

NuMicro Cortex-M0 Keil µVision 驱动之 Nu-Link 用户手册 V1.03

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1. 简介

nuvoton

Keil的µVision开发工具主要是用来管理工程,编写、编译、调试程序以及下载程序到目标板上的,而调试或下载 程序到目标板上则需要调试驱动程序的支持,如ULink ARM Debugger就是这样的调试驱动程序; Nuvoton也 为µVision提供了这样的调试驱动程序: Nu-Link,它主要用来辅助µVision调试Cortex-M0系列芯片的,尤其 是Nuvoton的NUC1XX系列的芯片。

在μVision的工程配置选项里选择了Nu-Link调试驱动程序后,就可以进行程序的调试了,比如开始/停止调试 会话,设置/清除断点,读写寄存器、内存,单步执行等等;另外还可以为特定的芯片选择Flash编程算法,该 算法程序可以对芯片的Flash空间进行快速地擦除、改写和验证。

这文档描述了怎样安装Nu-Link,以及怎样用Nu-Link配合Keil的µVision工具进行调试和下载。

2. 系统需求

软件: MDK-ARM — V3.04(或者以后版本) 硬件: 支持Nu-Link ICE Bridge

3. NU_LINK ICE 特性

一个 USB 接口和 PC 通信,并用 USB 接口供电。 用调试接口进行片上仿真, Flash 编程

4. 提供文件

在uVision4已经安装的前提下安装Nu-Link_Driver.exe,成功安装该调试驱动程序后,在uVision4的安装目录下 将多出如下目录和文件:

.\ARM\BIN\Nu_Link.dll: NuMicro Cortex-M0 Keil µVision Driver的DLL文件

.\ARM\BIN\Nu_Link: 包含COPYRIGHT, License和寄存器详细信息, semihosting示例程序等

.\ARM\Flash: 包含Flash编程算法

.\UV4\Nuvoton_NuMicro_Cortex_M0_DateBase.cdb : NuMicro Cortex-M0 MCU数据库

5. 支持芯片

NUC1XX 系列:

NUC100LE3ANNUC120LE3ANNUC130LE3ANNUC140LE3ANNUC100LD3ANNUC120LD3ANNUC130LD3ANNUC140LD3ANNUC100RE3ANNUC120RE3ANNUC130LD2ANNUC140LD2ANNUC100RD3ANNUC120RD3ANNUC130RE3ANNUC140RE3ANNUC100VE3ANNUC120VE3ANNUC130RD3ANNUC140RD3ANNUC100VD3ANNUC120VD3ANNUC130RD3ANNUC140RD2ANNUC100VD2ANNUC120VD2ANNUC130VE3ANNUC140VE3ANNUC100LD2ANNUC120LD2ANNUC130VD3ANNUC140VD3ANNUC100LD1ANNUC120LD1ANNUC130VD2ANNUC140VD2ANNUC100RD1ANNUC120RD2ANNUC120RD2ANNUC140VD2ANNUC100RD1ANNUC120RD1ANNUC120RD1ANNUC100RC1ANNUC120RC1AN				
NUC100LD3ANNUC120LD3ANNUC130LD3ANNUC140LD3ANNUC100RE3ANNUC120RE3ANNUC130LD2ANNUC140LD2ANNUC100RD3ANNUC120RD3ANNUC130RE3ANNUC140RE3ANNUC100VE3ANNUC120VE3ANNUC130RD3ANNUC140RD3ANNUC100VD3ANNUC120VD3ANNUC130RD2ANNUC140RD2ANNUC100VD2ANNUC120VD2ANNUC130VE3ANNUC140VE3ANNUC100LD2ANNUC120LD2ANNUC130VD3ANNUC140VD3ANNUC100LD1ANNUC120LD1ANNUC130VD2ANNUC140VD2ANNUC100RD2ANNUC120LD1ANNUC130VD2ANNUC140VD2ANNUC100RD1ANNUC120RD2ANNUC120RD1ANNUC100RD1ANNUC100RC1ANNUC120RC1AN	NUC100LE3AN	NUC120LE3AN	NUC130LE3AN	NUC140LE3AN
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NUC100VE3ANNUC120VE3ANNUC130RD3ANNUC140RD3ANNUC100VD3ANNUC120VD3ANNUC130RD2ANNUC140RD2ANNUC100VD2ANNUC120VD2ANNUC130VE3ANNUC140VE3ANNUC100LD2ANNUC120LD2ANNUC130VD3ANNUC140VD3ANNUC100LD1ANNUC120LD1ANNUC130VD2ANNUC140VD2ANNUC100LC1ANNUC120LD1ANNUC130VD2ANNUC140VD2ANNUC100RD2ANNUC120LC1ANNUC100RD2ANNUC140VD2ANNUC100RD1ANNUC120RD2ANNUC120RD2ANNUC100RD1ANNUC100RC1ANNUC120RC1AN	NUC100RD3AN	NUC120RD3AN	NUC130RE3AN	NUC140RE3AN
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NUC100VD2ANNUC120VD2ANNUC130VE3ANNUC140VE3ANNUC100LD2ANNUC120LD2ANNUC130VD3ANNUC140VD3ANNUC100LD1ANNUC120LD1ANNUC130VD2ANNUC140VD2ANNUC100LC1ANNUC120LC1ANNUC100RD2ANNUC120RD2ANNUC100RD1ANNUC120RD1ANNUC100RC1ANNUC120RD1ANNUC100RC1ANNUC120RC1AN	NUC100VD3AN	NUC120VD3AN	NUC130RD2AN	NUC140RD2AN
NUC100LD2ANNUC120LD2ANNUC130VD3ANNUC140VD3ANNUC100LD1ANNUC120LD1ANNUC130VD2ANNUC140VD2ANNUC100LC1ANNUC120LC1ANNUC100RD2ANNUC120RD2ANNUC100RD2ANNUC120RD2ANImage: Constraint of the second seco	NUC100VD2AN	NUC120VD2AN	NUC130VE3AN	NUC140VE3AN
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NUC100RD1ANNUC120RD1ANNUC100RC1ANNUC120RC1AN	NUC100RD2AN	NUC120RD2AN		
NUC100RC1AN NUC120RC1AN	NUC100RD1AN	NUC120RD1AN		
	NUC100RC1AN	NUC120RC1AN		

M05X 系列:

M051LAN	M052LAN	M054LAN	M058LAN	M0516LAN
M051PAN	M052PAN	M054PAN	M058PAN	M0516PAN
M051YAN	M052YAN	M054YAN	M058YAN	M0516YAN
M051ZAN	M052ZAN	M054ZAN	M058ZAN	M0516ZAN

N572 芯片

6. 安装

可以手动地把Nu_Link.dll、Flash编程算法、授权文件等文件拷贝到µVision安装目录下的相应目录下,然后更改 µVision的配置文件,这样有点麻烦而且容易出错,现在提供了一个安装包Nu-Link_Driver.exe,它可以完成以 上所有的操作,很安全且不容易出错;下面提供的步骤仅做参考之用:

为了使用Nu-Link,需要执行如下步骤:

- 安装MDK-ARM V3.04(或者以后版本)。
- 执行Nu-Link_Driver.exe文件进行驱动安装, 然后选择 <Keil的安装路径>。新安装的文件会出现在 <Keil的 安装路径>\ARM\BIN, <Keil的安装路径>\ARM\Flash, <Keil的安装路径>\UV4 和 <Keil 的安装路径>

\ARM\EXAMPLES\Nuvoton 目录下。

用Nu-Link调试程序之前需要执行如下步骤(以NUC1XX系列为例):

运行µVision4。选择 'Project – New Project...', 弹出创建新工程的对话框。输入新的工程名然后点击OK按钮。 然后弹出选择CPU数据库文件的对话框,选择CPU数据库文件后弹出为目标系统设置设备的对话框,如下:

Select a CPU Data Base File	
Generic CPU Data Base Generic <u>CPU Data Base</u> <u>NUVOTON NUC1XX Devices</u>	<u>م</u>

Select Device for Target 'Target 1'	×
CPU Vendor: Nuvoton Device: NUC140VE3AN Toolset: ARM Data base Des <u>c</u> ription:	
NUC130RD3AN ARM 32-bit Cortex-M0, CPU clock up to 50MHz ARM 32-bi	
Select Target ICU	
OK Cancel Help	

● 选择 'Options for Target – Devices'。从 'Database' 的下拉列表中选择我们的设备数据库 "Nuvoton NUC1XX Devices", 然后选择你的微控制器的型号。如果都设置正确的话, 对话框将显示如下:

ηυνοΤοη

Options for Target 'SemiHost' 🛛 🗙
Device Target Output Listing User C/C++ Asm Linker Debug Utilities Database: NUVOTON NUC1>>> Devices Vendor: Nuvoton Device: NUC140VE3AN Toolset: ARM NUC130RD3AN CPU Core:
Image: State Stat
Image: NUC140VD3AN -1°USB 2.0 Full Speed Device -4*32 bit Timers Image: NUC140VE3AN Image: NUC140VE

● 检查RAM和ROM的大小

Options for Target 'SemiHost'			X
Device Target Output Listing User	C/C++ A	Asm Linker Debug Vtilities	
Nuvoton NUC140VE3AN			
∐tal (MHz):	50.0	_ Code Generation	
Operating system: None	•	Use Cross-Module Optimization	
		Use MicroLIB 🔲 Big Endian	
Check RAI and ROI Si	ze		
X		Use Link-Time Code Generation	
Read/Only Memory Areas		Read/Write Memory Areas	- 1
default off-chip Start Size	Startup	default off-chip Start Size Noln	it
	0	RAM1:	
П ВОМ2:	0	RAM2:	
П ВОМЗ:	$\nabla \circ$	RAM3:	
on-chip		on-chip	
IROM1: 0x0 0x20000	۰	IRAM1: 0x20000000 0x4000	
	0	IBAM2:	
OK	Can	ncel Defaults Help	

● 选择 "Thumb mode"

Options for Target 'SemiHost'
Device Target Output Listing User C/C++ Asm Linker Debug Utilities
Conditional Assembly Control Symbols
Define:
Undefine:
Language / Code Generation
Split Load and Store Multiple
Read-Only Position Independent
Read-Write Position Independent
C Ihumb Mode Select Thumb Lode
□ No W <u>a</u> mings
Paths
Misc
Assembler device DARMCM1pd "EVAL SETA 1" -g16apcs=interwork -l
string
OK Cancel Defaults Help

- 选择 'Rebuild all target files' 构建工程。(检查代码是否有错误)
- 选择 'Options for Target Debug'。从组合框的下拉列表中选择我们的驱动程序 Nu-Link Debugger。确保 'Use:'单选按钮选中。如果都设置正确的话,对话框将如下所示:

Options for Target 'SemiHost'	×
Device Target Output Listing Vser C/C++	Asm Linker Debug Utilities
C Use <u>S</u> imulator <u>Settings</u>	● Use: Nu-Link Debugger Settings
Load Application at Startup Run to main() Initialization File: Edit	Load Application at Startup Initialization File:
Restore Debug Session Settings Breakpoints Watchpoints & PA Memory Display	Restore Debug Session Settings Breakpoints Watchpoints Memory Display
CPU DLL: Parameter: SARMCM3.DLL	Driver DLL: Parameter: SARMCM3.DLL
Dialog DLL: Parameter: DARMCM1.DLL	Dialog DLL: Parameter:
OK Car	ncel Defaults Help

单击 Setting 按钮, 弹出 Debug 设置对话框,选择 Chip Type 为 NUC1xx,如下所示:

Jebug	<u> </u>
-USB SW Adapter	
ICE Version:	3975
Device Family:	Cortex=M
Device ID:	OBB11477
Port:	SW 💌
Max Clock:	1MHz 💌
Chip Select	
Chip Type:	UC1xx
Reset Options	
Reset: Autode	tect 💌
ОК	Cancel

选择 'Options for Target – Utilities'。从组合框的下拉列表中选择我们的驱动程序 Nu-Link Debugger。确保 'Use Target Driver for Flash Programming:'单选按钮选中。如果都设置正确的话,对话框将如下所示:

Options for Tar	get 'SemiHost'			
Device Target Ou	tput Listing Vser C,	/C++ Asm Lind	ker Debug Vtilities	
Configure Flash Me	nu Command			
Use Target Drive	ver for Flash Programming			
Nu	Link Debugger	 Settings 	Update Target before De	bugging
Init File:			Edit	
C Use External T	ool for Flash Programming			
Command:				
Arguments:				
, E f	Run Independent			
-				
			1	
	OK	Cancel	Defaults	Help

单击 Setting, 弹出 Flash Download 对话框,如下所示:

Flash Download for NUClxx	
Flash Select RAM for Algorithm Flash Start 0x20000000 APROM Size: 0x4000 Programming Algorithm	Download Function C Erase Full Chip 🔽 Program Flash Erase Sectors 🔽 Verify Flash C Do Not Erase 🔽 Reset and Run
Description Device Type Device Size NUC1xx 128kB Flash ONCHIP Flash 128K	Address Range 00000000H - 0001
	Configure
OK	ancel Help

注意: Flash Select 可以让工程代码下载到 AP ROM 或 LD ROM 中

7. 调试工程

nuvoTon

这章描述了怎样使用Nu-Link来调试例子工程,假如安装和配置都执行完成。请执行如下步骤:

● 运行µVision4。选择 'Project – Open Project..',将弹出选择工程文件的对话框,这里选择SemiHost工程 如下图所示:

👿 SemiHost – 🛛 Vision4		
Eile Edit View Project Flash Del	bug Pe <u>ri</u> pherals <u>I</u> ools <u>S</u> VCS <u>W</u> indow <u>H</u> elp	
) 🔿 🛃 🛃 🐰 🐰 🖬 🛍 🗐	* ← → 隆 魯 魯 律 律 /// / / / / / / / / / / / / / / /	
] 🥸 🏥 🕮 🧼 洪 🕌 SemiHost	💌 🔊 🔥 🖶	
Project 🗸 🕈 🕈	Main.c	▼ ×
 SemiHost CMSIS Sore_cm0.c System_NUClax.c Drv97D.c Drv97D.c Drv97S.c Drv91K.c Src Src Src St_Startup_NUClax.s 	<pre>120 int v = getchar();//SH_SysReadC(); 121 printf("read: %d\n", v); 122) 123) 124) 125 126 int main() 127 {(128</pre>	•
	142 /* 185t Sn_opsheaut */ 143 SH_test(); 144 return 0; 145) 146 147	•
■ Pr ③Bo		<u> </u>
Build Output		★ û ×
		v
	Nu-Link Debugger L:1 C:1	CAP NUM SCRU OVR R/W

● 选择 'Project - Build target' 构建工程。如下是构建窗口。

<pre>be Edit yew Project Figh Debug Pergipherads Iools SVCS Window Help Bert I I I I I I I I I I I I I I I I I I I</pre>				
Image: Second conditions of the second condits of the second conditions of the second cond				
<pre>SealBot Project # # X # Mainc # Mainc</pre>				
Project * I × Image: SemiHost Image: SemiHost Image: S				
<pre>Image: SemiMost Image: Se</pre>				
Image: Stresses in the state of the st				
B = M core_m0.c 122) B = M core_m0.c 123) B = M core_m0.c 124) B = M core_m0.c 125) B = M core_m0.c 126) B = M core_m0.c 128) B = M core_m0.c 128) B = M core_m0.c 129) B = M core_m0.c 131 10_OOTPUT); B = M core_m0.c 133 */ 136				
Image: System 200Lix.c 123) Image: System 200Lix.c 125 Image: System 200Lix.c 127 Image: System 200Lix.c 127 Image: System 200Lix.c 127 Image: System 200Lix.c 128 Image: System 200Lix.c 129 Image: System 200Lix.c 128 Image: System 200Lix.				
Image: Street stree				
B → Drv3X5.c 126 int main() B → Drv3X47.c 127 (B → Src 128 int main() B → Src 138 int main() B → Src 131 int main() B → Src int m				
B- M DrvMAR.c 127 (C 7* Open GPIO for LED */ DrvGPIO_Open(LED_CPIO_GREEN_GRP, DrvGPIO_OPEN(LED_FIC, 13 LED_OPIO_GREEN_BIT, 13 13 134 /* Print */ 135 (136 SH_Systertup_NUCLXX.s 137 sprintf(buf, "Hello, Nu-Link!\n"); 381_SysterteO(buf); 138 138 printf("%s", buf); 139 printf("%s", buf); 141 /* 142 /* Test SH_SySReadC */ 143 sH_test(); return O; 144				
→ a src 1/2 /* Open GPIO for LED */ → Main. 2 DrvGPIO_GPEN_GREN_GRP, → Main. 132 LDD_GPIO_GREEN_BIT, 13 IO_OUTPUT); 132 134 /* Print */ 135 (• Ohar buf[64]; 137 138 SH_stertup_MULix.* 139 printf(buf, "Hello, Nu-Link!\n"); 138 SH_Systute(b(buf); 139 printf("%s", buf); 141 /* 142 /* Test SH_SySReadC */ 143 SH_test(); return 0; 144				
B M Droit Charles A Doctant SAC, SAC, SAC, SAC, SAC, SAC, SAC, SAC,				
<pre>132 133 134 /* Print */ 135 (136 char buf[64]; 136 sfl = ystrict(buf, "Hello, Nu-Link!\n"); 138 sfl = ystrict(buf); 139 printf("%s", buf); 140 } 141 142 /* Test SH_SySReadC */ 143 SH_test(); 144 return 0; 145)</pre>				
133 /* Print */ 135 (136 ohar buf[64]; 137 sprintf(buf, "Hello, Nu-Link!\n"); 138 SH SysWrite()(buf); 139 printf("%s", buf); 140) 141 /* Test SH_SysReadC */ 143 SH_test(); 144 return 0; 145)				
<pre>136</pre>				
136 ohar buf(54); 137 sprintf(buf, "Hello, Nu-Link!\n"); 138 SH_SysWrite0(buf); 139 printf("%s", buf); 140) 141				
137 sprintf(buf, "Hello, Nu-Link!\n"); 138 SH SysWite(Obuf); 139 printf("%s", buf); 140) 141				
138 Sh_Systerie0(bur); 139 printf("%s", buf); 140) 141				
140) 141				
141 /* Test SH_SySReadC */ 143 SH_test(); 144 return 0; 145)				
142 /* Test SH_SySReadC */ 143 SH_test(); 144 return 0; 145)				
143 SH_cest(); 144 return 0; 145)				
146				
147				
Pr Br D Fu D Fu D fe				
Build Output				
.\obj\SemiHost.axf: Warning: L6319W: Ignoringfirst command. Cannot find section startup_NUC1xx.o(RESET).				
ApplicationROM.scf(7): warning: L6329W: Pattern SH startup NUClxx.o(RO) only matches removed unused sections.				
ApplicationROM.scf(10): warning: L6314W: No section matches pattern ic ctype c.o(RO). hunlicationROM excitib: warning: L6312W: Bettern core cm0 o(RO) only marches removed unused sections				
ApplicationROM.scf [18]: warning: L6214W: No section matches pattern * (locale\$\$data).				
ApplicationROM.scf(19): warning: L6314W: No section matches pattern *(.conststring).				
Program Size: Code=2268 RO-data=252 RV-data=52 ZI-data=1136				
User comewand #1: fromelfbin ".\obj\SemiHest.axf"output ".\obj\SemiHest.bin"				
<pre>gesc command #2: fromeiftext -c ".\obj\Semihostarr"output ".\obj\SemiHost.txt" "></pre>				
Nu-Link Debugger L:1 C:1 CAPI NUM SCRLI OVRI R/W				

● 选择 'Flash - Download' 下载程序到 Flash 中



● 选择 'Start/Stop Debug session' 进行调试。当硬件正确配置,程序将成功地下载到 Flash 中,然后调试

窗口将如下图所示:

👿 SemiHost – µ Vision4				
Elle Edit View Broject Flash Debug Peripherals Iools SVCS Window Help				
i 🗋 💕 🛃 🥔 i X 🗈 🛍 i 🕫 🥲 i 🖛 🚽 i 🥐 🎘 🧞 🦄	(第二) () () () () () () () () () () () () ()	- 🗟 🥐 🍳	🕘 O 🔗 🊓 🔍	
: 🗱 : 😫 🕑 (P +0) ↔ I 🖸 🕼 🗐 🗮 :	🛛 🕶 🖉 e 🔜 e 🔝 e 🔛 e 👷 e	12.		
Registers 🗢 🗭 🗙 Disassembly				→ ‡ ×
Register Value 127: (<u>^</u>
Core 128: /*	Open GPIO for LED */			
R0 0±20000218 CP0x2000012C B500 R1 0±20000218 0±2000012E B091 R2 0±20000218 129: Drv R3 0±20000218 130: Drv R4 0±0000844 131: 132: R6 0±0000000 133: 133:	PUSH (Ir) SUB sp,sp,#0x44 vGPIO_Open(LED_GPIO_GREEN_ LED_GPIO_GREEN_BIT, IO_OUTPUT);	_GRP,		
	Print */			
R9 0x02408000 135. /				>
R11 0x00000864				• ×
R12 0x200000fc	t v = getgher()://SH SugP	eedC():		
R14 (128) 0+20000035 121 pr B15 (5C) 0+2000012- 122) Banked 123) Banked 125 123) System 125 125 125 FRIMASK 0 126 117 128 FRIMASK 0 126 117 128 FRIMASK 0 128 /* Open GP Stack MSP 130 LED_GP 131 LO_OUT 132 10	<pre>intf("read: %d\n", v); io for LED */ en(LED GPIO GREEN_GRP, io GREEN_BIT, PUT);</pre>			
134 /* Print .	*/			
Verify OK.	• • • × < Ca	an Juden	11-2 (4.3.3	¥ # X
Running with Code Size Limit: 32K	<u> </u>	stack Frames	Value/Address	
Load "C:\\Keil\\ARM\\BIN\\Nu_Link\\SemiHost\\obj\\SemiHost.AXF" *** Restricted Version with 32768 Byte Code Size Limit *** Currently used: 2572 Bytes (7%)				
<	×			
>				
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet 🛛 🖓 Cal Stack 🐺 Locals 🐺 Watch 1 🗐 Memory 1 📭 Symbols				
		Nu-Link Debugger	t1: 0.00000000 sec L:127 C:1	CAP NUM SCRL OVR R/W

在这点上,调试进程和 uVision4 的模拟器有点相似。程序可以运行,挂起,单步,断点可以设置、清除,变量可以监测,内存区域可以读出/写入/更改等等。

注意:

Nuvoton 的 ICE MCU 支持 4~8个 ROM 断点,以及无限制的 RAM 断点。其中有一个被保存用于调试命令。当用户设定的断点达到上限时,Keil 会弹出提示对话框。

8. 更新 Config 位

● 选择 'Options for Target – Utilities', 然后点击 Settings 按钮, Flash Download 对话框将显示如下:

ΛυνοΤοη				
lash Download for NUClxx				
Flash Select RAM for Algorithm Download Function Flash Start 0x20000000 C Erase Full Chip V Program Flash APROM Size: 0x4000 On Not Erase Reset and Run				
Programming Algorithm Description Device Type Device Size Address Range We Enable Flash BP				
NUC1xx 128kB Flash ONCHIP Flash 128K 000000000H - 0001 Config0/1 Configure				
OK Cancel Help				

点击 Configure 按钮,将弹出 'MO Config Bit'对话框。你可以选择域值然后点击 Write Config Bit 按钮 来更改 Config 的值,当然可以点击 Exit 按钮退出 Config 值的更改。

I O Config Bit	
Clock Source Selection-	tal c 💽 internal rc 22M
Brown Out Voltage	
	C 2.6V C 2.2V
-Boot Select	
APROM	C LDROM
Watch Dog Enable	🔽 Clock Filter Ens
🔲 Brown out reset enal	🔲 Brown out detector ens
🥅 Data Flash Enabl	
Data Flash Base	OxFFFFF
Wirte Config Bit	Exit

9. 外设

在调试模式下,选择 'Debug'菜单,将显示寄存器组,选择一个寄存器组,比如 'GCR',弹出如下 •

图的对话框:

	GCR		
0x50000004	RSTSRC	0x	00000063
0x50000008	IPRSTC1	0ж	00000000
0x5000000C	IPRST2	0ж	00000000
0x50000018	BODCR	0ж	00000086
0x50000030	GPA_MFP	0ж	00000000
0x50000034	GPB_MFP	0ж	00000000
0x50000038	GPC_MFP	0ж	00000000
0x5000003C	GPD_MFP	0ж	00000000
0x50000040	GPE_MFP	0ж	00000000
0x50000050	USPI_MFP	0ж	00000000
0x50000100	RegLockAddr	0ж	00000000
0x50000110	RCADJ	0ж	0000003F
0x5000001C	PORCR	0x	00000000

- 编辑框里的寄存器值可以被更改,当光标离开该编辑框后或按回车键后更改后的值将被写入到该寄存器中。
- 如果想知道详细的寄存器信息,可以双击编辑框,比如双击 'BODCR'的编辑框,将弹出BODCR 寄存器设置的对话框,如下图:

BODCR		
0x5000	0018 BODCR	0x 00000086
[0]	BOD_EN	tb 0 💌
[2:1]	BOD_VL	2b 11 🔻
[3]	BOD_RSTEN	1b 0 🔻
[4]	BOD_BYP_EN	1b 0 💌
[5]	BOD_LPM	1b 0 🔻
[6]	BOD_OUT	1b 0 🔻
[7]	LVR_EN	1b 1 💌
[8]	VTEMP_EN	1b 0 🔻
[9]	LDO_BYP	1b 0 🔻
OK		Cancel

 当已经更改了寄存器的域值,可以点击 OK 按钮来把该值写入寄存器中,当然也可以点击 Cancel 按钮来 取消值的写入;当把鼠标移到域的标签上时还能弹出 ToolTip 来说明该域的详细含义,比如把鼠标放在 ,BOD_VL'上时,将出现如下图所示的 ToolTip:

🔀 SemiHost –	µ¥ision4						
Elle Edit View Project Fligsh Debug Peripherals Iools SVCS Window Help							
i 🗋 💕 🔒 🥔 🗌	አ 🗈 🗈 🗠		🏾 🗐 律 //2 //長 🕍		- 🗟 🥐 🙋 🧅 🖉) 🔗 🊓 - 🔍	
: 👥 🗐 🚳 🖓	<u></u>			Brown Out Detecto	r Threshold Voltage	Selection (initiate 9, pr	otected bit)
RSI 🔤 🐨 🗘				The default value is	s set by flash contro	oller user configuration r	register
Registers	• + ×	Disassembly		config0 bit[22:21]	,	ĭ	- · · · · · · · · · · · · · · · · · · ·
Register	Value	127: {	/* Open GPIO for				
Core RO	0~20000218	Cx2000012C B500	PUSH (1r	BOV_VL[1]	BOV_VL[0]	Brown out voltage	
R1	0x20000218	0x2000012E B091	SUB sp,	sp,#Ox44			
	0x20000218	129:		1	1	4.5V	
K3 R4	0x20000218 0x00000864	130:	GCR				
R5	0x200001b8	131:	BODCR	1	0	3.8V	
R6	0x00000000	132.					
R	0x12420040	134:	0x5000001	O BODCR Ox	1000086	2.6V	
R9	0x02408000	135.					
R10	0x00000864			0	0	2.2V	
R11 R12	0x200000fc	Main.c	[0] BO	EN 16	0 ~ _		×
R13 (SP)	0x20000618	120	[2:1] BOI	1 2b	11 🔻		
R14 (LR) R15 (PC)	0x20000035	121	ran 100	- DC/// 11			
± xPSR	0x01000000	122 }	[3] 001	_ SIEN ID			
Banked		123 7	[4] BOI	_BYP_EN 1b	0 –		
PSP	0x20000618 0xa01001a0	125	[5] BOI	_LPM 1b	0 🔻		
🖃 System		126 int main()	[6] BOT	0107 15	• •		
PRIMASK	0	<₽>127 - {	101 202				
- Internal	0x00	128 /* Open	[7] LVB	LEN 1b	1 🔽		
Mode	Thread	129 DEVGPTO	[8] VTE	130P_EN 115	0 🔻		
Stack	MSP	131 10 0	101 F91 F91	RYP 1b	• •		
		132					
		133					-1
Project Regist	terr	134 /* Print	OK		Cancel		
Command							
Load "C:\\Keil	1//ARM//BIN/	Nu Link\\SemiHost\'	obi\\SemiHost.AX			ddress	
		_		💊 mai	nU		
*** Restricted	d Version wit	th 32768 Byte Code :	Size Limit				
*** Currently	used: 2572]	Bytes (7%)					
				~			
<				>			
>							
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet 🛛 🚱 Cal Stack 💭 Locals 💭 Watch 1 🔤 Memory 1 🔯 Symbols							
				1	lu-Link Debugger	t1: 0.00000000 sec	CAP NUM SCRL OVR R/W

10. Semihosting

- Nu-Link 支持一些 semihosting 函数。用户使用这些函数,可以很方便的在 μVision 中输入和输出调试信息 如要是使用 semihosting 功能,请按照如下的步骤进行:
 - 打开目录 C:\Keil\ARM\BIN\Nu_Link\SemiHost\Src,您将在这个目录下看到有两个文件:

SH_retarget.c

SH_startup_NUC1xx.s

将这两个文件复制到您的项目里。

- 然后打开您的项目,并且
 - ◆ 将 retarget.c 替换为 SH_retarget.c
 - ◆ 将 startup_NUC1xx.s 替换为 SH_startup_NUC1xx.s
- 在工程文件中需要调试的地方加 printf 或 getchar 等输入输出函数
- 为了减少代码大小,您可以修改 SH_retarget.c 的如下两个宏定义,可用来设定是否要支持 UART 或 semihosting 的 UART1。

#define DEBUG_ENABLE_UART

#define DEBUG_ENABLE_SEMIHOST

- 重新编译并运行
- 在调试模式下打开 'View Serial Windows UART #1'窗口。Semihosting 的输入输出将使用这个 窗口。
- 执行程序并运行到 printf("%s", string)时就可以看到调试信息打印到 UART #1 窗口了,如下图:





11. 修订历史

修订	描述	日期
V1.00	第一次发布测试	2010/02/05
V1.01	增加Config位,外设,semihosting等	2010/03/08
V1.02	更改Debug设置对话框,外设显示等	2010/06/23
V1.03	增加M50X系列和N572	2010/07/22

12. Nuvoton 的 Keil Add On-Component 许可协议

IMPORTANT-READ THIS AGREEMENT CAREFULLY

Nuvoton products are not designed, intended, authorized or warranted for use as components in equipment or systems intended for surgical implantation, atomic energy control instruments, aircraft or spacecraft instruments, transportation instruments, traffic signal instruments, combustion control instruments, or for any other applications intended to support or sustain life. Furthermore, Nuvoton products are not intended for applications whereby failure could result or lead to personal injury, death or severe property or environmental damage. Nuvoton customers using or selling these products for such applications do so at their own risk and agree to fully indemnify Nuvoton for any damages resulting from their improper use or sales