## DS90UH949A-Q1EVM or DS90UB949A-Q1EVM

# **User's Guide**



Literature Number: SNLU232A August 2018-Revised May 2019



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## DS90UH949A-Q1EVM or DS90UB949A-Q1EVM User's Guide

#### 1.1 General Description

The DS90Ux949A-Q1EVM (Evaluation Module) converts HDMI to FPD-Link III. This kit will demonstrate the functionality and operation of the DS90Ux949A-Q1. The DS90Ux949A-Q1 is an HDMI to FPD-Link III serializer which, in conjunction with the DS90Ux940-Q1/DS90Ux948-Q1 deserializers, takes the data from HDMI serial stream and translates it into either single- or dual-lane FPD-Link III interface. The DS90Ux949A-Q1 supports video resolutions up to 210 MHz for 3K (2880x1620) with 24-bit color depth.

The FPD-Link III interface supports video and audio data transmission and full duplex control, including I2C and SPI communication, over the same differential link. In backward-compatible mode, the device supports up to WXGA and 720p resolutions with 24-bit color depth over a single differential link.

The device supports up to 7.1 audio channels. Audio data received from the HDMI stream is encrypted, serialized, and sent out on the FPD-Link III stream to a compatible deserializer. Up to 8-channel I2S interface with maximum bit rate of 192 kHz.

The demo board is not intended for EMI testing. The demo board was designed for easy accessibility to device pins with tap points for monitoring or applying signals, additional pads for termination, and multiple connector options.

In this document:

- 1. The DS90UH949A-Q1EVM and DS90UB949A-Q1EVM devices are referred to as DS90Ux949A-Q1EVM.
- 2. The DS90UH949A-Q1 and DS90UB949A-Q1 devices are referred to as DS90Ux949A-Q1.
- 3. The DS90UH926-Q1 and DS90UB926-Q1 devices are referred to as DS90Ux926-Q1.
- 4. The DS90UH928-Q1 and DS90UB928-Q1 devices are referred to as DS90Ux926-Q1.
- 5. The DS90UH948-Q1 and DS90UB948-Q1 devices are referred to as DS90Ux948-Q1.
- 6. The DS90UH940-Q1 and DS90UB940-Q1 devices are referred to as DS90Ux940-Q1.



Features

#### 1.2 Features

- Supports pixel clock frequency up to 210 MHz for 3K (2880x1620) and 1080p60 resolutions with 24-bit color depth
- · HDMI receiver to accept HDMI as input
- Dual FPD-Link III output interface
  - Single channel: up to 105-MHz pixel clock
  - Dual channel: up to 210-MHz pixel clock
- Supports single-ended coaxial or differential shielded twisted-pair (STP/Q) cables
- Backward-compatible to DS90Ux926Q-Q1, DS90Ux928-Q1, DS90Ux940-Q1, and DS90Ux948-Q1 FPD-Link III deserializers
- @Speed BIST
- Supports 7.1 multiple I2S (4 data) channels
- Single +12-V power supply for EVM
- 1.8-V LVCMOS I/O interface
- 1.8-V or 3.3-V compatible LVCMOS I2C interface
- Automotive grade product: AEC-Q100 grade 2 qualified

#### 1.3 System Requirements

To demonstrate, the following is required:

- 1. FPD-Link III compatible deserializer
  - 1. DS90Ux940-Q1, DS90Ux948-Q1 up to 1080p60
  - 2. DS90Ux926Q-Q1, DS90Ux928-Q1 up to 720p60
- 2. HDMI source
- 3. Optional I2C controller
- 4. 12-V power supply at approximately 1 A (required)

#### 1.4 Contents of the Demo Evaluation Kit

1. One EVM board with the DS90Ux949A-Q1



#### 1.5 **Applications Diagram**

Figure 1-1 and Figure 1-2 show the use of the chipset in a display application.



HDMI – High Definition Multimedia Interface HDCP\* – High-Bandwidth Content Protection

\* Only on DS90UH devices



#### **Typical Configuration** 1.6



Figure 1-2. Typical Configuration



#### 1.7 Quick Start Guide

- 1. Configure switches S2, S3, and S6 to set the operating modes of the device
  - S2: MODE\_SEL0 = S2 switch position 1 = ON, all other switch positions = OFF (default factory setting)
  - S3: IDx = 0x18; S3 switch position 1 = ON, all other switch positions = OFF (default factory setting)
  - S6: MODE\_SEL1 = S6 switch ; position 1 = ON, all other switch positions = OFF (default factory setting)
- Connect P1 (DOUT[1:0]±) to the compatible deserializer (for example, the DS90Ux940-Q1EVM or DS90Ux948-Q1EVM using a STP cable (default))
- 3. Connect J8 to 12 V.
  - a. Optional power options available (see Table 1-3)
- 4. Plug in the HDMI source
- 5. Connect J34 with the miniUSB cable to PC USB port (5-pin\_ to USB A (4-pin))

For details of pin names and pin functions, see the DS90Ux949A-Q1 datasheet.





Figure 1-3. Interfacing to the EVM

Default Jumper Settings

#### 1.8 Default Jumper Settings

Ensure that the board has the default board jumper settings:

#### Table 1-1. Default Board Jumper Settings

Jumper	Jumper Settings
J5	Connect 2 and 3
J9	Connect 2 and 3
J11	Connect 2 and 3
J12	Connect 2 and 3
J20	Connect 2 and 3
J23	Connect 2 and 3
J40	Connect 2 and 3
J41	Connect 2 and 3

#### 1.9 Default Switch Settings

Ensure that the board has the default board switch settings:

#### Table 1-2. Default Board Switch Settings

Switch	Switch Settings
S2	1 ON (silk screen L side), 2-8 OFF (silk screen H side)
S3	1 ON (silk screen L side), 2-8 OFF (silk screen H side)
S6	1 ON (silk screen L side), 2-8 OFF (silk screen H side)
S5	1-2 OFF (silk screen H side), 3-4 ON (silk screen L side)

#### 1.10 Demo Board Connections

Designator	Signal	Description
J8	+12 V	12-V $\pm$ 5% Main Power, Single +12-V power connector that supplies power to the entire board.
J7.1 (Optional)	+1.1 V	1.1-V ±5%, Alternative to Main Power. If used, remove R17.
J10.1 (Optional)	+1.8 V	1.8-V ±5%, Alternative to Main Power. If used, remove R26.
J13.1 (Optional)	+3.3 V	3.3-V ±5%, Alternative to Main Power. If used, remove R29.
J4.1 (Optional)	+5 V	5-V ±5%, Alternative to Main Power. If used, remove R13.

#### Table 1-3. Power Supply

#### Table 1-4. FPD-Link III Output Signals P1 (HSD Connector)

Designator	Port	Signal
P1.1	EPD Link III Port 0	DOUT0-
P1.3		DOUT0+
P1.2	EPD Link III Port 1	DOUT1-
P1.4		DOUT1+

## Table 1-5. Alternative SMA FPD-Link III Output Signals (Note: SMAs are Not Connected by Default From the Factory)

Designator	Port	Signal
J15	FPD-Link III Port 0	DOUT0-
J17		DOUT0+
J14	EBD Link III Port 1	DOUT1-
J15		DOUT1+

#### Table 1-6. HDMI Input Signals

			-
	Designator	Signal	Description
	J18.12 J18.10	IN_CLK- IN_CLK+	HDMI TMDS clock input
Ī	J18.9 J18.7	IN_D0- IN_D0+	HDMI TMDS data0 input
Ī	J18.6 J18.4	IN_D1- IN_D1+	HDMI TMDS data1 input
	J18.3 J18.1	IN_D2- IN_D2+	HDMI TMDS data2 input

#### Table 1-7. USB2ANY Connector

Designator	Description
J34	mini USB 5 pin

#### Table 1-8. I2C/CCI Interface Header J25

Designator	Signal
J25.1	VDDI2C
J25.2	SCL
J25.3	SDA
J25.4	GND

Designator	Signal	Description
J26.18	SDIN/GPIO0	Aux I2S Data Input / Remote or Local I/O
J26.20	SWC/GPIO1	Aux I2S Word Clock Output / Remote or Local I/O
J26.2	I2S_DC/GPIO2	I2S Data Input / Remote or Local I/O
J26.4	I2S_DD/GPIO3	I2S Data Input / Remote or Local I/O
J26.8	I2S_DB/GPIO5_RE G	I2S Data Input / Local only I/O
J26.10	I2S_DA/GPIO6_RE G	I2S Data Input / Local only I/O
J26.12	I2S_WC/GPIO7_RE G	I2S Word Clock Input / Local only I/O
J26.14	I2S_CLK/GPIO8_RE G	I2S Clock Input / Local only I/O
J26.24	MCLK	I2S System Clock Output

Table 1-9. GPIO/Audio Interface

#### Table 1-10. SPI/D\_GPIO Interface

Designator	Signal	Description
J26.32	D_GPIO3/SS	I/O in Dual FPD-Link III mode / Slave Select
J26.30	D_GPIO2/SCLK	I/O in Dual FPD-Link III mode / Serial Clock
J26.28	D_GPIO1/MISO	I/O in Dual FPD-Link III mode / Master In, Slave Out
J26.26	D_GPIO0/MOSI	I/O in Dual FPD-Link III mode / Master Out, Slave In

Configuration of the device may be done through the MODE\_SEL[1:0]. These modes are latched into register location during power up:

Table 1-11. MODE SE	L[1:0] Settings
---------------------	-----------------

Mode	Setting	Function		
EDID_SEL: Display ID Select	0	Look for remote EDID, if none found, use internal SRAM EDID. Can be overridden from register. Remote EDID address may be overridden from default 0xA0.		
	1	Use external local EDID.		
ALITO SS: Auto Sloop State	0	Disable.		
AUTO-33. Auto Sleep-State	1	Enable.		
AUX_I2S: AUX Audio Channel	0 HDMI audio.			
	1	HDMI + AUX audio channel.		
EXT_CTL: External Controller	0	Internal HDCP/HDMI control.		
Override	1	External HDCP/HDMI control from I2C interface pins.		
	0	Enable FPD-Link III for twisted pair cabling.		
COAX. Cable Type	1	Enable FPD-Link III for coaxial cabling.		
REM_EDID_LOAD: Remote	0	Use internal SRAM EDID.		
EDID Load	1	If available, remote EDID is copied into internal SRAM EDID.		

#### Table 1-12. Configuration Select (MODE\_SEL0) -- SW-DIP8 - S2<sup>(1)</sup>

MODE #	EDID_SEL	AUX_I2S
1	0	0
2	0	1
3	1	0
4	1	1
(1) Oralis and an a lat		

<sup>(1)</sup> Only set one high.

Table 1-13. Configuration Select (MODE\_SEL1) - SW-DIP8 - S6<sup>(1)</sup>

MODE #	EXT_CTL	COAX	REM_EDID_LOAD
1	0	0	0
2	0	0	1
3	0	1	0
4	0	1	1
5	1	0	0
6	1	0	1
7	1	1	0
8	1	1	1

<sup>(1)</sup> Only set one high.

The strapped values can be viewed and/or modified in the following locations:

- EDID\_SEL: Latched into BRIDGE\_CTL[0], EDID\_DISABLE (0x4F[0]).
- AUX\_I2S: Latched into BRIDGE\_CFG[1], AUDIO\_MODE[1] (0x54[1]).
- EXT\_CTL: Latched into BRIDGE\_CFG[7], EXT\_CONTROL (0x54[7]).
- COAX: Latched into DUAL\_CTL1[7], COAX\_MODE (0x5B[7]).
- REM\_EDID\_LOAD: Latched into BRIDGE\_CFG[5] (0x54[5]).

#### Table 1-14. IDx SW-DIP8 - S3<sup>(1)</sup>

Designator	7-Bit Address	8-Bit Address
S3.1 (Default)	0x0C	0x18
S3.2	0x0E	0x1C
S3.3	0x10	0x20
S3.4	0x12	0x24
S3.5	0x14	0x28
S3.6	0x16	0x2C
S3.7	0x18	0x30
S3.8	0x1A	0x34

<sup>(1)</sup> Only set one high.

ALP Software Setup

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#### 1.11 ALP Software Setup

#### 1.11.1 System Requirements

Operating System:	Windows 7 64-bit
USB:	USB2ANY
USB2ANY Firmware Version:	2.5.2.0

#### 1.11.2 Download Contents

TI Analog LaunchPAD can be downloaded from: http://www.ti.com/tool/alp.

Download and extract the "snlc048.zip" file to a temporary location that can be deleted later.

Make sure J34 on the DS90Ux949A-Q1EVM is connected to a PC USB port with USB cable and power is applied to the DS90Ux949A-Q1EVM.

The following installation instructions are for the Windows 7 64-bit Operating System.

#### 1.11.3 Installation of the ALP Software

Execute the ALP Setup Wizard program called "ALPF\_setup\_v\_x\_x.exe" that was extracted to a temporary location on the local drive of your PC.

There are 7 installation steps after the setup wizard starts:

- 1. Click the "Next" button in the ALP Setup Wizard to start the installation.
- 2. Select "I accept the agreement" and then click the "Next" button.
- 3. Select the location to install the ALP software and then click the "Next" button.
- 4. Select the location for the start menu shortcut and then click the "Next" button.
- 5. Create the desktop icon on the next screen. After selecting the desired choices, click the "Next" button.
- 6. Click the "Install" button to install the software in the selected location.
- 7. Uncheck "Launch Analog LaunchPAD" and click the "Finish" button. The ALP software can start if "Launch Analog LaunchPAD" is checked, but it will not be useful until the USB driver is installed and board is attached.

Connect the J34 USB jack of the DS90Ux949A-Q1EVM board to a PC or laptop USB port using a Type A

power supply to launch the "Found New Hardware Wizard" on the PC or laptop.



#### 1.11.4 Start-Up - Software Description

Make sure all the software has been installed and the hardware is powered on and connected to the PC. Execute "Analog LaunchPAD" shortcut from the start menu. The default start menu location is under All Programs  $\rightarrow$  Texas Instruments  $\rightarrow$  Analog LaunchPAD vx.x.x  $\rightarrow$  Analog LaunchPAD to start MainGUI.exe.



Figure 1-4. Launching ALP

The application should come up in the state shown in Figure 1-5. If it does not, see Section 1.12, "Troubleshooting ALP Software".

**NOTE:** The ALP window graphics in this document show "DS90UH949", and the document text refers to the DS90Ux949. Replace the "DS90Ux949" text with "DS90UH949" if you have the DS90UH949A-Q1EVM or "DS90UB949" if you have the DS90UB949A-Q1EVM.



#### ALP Software Setup

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Under the Devices tab, select "DS90UH949" for the DS90UB949A-Q1EVM or "DS90UB949" for the DS90UB949A-Q1EVM to open up the device profile with its associated tabs.



#### Figure 1-5. Initial ALP Screen

After selecting the DS90Ux949, the screen shown in Figure 1-6 should appear.

Texas Instruments - Analog LaunchP	AD					_		_	
Tasks		USB2ANY 175F99460F000600/1) - D590UH949							
පු Devices	8	Information HDMI	HDCP Authentication	System Topology	Pattern Generator	Registers	Scripting	BIST	Remote Registers
<ul> <li>USB2ANY 175F99460F000600</li> <li>DSS0UH949</li> <li>Tools</li> <li>System Scripting</li> <li>Plug-in Management</li> <li>LPT Configuration</li> <li>USB2ANY/Aardvark Setup</li> <li>Demo Mode Setup</li> <li>Dewice Profiles</li> <li>EFEPCM Setup</li> </ul>	8	Device Informatio Device: Revision: I2C Address: Pixel Clock Range Repeater Mode: Serial Link Mode: Audio Mode: Partner Informatio Device: Revision: I2C Address:	n DS90UH949 HD 1 0x18 20-85 MHz Disabled FPD-Link III Surround DS90UH948 FP 1 0x58	MI-to-FPD-Link III i D-Link III Deserializ	Bridge with HDCP				
Preferences	% %	Pixel Clock Range Repeater Mode: Serial Link Mode: Audio Mode:	: 20-85 MHz Disabled FPD-Link III Surround						
		Current Link Statu Linked to Deserial Linked to Video So	is izer: Yes surce: No						
ALP Framework		h							

#### Figure 1-6. Follow-Up Screen



#### 1.11.5 Information Tab

The Information tab is shown in Figure 1-7. Note the device revision could be different.

asks	(USB2ANY 175F994	60F000600/1) - D59	0UH949					
Devices	Information HDMI	HDCP Authentication	System Topology	Pattern Generator	Registers	Scripting	BIST	Remote Registers
<ul> <li>USB2ANY 175F99460F000600</li> <li>DS90UH949</li> <li>Tools</li> <li>System Scripting</li> <li>Plug-in Management</li> <li>LPT Configuration</li> <li>USB2ANY/Aardvark Setup</li> <li>Demo Mode Setup</li> <li>Device Profiles</li> <li>EEPROM Setup</li> <li>Preferences</li> <li>Help</li> </ul>	<ul> <li>Device Informatic Device: Revision: I2C Address: Pixel Clock Range Repeater Mode: Audio Mode: Audio Mode:</li> <li>Partner Informati Device: Revision: I2C Address: Pixel Clock Range Repeater Mode: Serial Link Mode: Audio Mode:</li> <li>Current Link Statt Linked to Deseria Linked to Video Statistica</li> </ul>	In Contract Contract of Contra	MI-to-FPD-Link III E	Bridge with HDCP				

Figure 1-7. ALP Information Tab



ALP Software Setup

#### 1.11.6 HDMI Tab

The HDMI tab is shown in Figure 1-8.

Tasks	(USB2ANY 175F99460F000600/1) - DS90UH949
B Devices	Information HDMI HDCP Authentication System Topology Pattern Generator Registers Scripting BIST Remote Registers
	Bridge Control Settings   FPD-Link III Mode Auto-detect   FPD-Link III Mode Surround   EDID Mode Internal SRAM   Bridge Control Mode Internal   Ø Disable Remote EDID Load   Disable Auto HDMI Init   Disable Auto HDMI Init   Disable Auto HDMP   Apply Settings

Figure 1-8. ALP HDMI Tab

#### 1.11.7 Pattern Generator Tab

The SER Pattern Generator tab is shown in Figure 1-9.

Tasks	(US82ANY 175F99460F000600/1) - DS90UH949					
Devices	Information HDMI HDCP Authentication System Topology Pattern Generator Registers Scripting BIST Remote Registers					
C USB2ANY 175F99460F000600	Pattern Generator Control V2     Video Control       Enable Generator     Invert Video       Enable Scrolling     18-bit Color   Internal Timing					
<ul> <li>System Scripting</li> <li>Plug-in Management</li> <li>LPT Configuration</li> <li>USB2ANY/Aardvark Setup</li> <li>Demo Mode Setup</li> <li>Device Profiles</li> <li>EEPROM Setup</li> </ul>	Checkerboard/VCOM Control Scale by 16 Reverse VCOM Use Custom Color Fixed Pattern White  Custom Color # 000000 Auto-Scrolling Control Number of Patterns 14  Frames per Pattern 60 Pattern 1 White  Pattern 9 H Black/Blue  Pattern 1 White  Pattern 9 H Black/Blue  Pattern 1 White Pattern 9 H Black/Blue  Pattern 1 White Pattern 9 H Black/Blue  Pattern 1 White Pattern 9 H Black/Blue  Pattern 1 White Pattern 9 H Black/Blue  Pattern 1 White Pattern 9 H Black/Blue  Pattern 1 White Pattern 9 H Black/Blue Pattern 1 White Pattern 9 H Black/Blue Pattern 1 White Pattern 9 H Black/Blue Pattern 1 White Pattern 9 H Black/Blue Pattern 1 White Pattern 9 H Black/Blue Pattern 1 White Pattern 9 H Black/Blue Pattern 1 White Pattern 9 H Black/Blue Pattern 1 White Pattern 9 H Black/Blue Pattern 1 White Pattern 9 H Black/Blue Pattern 9 H Bla					
Preferences	Pattern 2 Black   Pattern 10 V Black/White  Active Area  I 280  720					
() Help	Pattern 3 Red     Pattern 11 V Black/Red       Pattern 4 Green     Pattern 12 V Black/Green       Status					
	Pattern 5     Blue     Pattern 13     V Black/Blue     Approximate Frames/Second: N/A       Pattern 6     H Black/White     Pattern 14     Custom     Detected Dimensions: 0x0					
	Pattern 7 H Black/Red   Pattern 15 VCOM					
	Pattern 8 H Black/Green 🔻 Pattern 16 Checker 💌					

Figure 1-9. ALP Pattern Generator Tab



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#### 1.11.8 Registers Tab

The Registers tab is shown in Figure 1-10.

Tasks 쀁 Devices		(USB2ANY 175F99460F000600/1) - D590UH949					
		Information HDMI HDCP Authentication System Topology Pattern Generator Registers Scripting	g BIST	Remot	e Registers		
😋 USB2ANY 175F99460F000600		Value: 00 Apply Refresh Refresh All Verbose Descriptions					
• Tools	۲	(2) 0x00 - I2C Device ID	۲	*	Display		
System Scripting		🗱 0x01 - Reset	۲	E	(		
Plug-in Management		23 0x03 - General Configuration			Load		
IPT Configuration		22 0x04 - Mode Select	۲		Save		
S USB2ANY/Aardvark Setup		😂 0x05 - I2C Master Config	۲				
Demo Mode Setun		😂 0x06 - DES ID	۲				
		段 0x07 - SlaveID[0]	۲				
E FERROM Setup		😫 0x08 - SlaveAlias[0]	۲				
	_	😫 0x09 - Reserved	۲				
Preferences	۲	🗱 0x0A - CRC Errors	۲				
() Help	8	😂 0x0B - CRC Errors	۲				
		없 0x0C - General Status	۲				
				段 0x0D - GPIO[0] Config	۲		
					2 0x0E - GPIO[1] and GPIO[2] Config	۲	
		428 0x0F - GPIO[3] Config	۲				
		42 0x10 - GPIO[5] and GPIO[6] Config	۲				
		0x11 - GPIO[7] and GPIO[8] Config     s					
		194 Nv12 - Datanath Control	(*	*			

Figure 1-10. ALP Registers Tab



#### 1.11.9 Registers Tab - Address 0x00 Selected

Address 0x00 selected as shown in Figure 1-11. Note that the "Value: 18 the hex value of that register.

, will now show

ALP Software Setup

Tasks		(USB2ANY 175F99460F000600/1) - D590UH949				
ង្ហី Devices	۲	Information HDMI HDCP Authentication System Topology Pattern Generator Registers Scripting BIST	Remote	Registers		
CS90UH949		Value: 18 Apply Refresh All Verbose Descriptions				
• Tools	۲	(2) 0x00 - 12C Device ID 😵	*	Display		
System Scripting		😫 0x01 - Reset 😵	E			
Plug-in Management		😫 0x03 - General Configuration 😵		Load		
IPT Configuration		😫 0x04 - Mode Select 😵	Sav	Save		
S USB2ANY/Aardvark Setup		😫 0x05 - 12C Master Config 🛛 😵				
Demo Mode Settin		🗱 0x06 - DES ID 🛞				
		😫 0x07 - SlaveID[0] 😵				
EEDDOM Setup		(2 0x08 - SlaveAlias[0] (8				
		🗱 0x09 - Reserved 😵				
Preferences	8	🗱 0x0A - CRC Errors 😵				
()) Help	*	😫 0x0B - CRC Errors 😵				
-		🗱 0x0C - General Status 😵				
		😫 0x0D - GPIO[0] Config 😵				
		🗱 0x0E - GPIO[1] and GPIO[2] Config 😵				
		🗱 0x0F - GPIO[3] Config 😵				
		🗱 0x10 - GPIO[5] and GPIO[6] Config 😵				
		🗱 0x11 - GPIO[7] and GPIO[8] Config 🛛 😵				
		83 Ov 12 - Datanath Control	*			

Figure 1-11. ALP Device ID Selected



#### 1.11.10 Registers Tab - Address 0x00 Expanded

Double-click on the Address bar

🕼 0x00 - I2C Device ID

획 or single-click the 遂

to expand the Address 0x00 content by bits. Any register address displayed can be expanded.

asks		(USB2ANY 175F99460F000600/1) - DS90UH949	
Devices	۲	Information HDMI HDCP Authentication System Topology Pattern Generator Registers Scripting BIST	Remote Registers
C USB2ANY 175F99460F000600		Value: 18 Apply Refresh All Verbose Descriptions	
Tools	۲	🗱 0x00 - I2C Device ID 🛞	Display
<ul> <li>System Scripting</li> <li>Plug-in Management</li> <li>LPT Configuration</li> <li>USB2ANY/Aardvark Setup</li> <li>Demo Mode Setup</li> </ul>		Bit(s)         Type         Default         Name         Description           7         6         5         RW         0         DEVICE ID         7-bit address of Serializer; 0x58h           4         3         2         1         0         RW         0         SER ID         0: Device ID is from CAD           0         RW         0         SER ID         0: Device ID is from CAD         1: Register I2C Device ID overrides CAD	E Load Save
EEDDOM Setup		😫 0x01 - Reset 😵	
		2 0x03 - General Configuration	
Preferences	۲	😫 0x04 - Mode Select 🔹	
) Help	۲	20 0x05 - 12C Master Config V	
		\$2 0X06 - DES ID	
		20 0x07 - SlaveAlae[0]	
		All Ov00 - Decenved	
		A DVDA - CPC Errore	
		(%) Ov0R - CRC Errors	
		20 0x00 cite Lifes	-

Figure 1-12. ALP Device ID Expanded

#### <u>Type</u>

Any RW Type register ( RW ) can be written into by either:

- writing the hex value into the "Value:" box ( Value: 00)
- putting the pointer into the individual register bit(s) box by a left mouse click to put a check mark (indicating a "1"),
- unchecking the check mark (indicating a "0").

Click "Apply" to write to the register and "Refresh" to see the new value of the selected (highlighted) register.

The box toggles on every mouse click.





#### 1.11.11 Scripting Tab

The Scripting tab is shown in Figure 1-13.

🛂 Texas Instruments - Analog Launc	hPAD	
Tasks		(US82AIIY 175F99460F000600/1) - DS90UH949
E Devices	۲	Information HDMI HDCP Authentication System Topology Pattern Generator Register Scripting BIST Remote Registers
USB2ANY 175F99460F000600	۲	Texas Instruments - Analog LaunchPAD © 2007-2013 Texas Instruments Inc. All Rights Reserved The variable "board" contains the selected daughter board object. The variable "alpBoards" contains a list of ALP Board objects present on this machine. > A CEC RX before
UFT Configuration USB2ANY/Aardvark Setup Demo Mode Setup Device Profiles EFEROM Setup		E CEC_TX_before masterAux
Preferences	*	
() Help	8	
LP Framework		

#### Figure 1-13. ALP Scripting Tab

The script window provides a full Python scripting environment that can be used for running scripts and interacting with the device in an interactive or automated fashion.

### WARNING

Directly interacting with devices either through register modifications or by calling the device support library functions can effect the performance and/or functionality of the user interface and may even crash the ALP Framework application.

#### 1.12 Troubleshooting ALP Software

#### 1.12.1 ALP Loads the Incorrect Profile

If ALP opens with the incorrect profile loaded, the correct profile can be loaded from the USB2ANY/Aardvark Setup found under the tools menu.

Index         Devices         IDEX	🚦 Texas Instruments - Analog Launcl	hPAD		172.				
Subsurgers          3 Tools       System Scripting         Plug-in Management       Tools Scripting         DenorMode Sctup       DenorMode Sctup         Device Profiles       EthROM Sctup         Preferences       One Sctup         Preferences       One Sctup         Device Profiles       EthROM Sctup <th>Devices           Image: Contract of the second sec</th> <th>۲</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	Devices           Image: Contract of the second sec	۲						
System Soripting       Pug-in Management       UsB2ANY/Aardvark sorieting       Device Profiles       EEPROM Setup       Preferences       Wildig       Male       Connector 2       Male       Connector 1	DS90UB927		<b>O</b> .	transfer and the second se	-	1151		. 0
Preferences     Welp     Use unit of a second of	System Scripting Plug-in Management USE Configuration USE 2ANY/Aardvark Self Device Profiles EEPROM Setup	~		Connector 4			Connector 3	Zdeado
	Preferences     Preferences     Preferences	8	USB Company Co	Connector 2		Analog Launc ALP100 Tell_state State of the state State of the state o	Dengwer fan	



1. Highlight the incorrect profile in the Defined ALP Devices list and click the remove button.

asks Devices	۲	ALP Profiles Setup for Aardvark/USB2	ZANY		
Tools	۲	Aardvark/USB2ANY Setup This dialog provides a method to setu Framework. Each emulated device m Nano board or LPT Phy MDIO board.	up the types of devices desired for emula ust be attached to a virtual ALP FPGA boa	tion inside the ALP ard (base board), ALP	
Plug-in Management		Defined ALP Devices	Select a Daughter Board		
LPT Configuration		USB2ANY 175F99461A000600	Name	Short Name	
USB2ANY/Aardvark Setup Demo Mode Setup Device Profiles EEPROM Setup			AVS_Demo CP104_Nano DP83640_Nano DS1008R210_111 DS1008R210_111	AVS_Demo CP 104 - Nano DP83640 DP83640 DS 100BRxxx Duals DS 100BRxxx Duals	SMA Connecto SMA Connecto
) Preferences () Help	8	Add FPGA Remove	DS100KR800_401 DS100MB203 DS110DF410 DS110DF410Standalone	DS100KR800_401 DS100MB203 MUX DS110DF410 EVK DS110DF410 Retimer	1
			Add Ok Cancel	DC13CDD111	

Figure 1-15. Remove Incorrect Profile



2. Find the correct profile under the Select a Daughter Board list, highlight the profile, and click Add.



Figure 1-16. Add Correct Profile

3. Click Ok and the correct profile should load.

Tasks							
Devices	ALP Profiles Setup for Aardvark/USB2ANY						
Tools System Scripting	Aardvark/USB2ANY Setup This dialog provides a method to setup the types of devices desired for emulation inside the ALP Framework. Each emulated device must be attached to a virtual ALP FPGA board (base board), ALP Nano board or LPT Phy MDIO board.						
Plug-in Management	Defined ALP Devices	Select a Daughter Board	1	an some b fin			
LPT Conguration     USB2ANY/Aardvark Setup     Demo Mode Setup     Device Profiles     EEPROM Setup	С С С С С С С С С С С С С С С С С С С	DS90UH928 DS90UH929 DS90UH940 DS90UH947 DS90UH948 DS90UH949	DS90UH928 DS90UH929 DS90UH940 DS90UH947 DS90UH948 DS90UH948	24400 SMA Connector 20400 SMA 20400 Connector			
2) Preferences (2) Help	Add FPGA Remove Add Nano Add LPT MDIO	DS90UR910 ds90ur916 EOM EOM_12Gbps EdLinkt conPart Add	DS90UR910 DS90UR916 EOM - Nano EOM - Nano - 12Gbps Ett int Loop Back Board				
ALP Framework							





Troubleshooting ALP Software

#### 1.12.2 ALP Does Not Detect the EVM

If the window shown in Figure 1-18 opens after starting the ALP software, double check the hardware setup.



Figure 1-18. ALP No Devices Error

1. Check the device manager to make sure that the USB driver is installed. There should be a "HIDcompliant device" under the "Human Interface Devices" as shown in Figure 1-19.



Figure 1-19. Windows 7, ALP USB Driver



 Check to make sure the software starts with only "DS90Ux949" in the "Devices" drop-down menu. If there are more devices then the software is most likely in demo mode. When the ALP is operating in demo mode there is a "(Demo Mode)" indication in the lower left of the application status bar as shown in Figure 1-20.



Figure 1-20. ALP in Demo Mode

3. Select the "Preferences" drop-down menu and un-check the "Enable Demo Mode" check mark to disable the demo mode.

💩 Tools	*
Preferences	۲
Enable Demo Mode	
(2) Help	8

Figure 1-21. ALP Preferences Menu

After demo mode is disabled, the ALP software will poll the ALP hardware. The ALP software will update and only have "DS90UH949" or "DS90UB949" under the "Devices" drop-down menu.



### 1.13 Typical Connection and Test Equipment

The following is a list of typical test equipment that may be used to generate signals for the serializer inputs:

- 1. Digital Video Source for generation of specific display timing such as Digital Video Processor or Graphics Controller (GPU) with HDMI or OpenLDI output.
- Any other signal generator / video source This video generator may be used for video signal sources for DVI or DP++
- 3. Any other signal / video generator that provides the correct input levels as specified in the datasheet.

Figure 1-22 shows a typical test set up using a Graphics Controller and display.





Figure 1-23 shows a typical test set up using a video generator and logic analyzer.







#### 1.14 Equipment References

**NOTE:** The following references are supplied only as a courtesy to our valued customers. It is not intended to be an endorsement of any particular equipment or supplier.

#### **Digital Video Pattern Generator:**

Astrodesign

www.astro-americas.com

#### Logic Analyzer:

keysight Technologies

www.keysight.com

#### Corelis CAS-1000-I2C/E I2C Bus Analyzer and Exerciser Products:

www.corelis.com/products/I2C-Analyzer.htm

#### Aardvark I2C/SPI Host Adapter Part Number: TP240141

www.totalphase.com/products/aardvark\_i2cspi

#### 1.15 Cable References

For optimal performance, TI recommends a Shielded Twisted-Pair (STP), 24 AWG (or larger diameter) cable with a  $100-\Omega$  differential impedance for high-speed data applications.

#### Leoni Dacar 538 series cable:

www.leoni-automotive-cables.com

#### **Rosenberger HSD connector:**

www.rosenberger.de/en/Products/35\_Automotive\_HSD.php



## **Bill of Materials**

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
IPCB1	1		Printed Circuit Board		HSDC016	Any
C15, C24, C39	3	10pF	CAP, CERM, 10 pF, 50 V,+/- 5%, C0G/NP0, 0402	0402	GRM1555C1H10 0JA01D	MuRata
C16	1	1.8pF	CAP, CERM, 1.8 pF, 50 V,+/- 5%, C0G/NP0, 0402	0402	GRM1555C1H1 R8CA01D	MuRata
C17, C21, C26, C27, C31, C35, C38, C40, C43, C44, C46, C47, C50, C54, C55, C57, C112, C113, C114, C121, C122, C124, C125, C127, C128	25	0.1uF	CAP, CERM, 0.1 μF, 16 V,+/- 10%, X7R, 0402	0402	GRM155R71C10 4KA88D	MuRata
C18	1	100uF	CAP, TA, 100 μF, 16 V, +/- 20%, 0.1 ohm, SMD	7343-31	T495D107M016 ATE100	Kemet
C19, C58, C66, C73, C80, C89, C92	7	47uF	CAP, CERM, 47 μF, 16 V,+/- 20%, X5R, 1210	1210	GRM32ER61C4 76ME15L	MuRata
C20, C28, C41, C45, C56, C115, C123	7	10uF	CAP, CERM, 10 μF, 10 V,+/- 10%, X7R, 0805	0805	GRM21BR71A1 06KE51L	MuRata
C22	1	3300pF	CAP, CERM, 3300 pF, 50 V,+/- 10%, X7R, 0402	0402	GRM155R71H33 2KA01D	MuRata
C23	1	1uF	CAP, CERM, 1 μF, 16 V,+/- 10%, X7R, 0603	0603	C1608X7R1C10 5K080AC	TDK
C25, C32, C37, C42, C59, C67, C74, C81, C90, C93	10	4.7uF	CAP, CERM, 4.7 μF, 16 V,+/- 10%, X7R, 0805	0805	GRM21BR71C4 75KA73L	MuRata
C29	1	22uF	CAP, TA, 22 μF, 25 V, +/- 20%, 0.7 ohm, SMD	7343-31	293D226X0025D 2TE3	Vishay-Sprague
C30	1	2.2uF	CAP, TA, 2.2 μF, 25 V, +/- 10%, 6.3 ohm, SMD	3216-18	293D225X9025A 2TE3	Vishay-Sprague
C33	1	0.01uF	CAP, CERM, 0.01 μF, 100 V,+/- 5%, X7R, 0603	0603	06031C103JAT2 A	AVX

#### Table 2-1. Bill of Materials



Table 2-1.	Bill of	Materials (	(continued)	
		matorialo	(oonaoa)	

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C34, C36	2	20pF	CAP, CERM, 20 pF, 50 V,+/- 5%, C0G/NP0, 0402	0402	GRM1555C1H20 0JA01D	MuRata
C48, C49, C51, C52, C53	5	4.7pF	CAP, CERM, 4.7 pF, 25 V,+/- 5%, C0G/NP0, 0402	0402	GRM1555C1E4 R7CA01D	MuRata
C60, C68, C75, C82, C94	5	10uF	CAP, CERM, 10 μF, 10 V,+/- 10%, X5R, 0805	0805	C0805C106K8P ACTU	Kemet
C61, C69, C76, C78, C83, C95, C96, C97, C98, C99, C100, C101	12	1uF	CAP, CERM, 1 μF, 16 V,+/- 10%, X5R, 0603	0603	C0603C105K4P ACTU	Kemet
C62, C63, C64, C65, C70, C71, C72, C77, C79, C84, C85, C86, C87, C88, C91	15	0.1uF	CAP, CERM, 0.1 μF, 25 V,+/- 10%, X7R, 0603	0603	06033C104KAT2 A	AVX
C104, C106, C108, C109	4	0.1uF	CAP, CERM, 0.1 μF, 50 V,+/- 10%, X7R, 0402	0402	C1005X7R1H10 4K050BB	TDK
C110	1	0.012uF	CAP, CERM, 0.012 μF, 16 V,+/- 10%, X7R, 0402	0402	GRM155R71C12 3KA01D	MuRata
C116, C120	2	220pF	CAP, CERM, 220 pF, 50 V,+/- 1%, C0G/NP0, 0603	0603	06035A221FAT2 A	AVX
C117, C118	2	30pF	CAP, CERM, 30 pF, 100 V,+/- 5%, C0G/NP0, 0603	0603	GRM1885C2A30 0JA01D	MuRata
C119	1	2200pF	CAP, CERM, 2200 pF, 50 V,+/- 10%, X7R, 0603	0603	C0603X222K5R ACTU	Kemet
C126	1	0.47uF	CAP, CERM, 0.47 μF, 16 V,+/- 10%, X7R, 0603	0603	GRM188R71C47 4KA88D	MuRata
D1	1	40V	Diode, Schottky, 40 V, 1 A, SOD- 123	SOD-123	1N5819HW-7-F	Diodes Inc.
D2, D3, D5	3	Green	LED, Green, SMD	1.6x0.8x0.8mm	LTST-C190GKT	Lite-On
D4	1	Orange	LED, Orange, SMD	1.6x0.8x0.8mm	LTST- C190KFKT	Lite-On
F1	1		Fuse, 7 A, 24VAC/VDC, SMD	3.18x1.52x1.14m m	0429007.WRML	Littelfuse
H1, H2, H5, H6	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
H3, H4, H7, H8	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B and F Fastener Supply



Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
J4, J6, J7, J10, J13, J19, J21, J22, J24, J29, J30, J31, J32, J33, J35, J36, J39, J40	18		Header, 100mil, 2x1, Gold, TH	Header, 2x1, 100mil	5-146261-1	TE Connectivity
J5, J9, J11, J12, J20, J23, J41, J42	8		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G- S	Samtec
J8	1		Connector, DC Jack 2.1X5.5 mm, TH	POWER JACK, 14.4x11x9mm	PJ-102A	CUI Inc.
J14, J15, J16, J17	4		Connector, End launch SMA, 50 ohm, SMT	SMA End Launch	142-0701-851	Cinch Connectivity
J18	1		Connector, HDMI, 19-Pos Recept, SMT	15.0x6.08x11.55 mm	1747981-1	TE Connectivity
J25, J27	2		Header (friction lock), 100mil, 4x1, Gold, TH	Header 4x1 keyed	0022112042	Molex
J26	1		Header, 100mil, 16x2, Gold, TH	16x2 Header	TSW-116-07-G- D	Samtec
J28	1		Header, 100mil, 4x1, Gold, TH	4x1 Header	TSW-104-07-G- S	Samtec
J34	1		Connector, Receptacle, Mini-USB Type B, R/A, Top Mount SMT	USB Mini Type B	1734035-2	TE Connectivity
L3	1	4.7uH	Inductor, Shielded Drum Core, Ferrite, 4.7 uH, 4.2 A, 0.02 ohm, SMD	WE-TPC-XLH2	7440650047	Wurth Elektronik
L4, L5	2		Coupled inductor, 0.22 A, 0.59 ohm, SMD	Inductor, 1.2x1.2x2.0 mm	DLW21SN261X Q2L	MuRata
L6, L9	2	1000 ohm	Ferrite Bead, 1000 ohm @ 100 MHz, 0.3 A, 0805	0805	BK2125HS102-T	Taiyo Yuden
L7, L8, L10	3	120 ohm	Ferrite Bead, 120 ohm @ 100 MHz, 3 A, 0603	0603	BLM18SG121TN 1D	MuRata
L12	1	330 ohm	Ferrite Bead, 330 ohm @ 100 MHz, 1.5 A, 0603	0603	BLM18SG331TN 1D	MuRata
P1	1		Right Angle Plug for PCB, TH	HSD connector, Waterblue	D4S20G-400A5- Z	Rosenberger
Q1, Q2, Q3, Q4	4	50V	MOSFET, N-CH, 50 V, 0.22 A, SOT-23	SOT-23	BSS138	Fairchild Semiconductor
R11	1	121k	RES, 121 k, 1%, 0.063 W, 0402	0402	CRCW0402121K FKED	Vishay-Dale
R12	1	22.1k	RES, 22.1 k, 1%, 0.063 W, 0402	0402	CRCW040222K1 FKED	Vishay-Dale
R13, R17, R26, R29	4	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000 Z0EA	Vishay-Dale



Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R14, R18, R22, R27	4	100k	RES, 100 k, 5%, 0.063 W, 0402	0402	CRCW0402100K JNED	Vishay-Dale
R15, R42, R45, R119, R120, R121, R174, R178	8	10.0k	RES, 10.0 k, 1%, 0.063 W, 0402	0402	CRCW040210K0 FKED	Vishay-Dale
R16	1	3.24k	RES, 3.24 k, 1%, 0.063 W, 0402	0402	CRCW04023K24 FKED	Vishay-Dale
R19	1	1.87k	RES, 1.87 k, 1%, 0.063 W, 0402	0402	CRCW04021K87 FKED	Vishay-Dale
R20, R24, R28, R33, R34, R36, R37, R38, R39, R40, R41, R43, R44, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R60, R61, R63, R122, R123, R127, R128, R130, R132, R133, R138, R142, R144, R145, R146, R147, R148, R149, R150, R152, R153, R154, R155, R156, R157, R158, R159, R160, R162, R163, R165	54	0	RES, 0, 5%, 0.063 W, 0402	0402	ERJ-2GE0R00X	Panasonic
R21	1	4.99k	RES, 4.99 k, 1%, 0.063 W, 0402	0402	CRCW04024K99 FKED	Vishay-Dale
R23	1	23.2k	RES, 23.2 k, 1%, 0.063 W, 0402	0402	CRCW040223K2 FKED	Vishay-Dale
R25	1	12.1k	RES, 12.1 k, 1%, 0.063 W, 0402	0402	CRCW040212K1 FKED	Vishay-Dale
R30, R31, R32	3	470	RES, 470, 5%, 0.063 W, 0402	0402	CRCW0402470 RJNED	Vishay-Dale
R35	1	1.0k	RES, 1.0 k, 5%, 0.063 W, 0402	0402	CRCW04021K00 JNED	Vishay-Dale
R46, R47, R151	3	4.7k	RES, 4.7 k, 5%, 0.063 W, 0402	0402	CRCW04024K70 JNED	Vishay-Dale
R58, R59	2	47k	RES, 47 k, 5%, 0.063 W, 0402	0402	CRCW040247K0 JNED	Vishay-Dale
R62	1	27k	RES, 27 k, 5%, 0.063 W, 0402	0402	CRCW040227K0 JNED	Vishay-Dale
R65, R74, R101	3	118k	RES, 118 k, 1%, 0.063 W, 0402	0402	CRCW0402118K FKED	Vishay-Dale
R66, R75, R102	3	107k	RES, 107 k, 1%, 0.063 W, 0402	0402	CRCW0402107K FKED	Vishay-Dale
R67, R76, R103	3	113k	RES, 113 k, 1%, 0.063 W, 0402	0402	CRCW0402113K FKED	Vishay-Dale
R68, R77, R104	3	82.5k	RES, 82.5 k, 1%, 0.063 W, AEC- Q200 Grade 0, 0402	0402	CRCW040282K5 FKED	Vishay-Dale



				. ,		
Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R69, R78, R105	3	68.1k	RES, 68.1 k, 1%, 0.063 W, 0402	0402	CRCW040268K1 FKED	Vishay-Dale
R70, R79, R106	3	56.2k	RES, 56.2 k, 1%, 0.063 W, 0402	0402	CRCW040256K2 FKED	Vishay-Dale
R71, R80, R107	3	13.3k	RES, 13.3 k, 1%, 0.063 W, 0402	0402	CRCW040213K3 FKED	Vishay-Dale
R82, R91, R109	3	40.2k	RES, 40.2 k, 1%, 0.063 W, 0402	0402	CRCW040240K2 FKED	Vishay-Dale
R83, R92, R110	3	30.9k	RES, 30.9 k, 1%, 0.063 W, 0402	0402	CRCW040230K9 FKED	Vishay-Dale
R84, R93, R111	3	51.1k	RES, 51.1 k, 1%, 0.063 W, 0402	0402	CRCW040251K1 FKED	Vishay-Dale
R85, R94, R112	3	88.7k	RES, 88.7 k, 1%, 0.063 W, 0402	0402	CRCW040288K7 FKED	Vishay-Dale
R86, R95, R113	3	102k	RES, 102 k, 1%, 0.063 W, 0402	0402	CRCW0402102K FKED	Vishay-Dale
R87, R96, R114	3	137k	RES, 137 k, 1%, 0.063 W, 0402	0402	CRCW0402137K FKED	Vishay-Dale
R88, R97, R115	3	210k	RES, 210 k, 1%, 0.063 W, 0402	0402	CRCW0402210K FKED	Vishay-Dale
R118	1	1.00k	RES, 1.00 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1001X	Panasonic
R161	1	49.9	RES, 49.9, 1%, 0.063 W, 0402	0402	CRCW040249R 9FKED	Vishay-Dale
R170, R171	2	33	RES, 33, 5%, 0.063 W, 0402	0402	CRCW040233R 0JNED	Vishay-Dale
R172, R179, R180	3	1.5k	RES, 1.5 k, 5%, 0.063 W, 0402	0402	CRCW04021K50 JNED	Vishay-Dale
R173, R176	2	33k	RES, 33 k, 5%, 0.063 W, 0402	0402	CRCW040233K0 JNED	Vishay-Dale
R175	1	1.2Meg	RES, 1.2 M, 5%, 0.1 W, 0603	0603	CRCW06031M2 0JNEA	Vishay-Dale
R177	1	200	RES, 200, 5%, 0.063 W, 0402	0402	CRCW0402200 RJNED	Vishay-Dale
S2, S3, S6	3		Switch, Slide, SPST 8 poles, SMT	Switch, 8Pos, 21.8x3.8x6.7 mm	219-8MST	CTS Electrocompone nts
S4, S7, S8	3		SWITCH TACTILE SPST- NO 0.02A 15V, TH	6x4.3x6mm	EVQ-PAD04M	Panasonic
			'Tactile Switch Through-hole- mounting Switches	SW_TACT	B3F-1000	OMRON
S5	1		DIP Switch, 4 position slide actuator, SPST, SMD	SMT DIP switch	A6S-4104-H	Omron Electronic Components
SH-J1, SH-J2, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8	7	1x2	Shunt, 2mm, Gold plated, Black	2mm Shunt, Closed Top	2SN-BK-G	Samtec
TP2, TP5, TP11	3		Terminal, Turret, TH, Double	Keystone1502-2	1502-2	Keystone



Table 2-1. Bill of Materials (continued)						
t <b>y</b>	Value	Description	Package Reference	Part Numb		

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
U2	1		4.5V to 18V Input, 2A Synchronous Step-Down Converter, PWP0014E (TSSOP-14)	PWP0014E	TPS54225PWP R	Texas Instruments
U3	1		Single Output LDO, 500 mA, Adjustable 0.8 to 3.6 V Output, 0.8 to 5.5 V Input, with Programmable Soft Start, 10-pin SON (DRC), -40 to 125 degC, Green (RoHS and no Sb/Br)	DRC0010J	TPS74701DRCR	Texas Instruments
U4	1		Dual Output LDO, 1 A, Fixed 1.8, 3.3 V Output, 2.7 to 10 V Input, 28-pin HTSSOP (PWP), -40 to 125 degC, Green (RoHS and no Sb/Br)	PWP0028D	TPS767D318PW P	Texas Instruments
U5	1		Socket, DIP-8, Sleeve Pin, 2.54 mm Pitch	DIP-8, Body 10.16x10.16mm, Pitch 2.54mm	110-13-308-41- 001000	Mill-Max
U6	1		Automotive 210MHz HDMI to FPD-Link III Bridge Serializer with HDCP, RGC0064K (VQFN-64)	RGC0064K	DS90UH949ATR GCRQ1 for Variant -001	Texas Instruments
			Automotive 210MHz HDMI to FPD-Link III Bridge Serializer, RGC0064K (VQFN-64)	-	DS90UB949ATR GCRQ1 for Variant -002	
U8	1		6-Bit Bidirectional Voltage-Level Translator with Auto Direction Sensing and +/- 15-kV ESD Protect, PW0016A (TSSOP-16)	PW0016A	TXB0106PWR	Texas Instruments
U9	1		ESD-Protection Array for High- Speed Data Interfaces, 4 Channels, -40 to +85 degC, 6-pin SON (DRY), Green (RoHS and no Sb/Br)	DRY0006A	TPD4E004DRY RG4	Texas Instruments



Designator	Quantity	Value	Description	PackagePart NumberManufacturReference		Manufacturer
U10	1		16-Bit Ultra-Low- Power Microcontroller, 128KB Flash, 8KB RAM, USB, 12Bit ADC, 2 USCIs, 32Bit HW MPY, PN0080A (LQFP-80)	PN0080A	MSP430F5529IP N	Texas Instruments
U11	1		TCA9406 Dual Bidirectional 1- MHz I2C-BUS and SMBus Voltage Level- Translator, 1.65 to 3.6 V, -40 to 85 degC, 8-pin US8 (DCU), Green (RoHS and no Sb/Br)	DCU0008A	TCA9406DCUR	Texas Instruments
Y4	1		Crystal, 24.000 MHz, 20pF, SMD	Crystal, 11.4x4.3x3.8mm	ECS-240-20- 5PX-TR	ECS Inc.
C1, C9	0	0.01uF	CAP, CERM, 0.01 μF, 100 V,+/- 5%, X7R, 0603	0603	06031C103JAT2 A	AVX
C2, C5, C6, C10, C11, C13	0	10uF	CAP, CERM, 10 μF, 10 V,+/- 10%, X7R, 0805	0805	GRM21BR71A1 06KE51L	MuRata
C3, C7, C12, C14	0	0.1uF	CAP, CERM, 0.1 μF, 16 V,+/- 10%, X7R, 0402	0402	GRM155R71C10 4KA88D	MuRata
C4, C8	0	1uF	CAP, TA, 1 μF, 16 V, +/- 10%, 9.3 ohm, SMD	3216-18	293D105X9016A 2TE3	Vishay-Sprague
C102	0	4.7uF	CAP, CERM, 4.7 μF, 16 V,+/- 10%, X7R, 0805	0805	GRM21BR71C4 75KA73L	MuRata
C103, C105, C107	0	0.1uF	CAP, CERM, 0.1 μF, 25 V,+/- 5%, X7R, 0603	0603	C0603C104J3R AC	Kemet
C111, C130	0	0.012uF	CAP, CERM, 0.012 μF, 16 V,+/- 10%, X7R, 0402	0402	GRM155R71C12 3KA01D	MuRata
C129	0	22uF	CAP, TA, 22 μF, 25 V, +/- 20%, 0.7 ohm, SMD	7343-31	293D226X0025D 2TE3	Vishay-Sprague
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A N/A		N/A
J1	0		Audio Jack, 3.5mm, Stereo, R/A, SMT	Audio Jack SMD	Audio Jack SMD SJ-3523-SMT	
J2, J37, J38	0		Header, 100mil, 2x1, Gold, TH	Header, 2x1, 100mil	5-146261-1	TE Connectivity
13	0		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G- S	Samtec



Designator

Quantity

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				Reference		
L1, L2	0	330 ohm	Ferrite Bead, 330 ohm @ 100 MHz, 1.5 A, 0603	0603	BLM18SG331TN 1D	MuRata
L11	0	1000 ohm	Ferrite Bead, 1000 ohm @ 100 MHz, 0.35 A, 0402	0402	BLM15AX102SN 1D	MuRata
R1, R2	0	100	RES, 100, 1%, 0.063 W, 0402	0402	CRCW0402100 RFKED	Vishay-Dale
R3, R7, R8, R10, R64, R72, R73, R81, R89, R90, R98, R99, R100, R108, R116, R117, R129, R131, R139, R141, R164, R166, R167, R168, R169, R186, R187	0	0	RES, 0, 5%, 0.063 W, 0402	0402	ERJ-2GE0R00X	Panasonic
R4, R5, R6, R9	0	10.0k	RES, 10.0 k, 1%, 0.063 W, 0402	0402	CRCW040210K0 FKED	Vishay-Dale
R124, R135, R136, R140, R181	0	10k	RES, 10 k, 5%, 0.1 W, 0603	0603	CRCW060310K0 JNEA	Vishay-Dale
R125, R126, R134, R137, R143, R183, R184	0	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000 Z0EA	Vishay-Dale
R182	0	3.24k	RES, 3.24 k, 1%, 0.063 W, 0402	0402	CRCW04023K24 FKED	Vishay-Dale
R185	0	0.51	RES, 0.51, 1%, 0.1 W, AEC- Q200 Grade 1, 0603	0603	ERJ-3RQFR51V	Panasonic
R188	0	2.00k	RES, 2.00 k, 1%, 0.063 W, 0402	0402	CRCW04022K00 FKED	Vishay-Dale
R189, R190	0	49.9	RES, 49.9, 1%, 0.063 W, 0402	0402	CRCW040249R 9FKED	Vishay-Dale
R191	0	1.30k	RES, 1.30 k, 1%, 0.063 W, 0402	0402	CRCW04021K30 FKED	Vishay-Dale
S1	0		Switch, Slide, SPST 3 poles, SMT	3 poles SPST Switch	219-3LPST	CTS Electrocompone nts
SH-J3	0	1x2	Shunt, 2mm, Gold plated, Black	2mm Shunt, Closed Top	2SN-BK-G	Samtec
U1	0		99dB SNR Stereo ADC with Single-Ended Inputs, PW0014A (TSSOP-14)	PW0014A	PCM1808PWR	Texas Instruments
U7	0		Single High Speed Differential Driver, 8-pin Narrow SOIC, Pb-Free	D0008A		Texas Instruments

Table 2-1. Bill o	f Materials	(continued)
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Package

Description

Part Number

Manufacturer

Value



Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
U12	0		Single Output Automotive LDO, 750 mA, Fixed 5 V Output, 6 to 26 V Input, 5-pin PFM (KVU), -40 to 125 degC, Green (RoHS and no Sb/Br)	KVU0005A	TL751M05QKVU RQ1	Texas Instruments
Y1	0		OSC, 12.288 MHz, 3.3 Vdc, SMD	14x9.8x4.7mm	ECS-8FA3X- 122.8-TR	ECS Inc.
Y2	0		OSC, 96 MHz, 3.3 Vdc, SMD	SMD, 4-Leads, Body 7x5mm	FXO-HC736R-96	Fox Electronics
Y3	0		OSC, 148.5 MHz, LVDS, 3.3 V, SMD	7x5mm	FVXO-LC73BR- 148.5	IDT



Appendix A SNLU232A-August 2018-Revised May 2019

## **EVM PCB Schematics**



Figure A-1. Schematic - Block Diagram





Figure A-2. Schematic - DS90UH949A-Q1 and Power Decoupling





Figure A-3. Schematic - MSP430







Figure A-4. Schematic - PDB, IDx and MODE\_SEL Switches





Figure A-5. Schematic - HDMI, HSD, SMA, I2C, DDC, CEC and GPIO/I2S/SPI Connectors

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Appendix A



Figure A-6. Schematic - LEDs





#### Appendix A



Figure A-7. Schematic - Audio (Not Populated)







#### Appendix A



#### Figure A-9. Schematic - Hardware



Appendix B SNLU232A–August 2018–Revised May 2019

## **Board Layout**

#### **Board Layers**



ALL ARTWORK VIEWED FROM TOP SIDE	BOARD #: HSDC016	REV: B	SVN REV:	Not In VersionControl
LAYER NAME = Top Overlay	TID #: N/A			
	GENERATED : 5/15/2	2019 6:56:48	PM	TEXAS INSTRUMENTS

#### Figure B-1. Board Layer - Top Overlay







ALL ARTWORK VIEWED FROM TOP SIDE	BOARD #: HSDC016	REV: B	SUN REU:	: Not In VersionControl
LAYER NAME = Top Solder	TID #: N/A			
	GENERATED : 5/15/2	2019 6:56:51	ΡM	TEXAS INSTRUMENTS



Appendix B





ALL ARTWORK VIEWED FROM TOP SIDE	BOARD #: HSDC016	REV: B	SVN REV:	: Not In VersionControl
LAYER NAME = Top Layer	TID #: N/A			
	GENERATED : 5/15/2	2019 6:56:53	PM	TEXAS INSTRUMENTS

#### Figure B-3. Board Layer - Top





ALL ARTWORK VIEWED FROM TOP SIDE	BOARD #: HSDC016	REV: B	SVN REV:	: Not In VersionControl
LAYER NAME = GND	TID #: N/A			
	GENERATED : 5/15/2	2019 6:56:56	PM	TEXAS INSTRUMENTS

#### Figure B-4. Board Layer - Ground-1



ALL ARTWORK VIEWED FROM TOP SIDE	BOARD #: HSDC016	REV: B	SVN REV:	Not In VersionControl
LAYER NAME = Signal Layer	TID #: N/A			
	GENERATED : 5/15/2	2019 6:56:58	PM	TEXAS INSTRUMENTS

#### Figure B-5. Board Layer - Signal Layer





ALL ARTWORK VIEWED FROM TOP SIDE	BOARD #: HSDC016	REV: B	SUN REU	: Not In VersionControl
LAYER NAME = PWR Split/GND	TID #: N/A			
	GENERATED : 5/15/2	2019 6:57:00	PM	TEXAS INSTRUMENTS

#### Figure B-6. Board Layer - Power Split/GND



ALL ARTWORK VIEWED FROM TOP SIDE	BOARD #: HSDC016	REV: B	SUN REU	: Not In VersionControl
LAYER NAME = GND	TID #: N/A			
	GENERATED : 5/15/2	2019 6:57:02	PM	TEXAS INSTRUMENTS

#### Figure B-7. Board Layer - Ground - 2





ALL ARTWORK VIEWED FROM TOP SIDE	BOARD #: HSDC016	REV: B	SUN REU	: Not In VersionControl
LAYER NAME = Bottom Layer	TID #: N/A			
	GENERATED : 5/15/2	019 6:57:05	PM	TEXAS INSTRUMENTS

#### Figure B-8. Board Layer - Bottom



ALL ARTWORK VIEWED FROM TOP SIDE	BOARD #: HSDC016	REV: B	SVN REV:	: Not In VersionControl
LAYER NAME = Bottom Solder	TID #: N/A			
	GENERATED : 5/15/2	2019 6:57:07	PM	TEXAS INSTRUMENTS

#### Figure B-9. Board Layer - Bottom Solder



### **Revision History**

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

#### Changes from Original (August 2018) to A Revision

#### Page

•	Added DS90UB949A-Q1EVM information	5
•	Added content to the General Description section	5
•	Changed S4, S7, S8 BOM information	34
•	Changed U6 BOM information	35

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