name         0x000020:         F6 4F 30 DE 8E EA AA 5E           0x000018:         D2 ED AF EF FA 1D 31 C7         0x000020:         F6 4F 30 DE 8E EA AA 5E           0x000020:         D7 AB D4 65 7F DB 77 BF 74 BF 94 90         0x000030:         D7 AB D4 65 7F DB 77 BF 72 BF 77 BF 77</f2>

Figure 19. View Global Variables

#### 5.2.7 View Memory Window

To open this window, select *View* item in the main menu then select *Memory Window* in its sub-menu. The available commands are as follows.

d:0x00~d:0xFF is for data type memory view.

i:0x00~i:0xFF is for idata type memory view

x:0x0000~x:0xFFFF is for xdata type memory view

c:0x0000~c:0xFFFF is for code type memory view

Users can view the memory content of any of these 4 types by entering the corresponding command. Refer to Chapter 7.2 for more details of xdata type memory view.

![](_page_16_Picture_8.jpeg)

Figure 20. View Memory Window

## 6 ICP Tools

## 6.1 Introduction

ICP (In-Circuit Programming) is a tool allowing users to update user programs and modify hardware settings without removing a chip from the product, through using ICP software and ICE adapters. As user programs can be saved in non-volatile memory, it supports offline programming through the ICE adapter, with no need for PC connecting, suitable for cases without a computer.

### 6.2 ICP Usage

To open the ICP software, users need to go to the Keil installation folder \C51\INC\Cmostek\ and execute ICPProgrammer.exe.

Notes:

1. Please open the project and build it first, then ICP software can run correctly.

#### 6.2.1 Download Program to ICE Adapter

#### Step 1, select MCU model

This step can be skipped if users open ICP software by clicking on the toolbar. The ICP software will apply the model used in the project automatically in this case.

I CMOSTEK 8051 ICP 编程器 (v3.10A FW = v2.20)	hading water		
CMOST	ГЕК		
「編程器接口 C ISP C ICP CMT2380F16 ▼ C 否 C 是	载入文件	更新目标芯片	
	保存项目*.MPJ	设置脱机模式	
C User Define Address : 0x © Whole-chip	退出	插入ISP代码	
硬件选项设置 ISP存储区域 设置: None 以因: IAP存储区域 设置: 1.5 K ▼ IAP低边 3A00h 代码缓冲区	☐ HWBS ☐ LOCK ☐ HWBS2 ☐ BOIREO ☐ BOIREO ☐ WRENO	☐ HWENW NSWDT WDSFWP □ □	

#### Figure 21. Select MCU Model

Step 2, click *load file* (as shown in the red rectangle in the below figure), select to load *AP file* or *IAP file*. Users can reload a file by repeating load file if needed. Please input file path when loading an IAP file. It supports HEX and BIN file formats.

If users click on the toolbar to open the ICP software, step 1 can be skipped as the ICP software will load the program used in the project automatically.

CMOSTEK 8051 ICP 编程器 (v3.10A FW = v2.20)     CMOSTEK 8051 ICP 编程器 (v3.10A FW = v2.20)     GMOSTEK 8051 ICP 编程 (v3.10A FW = v2.20)     GMOSTEK 8051 ICP mostek 8051 ICP moste	■	E E X 更新目标芯片 设置脱机模式 描入ISP代码 HWENW NSWDT WDSFWP	
C IAP (数据) 位址: 0x 3600 OK Cancel		「 自动重新载入数据	

## Figure 22. Load File

Step 3, click *Insert ISP Code* (as shown in the red rectangle in the below figure) to insert the ISP code provided by *Shengquan* or user-defined ISP code.

If users do not need to use the ISP function, skip step 3.

	IIII CMOSTEK 8051 ICP 编程器 (v3.10A FW = v2.20)	
	「編程器接口 単片机型号 更新硬件选项 載入文件 載入文件	更新目标芯片
	「编程区域 保存项目*.MP	y 设置脱机模式
	○ User Define Address : 0x	插入ISP代码
5	硬件选项设置 ISP存储区域 设置:None 插入ISP代码	HWENW NSWDT WDSFWP
	IAP存储区域     ○ 泽太微提供的ISP代码       设置: 1.5 K     IAP低边       ○ 用户自定义的ISP代码	
		<u></u>

Figure 23. Insert ISP Code

Step 4, hardware settings.

[編] CMOSTEK 8051 ICP 编程器 (v3.10A FW = v2.20)	March Andrew	×	
CMOST	EK		
编程器接口     単片机型号     更新硬件选项       C ISP © ICP     CMT2380F16     ▼     C 否 © 是	载入文件	更新目标芯片	
│└────────────────────────────────────	保存项目*.MPJ	设置脱机模式	
C User Define Address : 0x	退出	插入ISP代码	
硬件选项设置 ISP存储区域 设置:None IAP存储区域 设置:1.5 K ▼ IAP低边 3A00h	☐ HWBS ☐ LOCK ☐ HWBS2 ☐ BO0REO ☐ BO1REO ☐ WRENO		

Figure 24. Hardware Settings

Step 5, click set offline mode to download the data into the ICE adapter.

Please be noted that *set offline mode* (as shown in the red rectangle in the below figure) function can be used only when the ICE adapter is connected.

CMOSTEK 8051 IC	P 编程器 (v3.10A FW	= v2.20)	and success	×
	CN	ΛΟΣΤ	ΈK	
「编程器接口 ○ ISP ⓒ ICP	单片机型号 CMT2380F16	■ 更新硬件选项	载入文件	更新目标芯片
└			保存项目*.MPJ	设置脱机模式
O User Define	Address:0x	Whole-chip	退出	插入ISP代码
健件选项设置 ISP存储区域 设置:None IAP存储区域 设置:1.5 K ▼	▼ IAP低边 <sup>3A00h</sup>	HWENW HWWIDL T HWPSx F/256 -	HWBS LOCK HWBS2 BO0REO B01REO WRENO	HWENW NSWDT WDSFWP

Figure 25. Set Offline Mode

#### 6.2.2 Update Target Chip

The methods to update target chips are as follows.

Method 1, refer to step 1 to step 4 of *Download Program to ICE Adapter* in chapter 6.2.1, and click *update target chip* for online update.

Method 2, refer to Download Program to ICE Adapter in chapter 6.2.1, press download key on the ICE adapter for offline update.

## **7** Special Considerations

## 7.1 Register Definition Files

Register definition files *REG\_CMT2380F16.INC* and *REG\_CMT2380F16.H* define all Special Function Registers (SFRs) and bit-addressable control/status bits. They are installed in the default path of the Keil 8051 IDE software during the OCD ICE installation (see Chapter 2 for more details). Therefore, when using Keil for programming, users can include the register definition files by \$INCLUDE (REG\_ CMT2380F16.INC) or #include <REG\_ CMT2380F16.H> with no need for copying the register definition files into users' project folders.

### 7.2 On-chip XRAM and External Data Memory

The CMT2380F16 provides on-chip XRAM (eXpanded RAM), which is accessed in the same way as the traditional external data memory. The size of on-chip XRAM in CMT2380F16 is 1024 bytes with an address range of 0x0000 to 0x03FF, which overlaps that of the external data memory. So, there must be a control bit applied to distinguish these two physical memories during access. The ERAM bit (bit-1 in register AUXR) plays this role. As the C51 compiler will not take care which physical memory a user wants to access, the user must manually clear this bit before accessing on-chip XRAM and set this bit before accessing external data memory. By default, this control bit is 0 after power on or chip reset for on-chip XRAM accessing.

The C51 compiler offers two different memory types for accessing external data: xdata and pdata (the xdata memory can locate the 64 kbyte external data memory while the pdata can locate the 256 bits data only). To view xdata or pdata directly in the Memory Window rather than in the Watch Window, users need to click XRAM in *Peripherals* menu then tick on *Display xdata from on-chip XRAM* or *Display xdata from external RAM* in the sub-window popped up, as shown in the following figure.

🕎 test - 猩ision3 - [C:\tmp\test\Main	.g 🔲 🗖 🔁 🔀
■ Ele Edit View Broject Debug Flas         ■ □ □ □         ■ □ □         ■ □         □	I Penipherals Iools SVCS Window Help
Register         Value           □         Regs           10         0x00           -r1         0x00           -r2         0x00           -r3         0x00           -r5         0x00           -r5         0x00           -r5         0x00           -r5         0x00           -r6         0x00           -r7         0x00           -r8         0x00           -r9         0x8f           -dptr         0x000           -PC \$         0x00	Imer         Serial Port         AD Converter         Ata 6_array1[16] _at_ 0x60; //in 'data' space         AD Converter         Add Garray2[16] _at_ 0x80; //in 'data' space         Yari         SP1         PCA         Variables         vari, L, var2, L, var3;         var4, L, var2, //in         Variables         var4, L, var2, //in         Others         Unsigned char i;         Odd         LED_blinking();         Odd         Le_blinking();         Odd         U         Le_blinking();         Odd         U         Later of the star source of 'xdata'.         On-chip XRAM, or external RAM.
Load "C:\\tmp\\test\\te \ WS 1, `G_var1 WS 1, `G_var2	Image: Constraint of the system         View 'xdata'           Image: Constrest of the system         View 'xdata' </td
	Mercawin On -Chin-Debug Driver 11-0 0000000 sec L-54 C-41

Figure 26. View Xdata or Pdata in Memory Window

The following example code shows how to use both on-chip XRAM and external memory in an application. Select *Display xdata from on-chip XRAM* to view G\_array1[], and select *Display xdata from external RAM* to view G\_array2[].

An example of using both on-chip XRAM and external RAM are as follows.

unsigned char xdata G\_array1[512] \_at\_ 0x0000; // in 'xdata' space, will use on-chip XRAM unsigned char xdata G\_array2[512] \_at\_ 0x0000; // in 'xdata' space, will use ext. RAM unsigned int i;

```
      AUXR&=0xFD;
      //clear AUXR.1 for on-chip XRAM

      for (i=0; i<512; i++)</td>
      // fill XRAM with 0x5A

      G_array1[i]=0x5A;
      // fill XRAM with 0x5A

      AUXR|=0x02;
      //set AUXR.1 for external RAM

      for (i=0; i<512; i++)</td>
      // fill ext. RAM with 0xA5
```

Please be noted that the linking warning listed below can be ignored. Although we intentionally define G\_array1 and G\_array2 in the same address space, the ERAM bit is applied to control switching between the different physical memory.

linking... \*\*\* WARNING L6: XDATA SPACE MEMORY OVERLAP FROM: 0000H TO: 01FFH

#### Figure 27. Linking Warning

### 7.3 Code Optimization and Source-Level Debug

As shown in the following source code, the C51 compiler will not generate any machine code for L\_var1=0x38 as it is followed by L\_var1=0xC7, which makes it a meaningless instruction. Due to code optimization, L\_var1=0x38 will be optimized out (ignored) unless the code optimization is disabled as described in Chapter 4.4.

unsigned char L\_var1;

L\_var1=0x38; //! Note: this statement may be optimized out by the C51 compiler L\_var1=0xC7;

It should be noticed that, during source-level debug, when executing this instruction, L\_var1 will not show 0x38 but a random number since there is no machine code for this instruction actually.

As users may disable the compiler's code optimization for debug purpose sometimes, it should be noted that once the compiler's code optimization is disabled, there may be some linking errors which won't occur when the code optimization is enabled. For example, the below linking error message indicates the variables exceeding the MCU memory range. To make this error disappear, users need to enable the compiler's code optimization to let the compiler make more efficient use of the memory.

linking...
\*\*\* ERROR L107: ADDRESS SPACE OVERFLOW
 SPACE: DATA
 SEGMENT: ?DT?\_VP\_DISPLAYMODE?VP
 LENGTH: 0001H

#### Figure 28. Linking Error

### 7.4 Source-Level Debug per For-loop

The following two instruction sets are exactly the same for the 8051 CPU to execute them. When performing step run in source-level debug, the first instruction set will not encounter problem, however running the second instruction set will take much long time, which may be caused by uncertain processing in the Keil debugger on such instructions. So, for step run, it is recommended to use the first instruction set instead of the second one before we get the clarification from Keil. Another way for debugging the second instruction set is, moving the cursor to line 2 and clicking *Run-to-Cursor* button to skip line 1.

```
Instruction 1:

Line1: for (i=0; i<16; i++)

{

Line2: G_array1[i]=i+0x60;

Line3: }

Instruction 2:

Line1: for (i=0; i<16; i++)

G_array1[i]=i+0x60;

Line2: ...

Line3: ...
```

## 7.5 Hardware Requirements for Debug

There are two hardware requirements regarding to the dScope-Debugger mode.

• Requirement 1, the debugged chip must be in un-locked state

If a debugged chip is locked, the downloading of the user's application program in the dScope- Debugger mode will cause the chip to be erased, thus all the chip's hardware settings will be disabled, resulting in abnormal behaviors of the chip due to loss of original hardware settings. For example, for a locked chip with IAP configured, after accessing the dScope-Debugger and downloading the user's application program, its IAP setting will disappear, which may cause abnormal behaviors of the chip.

• Requirement 2, the ISP function of the debugged chip must be disabled

If the ISP function is enabled, the debugged chip will always boot from the ISP-memory and run the ISP program (e.g. ISP-code) instead of user program when receiving a reset command in the dScope-Debugger mode. Thus during debugging, the HWBS must be disabled to prevent ISP function execution.

Notes:

1. When application code debug completes, users can restore the original hardware settings using ICP Programmer.

## 7.6 Error Message

The error message, *Error* - *Target DLL has been cancelled. Debugger aborted!*, as shown in the below figure will display under the following conditions.

- 1. ICE adapter hardware fails.
- 2. Target MCU doesn't work, e.g. chip is not powered on or damaged.
- 3. Cable error or improper connection between ICE adapter and the target MCU.

Once the error message pops out, click OK. Then, check the above possible causes to solve the problem.

![](_page_23_Picture_9.jpeg)

## 7.7 Connect the ICE Adapter to a Host

The data transfer rate of the ICE adapter will be slowed down severely if it is connected to a host via a USB HUB. When debugging using dScope, users should plug the ICE adapter into the host's USB port directly to speed up the downloading, as shown in Figure 30. Please don't plug into a hub then connect to the host, as shown in Figure 31.

![](_page_24_Figure_3.jpeg)

Figure 30. Plug into Host's USB Port Directly

![](_page_24_Figure_5.jpeg)

Figure 31. Don't Plug into a USC Hub

## 8 Revise History

#### Table 3. Revise History Records

	ion	Date
0.8 All Initial version		2018-5-6

## 9 Contacts

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