

# UCD3xxx 数字电源控制器调试工具:内存调试器(Memory Debugger)的详细介绍

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#### 摘要

边界扫描(JTAG)是一种常用的调试方法,大多数 MCU 都支持 JTAG 调试,比如 TI 数字信号处理器(DSP)、数字信号控制器(DSC)、以及基于 ARM 架构的处理器等。

JTAG 在电源调试应用中会有很大风险,因为 JTAG 常常需要中止程序的正常运行去查看寄存器和 变量。这里推荐的 UCD3xxx 主要调试方法是基于通用异步收发器(UART)和电源管理总线 (PMBUS)。它们都支持在线调试功能。

UART 调试方法比较简单,本文不做论述,可以参考 UCD3xxx 示例代码。对于 PMBUS 调试方法,使用的主要工具就是内存调试器(Memory Debugger)。所以,本文主要详细介绍 Memory Debugger 的使用方法。

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# 1 引言

#### 1.1 UCD3xxx 简介

UCD3xxx 系列芯片是 TI 公司开发的专门面向数字电源应用的控制器,主要应用在通讯电源、服务器电源、无线功放电源以及标准砖模块电源等领域。UCD30xx 系列产品主要是 UCD3028、UCD3020 以及 UCD3040。最新一代产品是 UCD31xx 系列,主要产品是 UCD3138、UCD3138064 以及 UCD3138128 等。

🜵 Fusion Memory Debugger - DC-DC	HSFB Firmware v0.0.2.1 @	Address 88d								_			
File											-		
Change Map													
Close					-	-		-	-				
Close	S	ubstring Match 🖂	Filter	Clear Filter S	how: 💿 All	O Registers	() RAM	() DFlash	() PFlas	h 🎠 To	ggle		
Start Polling Polling Interval: 500 🖉 ms Global Poll Change: Check All Uncheck All													
Selection: All (2 > Dpwm0Regs (2													
Name Description	Type	Value	Hex	Address	Size	Category	+ -	Refresh	Write	AutoWr			
+ AdcReas IRO Index Off	set V Struct ADC REGS			0x00040000	152 bytes	Register					T		
Eine B	ase Struct CIM_REGS			0xFFFFFF20	24 bytes	Register							
DecRegs DPWM Individu	al R Struct DEC_REGS			0xFFFFFE00	156 bytes	Register					-		
🕀 🕂 Dpwm0Regs	Struct DPWM_REGS			0x000D0000	140 bytes	Register		REFRESH	WRITE		1		
🕀 🔆 Dpwm 1Regs	Struct DPWM_REGS			0x000A0000	140 bytes	Register							
🗄 🕁 Dpwm2Regs	Struct DPWM_REGS			0x00070000	140 bytes	Register							
🖶 🔆 Dpwm3Regs 🛛 Analog Compar	rator Struct DPWM_REGS			0x00050000	140 bytes	Register							
FaultMuxRegs Ramp Control F	Regi Struct FAULT_MUX			0x00030000	128 bytes	Register							
FeCtrl0Regs	Struct FE_CTRL_R			0x000E0000	68 bytes	Register							
🕂 🛨 FeCtrl 1Regs	Struct FE_CTRL_R			0x000B0000	68 bytes	Register							
🗄 👷 FeCtrl2Regs 🛛 Filter Status Re	egister Struct FE_CTRL_R			0x00080000	68 bytes	Register							
🗄 🛧 Filter0Regs	Struct FILTER_REGS			0x000C0000	100 bytes	Register							
🕀 🍿 Filter 1 Regs	Struct FILTER_REGS			0x00090000	100 bytes	Register					-		
H Filter2Regs Fault Port I/O	Direc Struct FILTER_REGS			0x00060000	100 bytes	Register					-		
GioRegs Front End Con	trol Struct GIO_REGS			0xFFF7FA00	64 bytes	Register					-		
LoopMuxRegs Clock Trim Reg	ister Struct LOOP_MUX			0x00020000	120 bytes	Register					$\sim$		
Expand All Collapse All	Refresh All	Write Changes	Import	Export Se	lected	Export All	<b>C</b>	lear Watch Li	st				
Timestamp Message								<u>c</u>	Copy Log	<u>Clear Log</u>	1		
09:27:02.313 0x000D0084: read 4 byte	(s) 0x0000000										Ð		
09:27:02.313 0x000D0088: read 4 byte	(s) 0x0000000										~		
Fusion Digital Power Designer v1.8.329 [/	2013-05-29] DC-DC HSFB	Firmware v0.0.2.1	@ Address 880	d Map Folder: U	CD3138HSF	BEVM_029 USE	B Adapte	r v1.0.10 [PE	C; 400 kH	z]			

#### 图1. Memory Debugger 界面

#### 1.2 PMBUS 简介

PMBUS(电源管理总线)是一种开放标准的数字电源管理协议。可通过定义传输和物理接口以及命令语言来促进与电源转换器或其他设备的通信。该协议是由一群认为由于没有合适的标准而抑制了全数字电源管理解决方案发展的电源和半导体生产商共同建立的。目前使用标准是 PMBUS 1.2, PMBUS 1.3 正在制定中。

PMBUS 总共可以有 256 条命令,主要有几种:标准命令,是固定的不可改动的,如读取输出电压 命令是 0x8B,那么 0x8B 就不能用做其它命令;保留命令,留作以后扩展使用;用户自定义命令,用户 可以根据自己的应用来定义这些命令。具体命列表可以参考文献 1。



### Overwrite this text with the Lit. Number

🚸 Fusion Digital	Power Designer - DC-DC HSFB @ Address 88d -	Page 0x0 - Texas Instruments	_ 🗆 🔀
File Device	Tools Debug Help	DC-DC HSFB @ 88d - F	Page 0x0
Monitor	Device/Project Configuration Compare	Vin - Input Voltage 🛛 🛞 Vout - Output Voltage	
Show/Hide Plots:	Voltage Switching Tool	75.000 Â V 33.000 Â V 14.000 Â V	12.000 🚔 V
Vin 🗸	Debug Console		
	Data Logging	37.000 V 35.000 V WREE	write
	PMBus Logging	16.00	
	Memory Debugger	80.00	
Fit All Plots on	Memory Peek/Poke/Dump	60.00	
<ul> <li>Scale Plots to Width</li> </ul>	SMBus & SAA Tool	40.00 6.00	8.004 V
Height: 2	Numeric Encode/Decode Tester	20.00 4.00	
	Device Read/Write Stress Tester	0.000 V 2.00	
└╱ Show Warn & Limit Editors	Group Command Protocol Tester	13:00 13:20 13:40 14:00 13:00 13	20 13:40 14:00
Show Value La	Configuration Import Tester	Tout - Output Current	×
	ASCII Tool	38.00 (A Write) 50 (A Write)	Write
Polling Rate: 5 (msec)	EEPROM File Tool	40.00 7	
	EEPROM File Compare Tool		
Stop Pollin	Isolated GUI Bit Mask Generator	30.00 40	
Launch Dashb	Decimal & Mantissa Exponent Tool	20	
	PEC & SMBus -> I2C Translation Tool	20.00	
🧄 Configure	Clear Configuration	10.00	
di) Design	Download Firmware	-20	-32 °C
besign	Multi Image	0.00 A -40	
🧄 Monitor	Download USB Adapter Firmware	13:00 13:20 13:40 14:00 13:00 13:	20 13:40 14:00
🚸 Status	1 New PMBus Log Messages Show PMB	us Log 🔽 Unique open/dose settings for Configure,	Design, Monitor, and Status 📳
Fusion Digital Pov	ver Designer v1.8.329 [2013-05-29] DC-DC HSFB F	irmware v0.0.2.1 @ Address 88d USB Adapter v1.0.10 [PEC; 400 kHz] 🛛 🏘 Texas	INSTRUMENTS   fusion digital power

# 图2. Memory Debugger 在 Fusion Design Online 的位置

Scan Device in ROM Mode Custom: None
Scan for Device in Program Mode: <u>DEVICE ID</u> <u>DEVICE CODE</u> <u>PMBUS REVISION</u> When a device is found, dump additional PMBus commands  Command ROM to execute its program (SendByte 0xF0 to Address 11)  Command Program to jump to ROM (SendByte 0xD9 to Address 88)
Multi-image       Firmware Download       SMBus Debug       USB Adapter (SAA) Settings       Memory Debugger         Memory Peek/Poke       ROM API       Erase/Set DFlash:       0xFF       0xAA         Report trim status       Dump Info Block       Info Block Tool       Erase/Set PFlash:       0xFF       0xAA         Pfash checksum(includes boot)       Dump       Calculate       Recreate       Validate       Clear         Boot flash 2k8 checksum       Boot size:       2       k8       Dump       Calculate       Recreate       Validate       Clear         Export Flash       Compare Flash Files       Dump Flash File       Elash Test Tool       Full Export Tool       X0 to Hex Tool         Device Debug Tool       Mantissa/Exponent Tool       Iso Bitmask Tool       PEC & SMBus -> 12C Translation Tool
Display all SMBus/I2C activity in log

# 图3. Memory Debugger 在 UCD3xxx & UCD9xxx Device GUI 的位置



# 2 怎么找到 Memory Debugger

Memory Debugger 是德州仪器数字电源设计调试工具 Fusion Digital Power Designer (下载地址: <u>http://www.ti.com/fusiongui</u>,请下载最新版本,早期版本不支持 Memory Debugger 功能)的一部分,主要用来读写 UCD3xxx 内部全局变量和寄存器的值。Memory Debugger 界面如图 1 所示。如果是第一次 调用 Memory Debugger,需要输入密码 "forestln"。

那么如何调出 Memory Debugger 工具,有两条途径: 一是执行 Fusion Design Online 可执行文件 (桌面直接双击 Fusion Design Online 快捷方式,如果没有创建桌面快捷方式,在开始菜单中找到 Texas Instruments Fusion Digital Power Designer 目录下的 Fusion Digital Power Designer,点击即 可),然后就可以在 Fusion Design Online 上的 Tools 菜单下面找到 Memory Debugger 项,如图 2 所 示; 二是执行 UCD3xxx & UCD9xxx Device GUI 可执行文件(桌面直接双击 UCD3xxx & UCD9xxx Device GUI 快捷方式,如果没有创建桌面快捷方式,在开始菜单中找到 Texas Instruments Fusion Digital Power Designer\Device GUIs 目录下的 UCD3xxx & UCD9xxx Device GUI,点击即可),Memory Debugger 在图 3 红圈处。

# **3** 如何产生 Memory Debugger 需要的.PP 和.MAP 文件

在详细介绍 Memory Debugger 之前,需要介绍 Memory Debugger 所需要的两种文件,预编译 (.PP)文件和地址映像(.MAP)文件。在 CCS3.x 中,进入 Project\Build Options 选项,按图 4 红框 中所示配置就可以生成所需要的文件。PP 文件主要保存预编译生成的文件,关于预编译的详细内容,可 以参考文献 2。MAP 文件主要是把变量和它的地址都对应起来,如图 5 所示。MAP 文件的其他功能也可 以参考文献 2。

Build Options for HSFB.pjt (Debug)	Build Options for HSFB.pjt (Debug)
General Compiler Linker Link Order	General Compiler Linker Link Order
Category:       Preprocessor         Basic       Advanced         Advanced Opt.       Pre-Define Symbol (-d):         Feedback       Pre-Define Symbol (-d):         Assembly       Parser         Preprocessor       Include Search Path (-j):         Diagnostics       Vith Comments (-ppc)	Category:       Basic         ABI (-abi=):       None, default to ARM9 ▼         Libraries       Suppress Banner (-q)         Output Module:       ▼         Output Filename (-o):       \Debug\cyclone.out         Map Filename (-m):       \cyclone.map         Autoinit Model:       Run-Time Autoinitialization (-c) ▼         Heap Size (+heap):       10         Stack Size (stack):       200         Fill Value (f):       Code Entry Point (-e):
OK Cancel Help	OK Cancel Help

图4. 预编译(.PP)文件和地址映射(.MAP)文件的产生



MEMORY CONFIGURATION used attr fill name origin length \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_ \_\_\_\_\_ 00000000 0000020 00000020 RWIX VECS SECTION ALLOCATION MAP output attributes/ section page origin length input sections ---- -----\_\_\_\_\_ \_\_\_\_\_ 00000020 000057b4 0 .text GLOBAL SYMBOLS: SORTED ALPHABETICALLY BY Name address name \_\_\_\_\_ \_\_\_\_ 00019054 \_debug\_buffer 00019260 \_supply\_state GLOBAL SYMBOLS: SORTED BY Symbol Address address name ----00019054 \_debug\_buffer 00019260 \_supply\_state 

### 图5. 地址映像(.MAP)文件

Fusion Memory Debugger - DC-D	C HSFB Firmware v0.0.2	1 @ Address 8	38d									-	
File													-
All 🔆 Watch List													
Register/Variable Name:	~	Substring Mat	tch 🗸 🦳	Filter	Clear Filter	Show:      All	○ Registers	0	RAM	O DFla	sh 🔿 PFI	lash 🔭 T	oggle
Start Polling Polling Interval: 500 💭 ms Global Poll Change: <u>Check All Uncheck All</u>													
Selection: Watch List () > supply_state ()													
Name	Description	Туре	Value	Hex	Address	Size	Category	+	-	Refresh	Write	AutoWr	Poll
🖃 📌 debug_buffer		Array unsig			0x00019054	8 bytes	RAM						
		UInt8	1	0x01	0x00019054	1 byte	RAM						
		UInt8	2	0x02	0x00019055	1 byte	RAM						
		UInt8	3	0x03	0x00019056	1 byte	RAM						
		UInt8	4	0x04	0x00019057	1 byte	RAM						
		UInt8	5	0x05	0x00019058	1 byte	RAM						
		UInt8	6	0x06	0x00019059	1 byte	RAM						
		UInt8	7	0x07	0x0001905A	1 byte	RAM						
debug_buffer[7]		UInt8	8	0x08	0x0001905B	1 byte	RAM						
		Enum SUPP	5 - S 🖂	0x00000	0x00019260	4 bytes	RAM			REFRESH	WRITE		
			0-STATE	IDLE									
			1 - STATE	RAMP_UP_F	PREBIAS								
			2 - STATE	RAMP_UP									
			3 - STATE	SYNFEL_RA	MP_UP								
			5 - STATE	REGULATED									
			6 - STATE	6 - STATE_REGULATED							_		
Expand All Collapse All	Refresh Watch List	7 - STATE	LATCH	port	Selected	Export Watchli	st )	( C	lear Watch	List			
		8 - STATE	CPCC					_					
		ISITION						<u> </u>	<u></u>				
() Tanantana   Maaaaa			10 - STATE	HICCUP							- Copy Loo	Clear Lo	)q
Fusion Digital Power Designer v1.8.329	9 [2013-05-29]   DC-DC H	SFB Firmware v	0.0.2.1 @ A	aaress ooa	IVIap Folder:	UCD3138HSF	-BEVM_029   US	SB Ad	dapte	er v1.0.10 [	PEC; 400	kHz]	

图6. Memory Debugger 变量显示



为什么 Memory Debugger 需要.PP 和.MAP 文件? Memory Debugger 通过读取.PP 文件可以知道变 量是什么类型:结构体、数组、枚举等;通过.MAP 文件知道这些变量的地址。在图 5 中,可以看到变 量 debug\_buffer 和 supply\_state 的首地址分别是 0x00019054 和 00019260。图 5 中红色虚线是指省略 部分。在图 6 中,红框中是变量 debug\_buffer 和 supply\_state 的地址。debug\_buffer 变量是 8 个字节的 数组,如图 6 中红框所示,可以和图 5 地址对照一下,是一样的; supply\_state 是枚举变量,如图 6 绿 框所示,此时 supply\_state 变量值是 5,处在 STATE\_REGULATED 状态。

🥹 💶 🗖 🛛 🗶													
- About Map/PP Files													
While only IC registers can be debugged by default, if you tell the debugger where certain Code Composer output files are located, non-local global (extern) variables can be debugged. The Code Composer files that are used are:													
<ul> <li>*.map - A map file defines the top-level variables in your "C" source code and at what address in memory they have been located. There is only one map file.</li> <li>*.pp - Contains declarations from your source code, after they have been run through the C pre-processor. There will be one .pp file for each source code file.</li> </ul>													
Add the -m xxxxx.map linker option to create a map file during compilation. Add the -ppa -ppo pre-processor options to create the .pp files, one per source file.													
Note that IC register definitions are taken from your .map and .pp files, overriding the default definitions bundled with the GUI.													
Settings are saved for each unique DEVICE_ID. So for example, if you switch between UCD9244 and UCD9222, the debugger will automatically use the apprpriate files. Current Setting: Folder: C:\CCStudio_v3.3\MyProjects\PWR029_Test_Play_single_frame_ bdr\UCD3138HSFBEVM_029													
Select Folder Containing Map/PP Files Select ZIP File Containing Map/PP Files													
Show Registers Only - Auto Select Map Show Registers Only - Manually Select Map													
Show Registers Only - Auto Select Map     Show Registers Only - Manually Select Map     Collapse unions in favor of bit fields     Because the debugger allows you to edit bit field structures full "hex" values in addition to the     lower level bit fields, you may find that alternative byte and word representations of a struct     bitfield complicate debugging. Checking this box simplifies the variable node tree by only     showing bit field structs when other members of a union are only simple types.     Code Composer small enums mode was used     Check this if thesmall-enums mode was used in Code Composer when the target firmware was     compiled. Small enums mode reduces the size that enums take up in memory (varable length     instead of fixed 4 byte llength).													
OK Cancel													

图7. 选择.PP 和.MAP 文件

# **4 Memory Debugger** 的具体操作

Memory Debugger 主要使用命令 0xE2 和 0xE3 和 UCD3xxx 通讯,所以 UCD3xxx 代码需要支持这两个命令。这两个命令可以直接读取 UCD3xxx 内部程序 FLASH 和数据 FLASH 的值,可以读取或修改内部 RAM 的值。关于这两个命令的详细代码,请参考文献 3。

图 1 中绿框所示是切换 Memory Debugger 显示内容,包括显示所有(ALL)、寄存器(Register)、 RAM、程序闪存(PFLASH)以及数据闪存(DFLASH)。如果想刷新某个变量,可以点击每个变量右 边的刷新(REFRESH)按钮,如图 1 中粉红框所示。



#### 4.1 选择.PP 和.MAP 文件

在 Memory Debugger 文件菜单下,选择 Change Map...(图 1 红框所示),会弹出图 7 所示界面。 点击图 7 中红框所示,选择.PP 和.MAP 所在的目录(.PP 和.MAP 需要在同一个文件夹里面)。如果不 需要看全局变量,只看寄存器的话,可以不需要执行这一步。因为对于寄存器变量,地址都固定的, Memory Debugger 可以识别这些寄存器。对于变量,每个项目都不一样,即使同一个变量,地址也可能 不同,所以如果看全局变量,需要执行这一步。如果程序没有改动,执行一次就可以一直调试下去, Memory Debugger 会记住上一次的选择的.PP 和.MAP 文件。

👆 Fusion Memory Debugger - DC-DC HS	FB Firmware v0.0.2.	L @ Address 8	8d									_	
File       ✓         All       ✓         Watch List       ✓         Register/Variable Name:       ✓         Substring Match ✓       Filter         Clear Filter       Show: <i>All         Registers       CRAM         DFlash       Filter         Start Polling       Polling Interval:         500       ms         Global Poll Change:       Check All         Uncheck All         Selection:       Watch List         Dpwm0Regs       D</i>													
Name	Description	Туре	Value	Hex	Address	Size	Category	+	- R	Refresh	Write	AutoWr	Poll
Home     Home     Home     Home     Home     Home     Home     Home       ⊕ yr     ppmm0Regs     Struct DPW      0x000D0000     140 bytes     Register     REFRESH     WRITE													
🗄 📩 Dpwm 1Regs		Struct DPW			0x000A0000	140 bytes	Register						
⊕.☆ Dpwm2Regs		Struct DPW			0x00070000	140 bytes	Register						
	Analog Comparator	Struct DPW			0x00050000	140 bytes	Register						
Expand All       Collapse All       Refresh Watch List       Write Changes       Import       Export Selected       Export Watchlist       Clear Watch List													
Timestamp Message Copy Log Clear Log													
09:27:02.313 0x000D0088: read 4 byte(s)	0x0000000												
Fusion Digital Power Designer v1.8.329 [201	3-05-29] DC-DC HS	FB Firmware v	).0.2.1 @ A	ddress 88d	Map Folder:	UCD3138HSF	BEVM_029 US	B Ada	apter	v1.0.10 [	PEC; 400 I	(Hz]	

图8. 监控列表(Watch List)视图

#### 4.2 放置变量到监控列表(Watch List)

进入 Memory Debugger 界面时,是显示所有的变量和寄存器,如图 1 所示。需要注意的是, UCD3xxx 有些寄存器位是读清除的,所以不能随便读取某个寄存器,需要结合编程手册来看这个寄存器 是否可以读取。为了方便使用,可以把经常需要读取的寄存器和变量加入到监控列表(Watch List),如 图 8 红框所示。在图 1 中,如果我们点击每个变量左边灰色的星号(蓝色框所示),那么就可以把想要 监控的寄存器或变量加入到监控列表中,如图 8 所示。在监控列表中,可以设置自动刷新所监控的寄存 器或变量,自动刷新频率也可以设置,如图 8 绿色方框所示。

#### 4.3 实验演示

把寄存器 Fiter0Regs 放到监控列表,展开后找到 OUTPUT\_CLAMP\_HIGH,如图 9 所示。初始值 是 0x2500。点击 0x2500,输入 0x1250,然后点击右边的 WRITE,写入 UCD3xxx,如图 10 所示。

图 11 是 DPWM0A/B (Ch1-DPWM0A, Ch2-DPWM0B)的波形,可以看出修改前后 DPWM 的最大 占空比的变化。图 11 左边是最大占空比修改前,右边是最大占空比修改后。实验是在 TI 实验板 (UCD3138OL40EVM-032,见文献 4)上验证的,把反馈短接到地,然后把示例代码各种保护屏蔽掉, 那么程序就可以运转起来,环路会一直输出最大占空比。



🟘 Fusion Memory Debugger - DC-DC HSFB Firmw	are v0.0.2.1	@ Address 88	d										
File ~													
All 🔆 Watch List													
Register/Variable Name: Substring Match V Filter Clear Filter   Show:  All O Registers O RAM O DFlash PFlash													
Start Polling Polling Interval: 500 🐨 ms Global Poll Change: Check All Uncheck All													
Selection: Watch List (2) > FilterOReas (2) > FILTEROCLPHI (2) > bit (2) > Bit Fields (2) > OUTPUT_CLAMP_HIGH [17:0] (2) (Output Clamp High)													
Name         Description         Type         Value         Hex         Address         Size         Category         +         -         Refresh         Write         AutoWr         Poll													
Name         Description         Type         value         nex         Address         Size         Category         +         -         Refresh         Write         AutoWr           Grad         Struct FILT         0x000C0000         100 bytes         Register         Image: Category         Image: Category <td></td>													
ight FILTEROCLPHI Filter Outp Union FILT 0x0000 0x000C0058 4 bytes Register													
🖨 👷 bit		Struct FILT		0x0000	0x000C0058	4 bytes	Register						
🖃 🥋 Bit Fields		Bit Fields		0x0000	0x000C0058	4 bytes	Register						
	Reserved	U Bit Field: 14	0	0x0000	0x000C0058	14 bits	Register						
	Output Cla	U Bit Field: 18	9,472	0x002500	0x000C0059	18 bits	Register	•		REFRESH	WRITE		
		UInt32	9,472	0x0000	0x000C0058	4 bytes	Register						
Expand All       Collapse All       Refresh WatchList       Write Changes       Import       Export Selected       Export Watchlist       Clear Watch List													
Timestamp Message											Copy Loc	Clear Lo	a 🚆
16:00:10.294 0x000C0014: read 4 byte(s) 0x000000	00												
Fusion Digital Power Designer v1.8.329 [2013-05-29]	DC-DC HSF	B Firmware v0/	0.2.1 @ Ad	dress 88d	Map Folder:	UCD3138HS	FBEVM 029 US	SB Ac	lante	er v1.0.10 [	PEC: 400	kHz1	

图9. DPWM 输出最大占空比修改前

👆 Fusion Memory Debugger - DC-DC HSFB Firms	ware v0.0.2.1	@ Address 88	d										
File													-
All 🔆 Watch List													
Register/Variable Name:       Substring Match V       Filter       Clear Filter       Show: <ul> <li>All</li> <li>Registers</li> <li>RAM</li> <li>DFlash</li> <li>PFlash</li> <li>Toggle</li> </ul> Start Polling       Polling Interval:       500 <ul> <li>ms</li> <li>Global Poll Change:</li> <li>Check All</li> <li>Uncheck All</li> </ul>													
Selection: <u>Watch List</u> (2) > <u>FilterOReas</u> (2) > <u>FILTEROCLPHI</u> (2) > <u>Bit Fields</u> (2) > OUTPUT_CLAMP_HIGH [17:0] (2) (Output Clamp High)													
Name Description Type Value Hex Address Size Category + - Refresh Write AutoWr Pol													
⊡·☆ Filter0Regs		Struct FILT			0x000C0000	100 bytes	Register						
🗐 👷 FILTEROCLPHI	Filter Outp	Union FILT		0x0000	0x000C0058	4 bytes	Register						
bit Struct FILT 0x0000 0x0000058 4 bytes Register													
🖃 👷 Bit Fields		Bit Fields		0x0000	0x000C0058	4 bytes	Register						
📌 rsvd0 [31:18]	Reserved	U Bit Field: 14	0	0x0000	0x000C0058	14 bits	Register						
	Output Cla	U Bit Field: 18	4,688	0x001250	0x000C0059	18 bits	Register			REFRESH	WRITE		
		UInt32	4,688	0x0000	0x000C0058	4 bytes	Register						
Expand All       Collapse All       Refresh WatchList       Write Changes       Import       Export Selected       Export Watchlist       Clear Watch List													
Timestamp Message											Copy Lo	g <u>Clear Lo</u>	20
16:02:04.500 0x000C0058: read 4 byte(s) 0x00001	250												-
Fusion Digital Power Designer v1.8.329 [2013-05-29]	DC-DC HSF	B Firmware v0.	0.2.1 @ A	ddress 88d	Map Folder:	UCD3138HS	FBEVM_029	ISB A	dapte	er v1.0.10	PEC; 400	kHz]	

图10. DPWM 输出最大占空比修改后

# 5 总结

本文主要介绍使用 Memory Debugger 来调试 UCD3xxx。通过本文可以看出,利用 Memory Debugger,可以灵活地监控及修改变量,达到调试的目的。



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		/ B. ()	2.00.11 8.	2.00µs	500MS/s	1 <i>5</i>	6 Sep 2013			2.00.11 8.	2.00µs	500MS/s		6 Sep 2013
	Coupling	Termination (Ω)	Invert	Bandwidth 20MHz	2 Label	More	(17:58:00	Coupling	Termination (Ω)	Invert	Bandwidth 20MHz	2 Label	More	<u>(17:59:01</u> )

图11. DPWM 输出最大占空比修改前后的波形

# 6 参考文献

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