

Using the UCD3138ACCEVM149

User's Guide



Literature Number: SLUUB82
March 2015

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1 Introduction

This UCD3138ACCEVM149 evaluation module is to help evaluate the UCD3138A digital controller device from Texas Instruments and aid in design of digitally controlled isolated power converters. The UCD3138A device belongs to the UCD3138 family of highly integrated digital controller devices optimized for isolated power supply applications.

The UCD3138ACCEVM149 is quite similar to the UCD3138CC64EVM-030. The UCD3138ACCEVM149 is to be used either as a stand-alone control card to study the UCD3138A controller device or as a DPWM controller board working with a power stage board to implement a fully regulated power converter. To help the targeted off-line isolated power applications, this EVM has been designed to work seamlessly with power converter EVM offered by TI: UCD3138ALLCEVM-150. Please contact Texas Instruments for assistance with firmware needed to configure the UCD3138A device and successfully interface UCD3138ACCEVM149 with the above mentioned power converter EVM.

Alternately the EVM can also be loaded with user's custom developed firmware. In order to communicate with the UCD3138A digital controller in this EVM, a separate USB Interface Adapter EVM from Texas Instruments known as the "USB-TO-GPIO Adapter" is required. The USB-TO-GPIO adapter is NOT supplied with UCD3138ACCEVM149 evaluation module and must be purchased separately. Texas Instruments also offers a Graphical User Interface in order to program the UCD3138A controller and configure parameters when used with the power converter EVM mentioned above.

2 Description

The UCD3138ACCEVM149 is an EVM board, functioning as a control card for UCD3138ARGC digital power supply applications. This EVM is used to control a power converter topology such as LLC Resonant Half-Bridge DC converter, etc., by downloading the associated firmware and interfacing with an appropriate power stage board. The EVM works seamlessly with the following EVM board, together with corresponding firmware, all developed by Texas Instruments.

- UCD3138ALLCEVM-150, a digital controlled LLC half-bridge DC-to-DC converter evaluation board

Contact Texas Instruments for assistance with firmware needed to configure the UCD3138A device and successfully interface UCD3138ACCEVM149 with above mentioned power converter EVM.

2.1 Typical Applications

- Off-line Isolated Power Supply Applications (such as, LLC resonant half-bridge DC-to-DC power converter, and phase-shifted full-bridge DC-to-DC power converter)
- Server Systems
- Telecommunication Systems

2.2 Features

- 40-Pin Digital Signal Connector (to connect digital signals to power converters)
- JTAG Connector
- LED Indicator
- PMBus Connector to PC Computer Connection through USB-to-GPIO Adapter
- Rich Test Points to Facilitate the Device Evaluation (system design and circuit and firmware debugging)
- 12-V Input Capable With Onboard Regulator 3.3 V

3 Specifications

Table 1. 3138ACC32EVM-149 Specifications

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Connector J1					
PMBus connector	Port of connection to USB-to-GPIO, pin definition refer to TI standard USB-to-GPIO document SLLU093	Standard			
Connector J2					
3.3-V connection to PMBus	Port to use on board 3.3 VD to bias PMBus ⁽¹⁾	3.25	3.30	3.35	VDC
Connector J3					
Analog signal connection	Pin definition in compliance with UCD3138	40-pin			
Connector J4					
Digital signal connection	Pin definition in compliance with UCD3138	40-pin			
Pin 39	External voltage source input	11.5	12.0	12.5	VDC
Connector J5					
JTAG	Standard JTAG communication connection	Standard			
Connector J6					
3.3-V on board to external use	Port to use 3.3 V on board to bias external circuit	3.27	3.30	3.32	VDC
Connector J7					
TDI pull up connection	Jump across to use JTAG	2-pin			
Connector J8					
TDO pull up connection	Jump across to use JTAG	2-pin			
Operation Environment					
Operating temperature range	Natural Convection	25			°C
Mechanical Characteristics					
Dimensions	Width	1.8			inches
	Length	3.4			
	Component height	0.5			

⁽¹⁾ Apply jumper to provide a 3.3-V bias to board from USB-to-GPIO adapter.

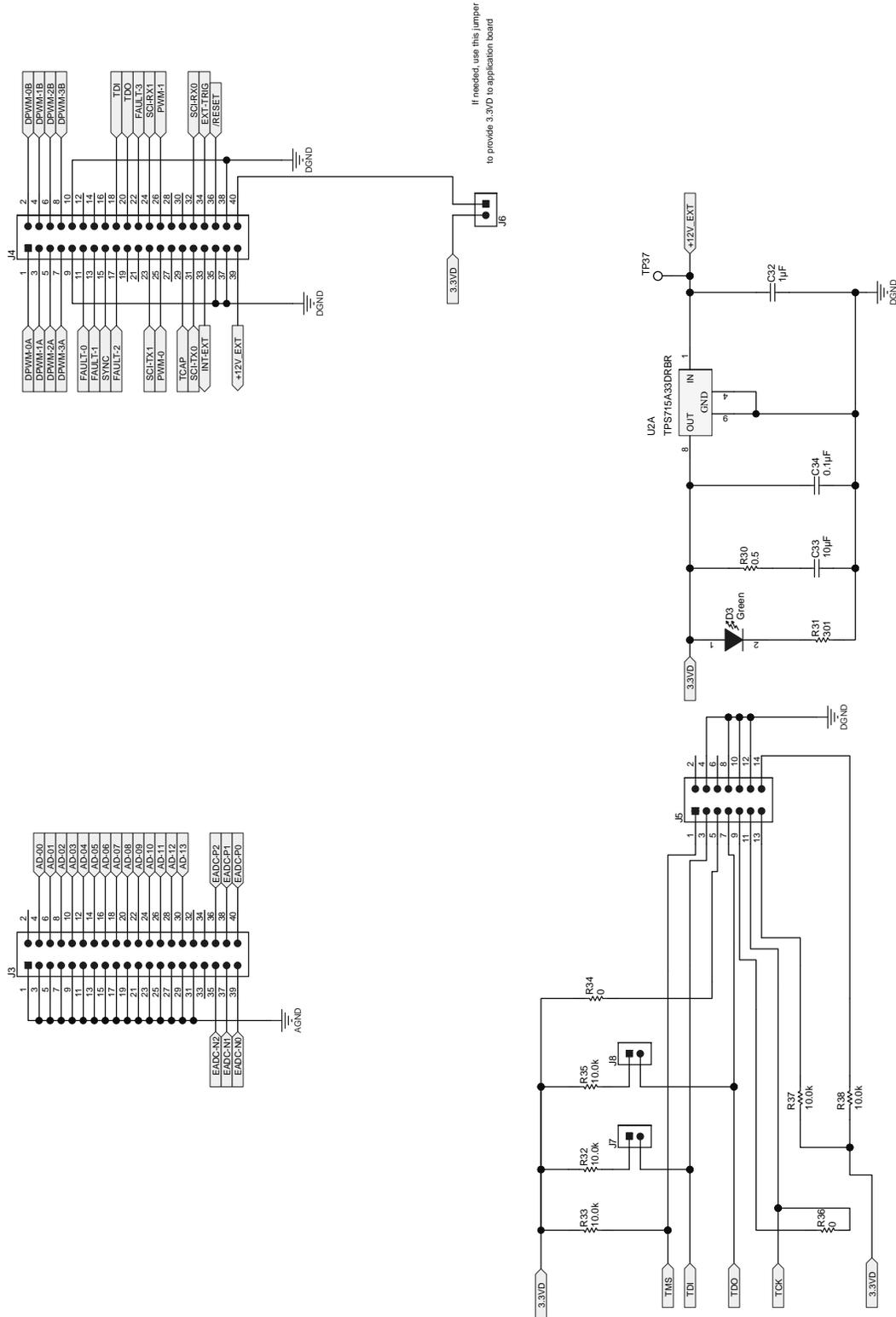


Figure 2. UCD3138ACCEVM149 Schematic (2 of 3)

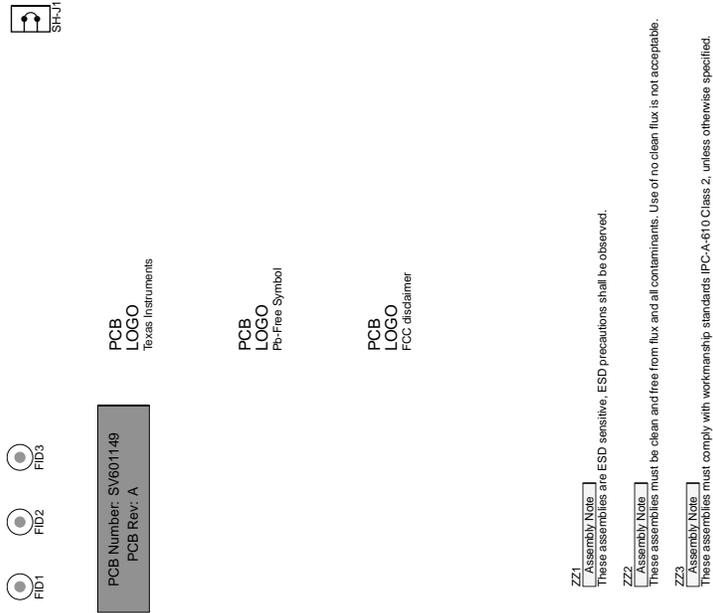


Figure 3. UCD3138ACCEVM149 Schematic (3 of 3)

5 Test Equipment

5.1 Operating System

Microsoft Windows XP (32-bit), or Vista (32-bit), or Windows 7 (32-bit).

5.2 USB-to-GPIO Interface Adapter

This adapter is to establish the communication between the control card UCD3138ACCEVM149 and the PC computer through the PMBus and the **GUI, Texas Instruments Fusion Digital Power Designer**. To order the USB-to-GPIO adaptor, visit: <http://www.ti.com/tool/usb-to-gpio>

5.2.1 USB-to-GPIO Interface Adapter (HPA172)

Accessories including:

- (a) USB interface adapter (HPA172).
- (b) USB cable, 5-pin B Mini Male to Type A Male.
- (c) Ribbon cable, socket-to-socket, 10-pin, 2-headers, polarized.



Figure 4. USB-to-GPIO Interface Adapter (HPA172)

5.3 Oscilloscope

An oscilloscope of analog or digital type is capable of 200-MHz bandwidth with an appropriate accompanying oscilloscope probe.

6 Equipment Setup

6.1 GUI (Graphical User Interface)

6.1.1 File for Installation

The GUI installation file is **TI-Fusion-Digital-Power-Designer-Version-2.0.16.exe** or newer version. To obtain the latest version of GUI, visit http://www.ti.com/tool/fusion_digital_power_designer

6.1.2 Installation

Double click and launch the **.exe** file to start the installation. Click **Next** all the way through. When present, click **I accept the agreement** after reading it. Then click **Install**. After the installation, click **Finish** to exit setup. Then click **Exit Program**.

6.1.3 Launch UCD3138A Device GUI

The GUI for UCD3138ACCEVM149 board can be launched through the below steps:

1. Click the window **start** → click **All Programs** → click **Texas Instruments Fusion Digital Power Designer** → click **Device GUIs** → click **UCD3xxx & UCD9xxx Device GUI**.

6.2 Hardware Setup

6.2.1 Setup Overview

Shown in [Figure 5](#) is the connection between UCD3138ACCEVM149 and the PC computer through USB-to-GPIO Interface Adapter.

USB Adapter Connection:

1. Connect one end of the ribbon cable to the EVM (SV601149), and connect the other end to the USB interface adapter
2. Connect the Mini USB connector of the USB cable to the USB interface adapter, and connect the other end to the USB port of the PC computer.

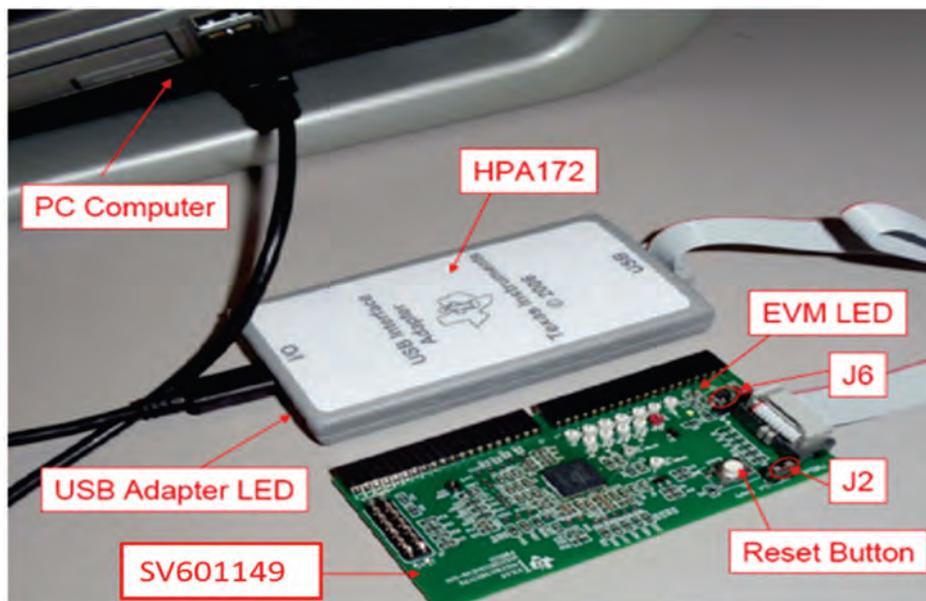


Figure 5. UCD3138ACCEVM149 Test Connections

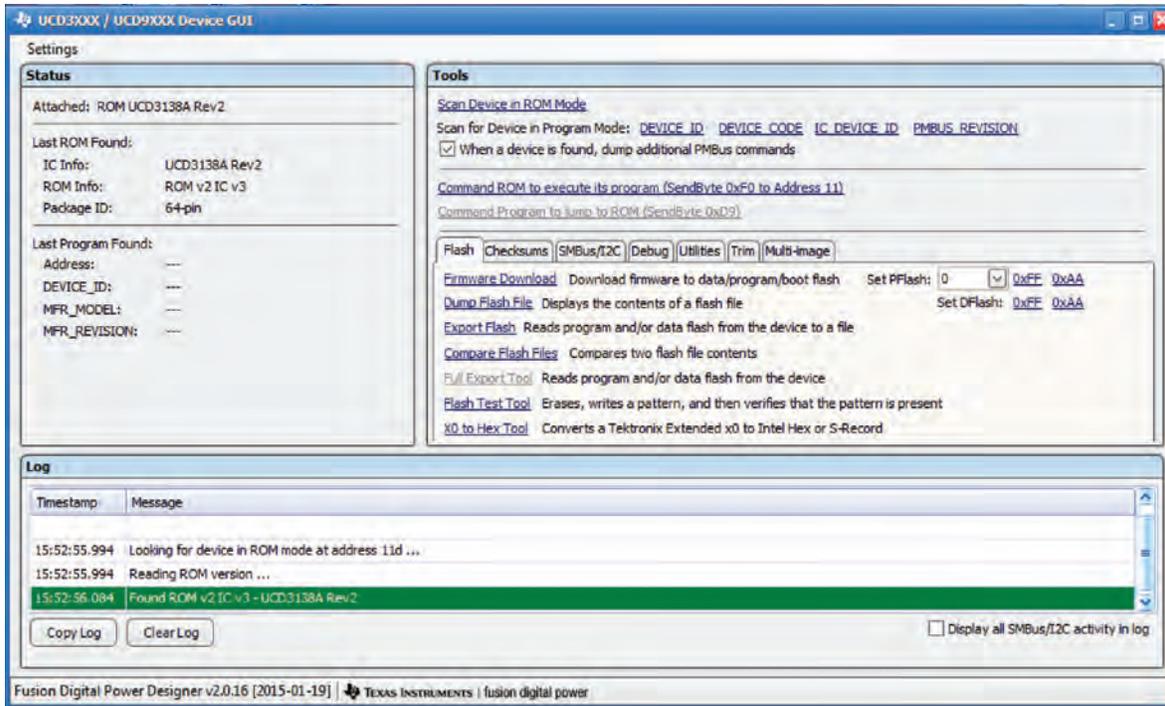


Figure 6. UCD3XXX / UCD9XXX Device GUI

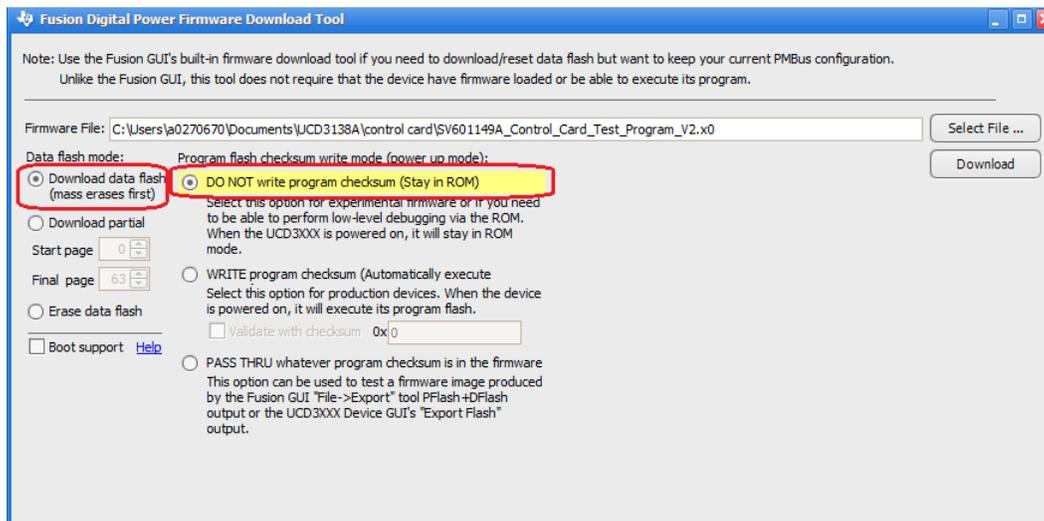


Figure 7. Firmware Code Downloading

6.3 List of Test Points

Table 2. The Functions of Each Test Point

Test Points	Name	Description
TP1	3.3VA	3.3-V analog on board
TP2	RC filter 2B	DPWM2B RC filter
TP3	RC filter 3A	DPWM3A RC filter
TP4	PWM-0	PWM0
TP5	AGND	Analog GND
TP6	DGND	Digital GND
TP7	PWM-1	PWM1
TP8	EADC-N0	EAN0
TP9	EADC-P1	EAP1
TP10	EADC-P0	EAP0
TP11	EADC-N1	EAN1
TP12	DPWM-0A	DPWM0A
TP13	DPWM-0B	DPWM0B
TP14	DPWM-1A	DPWM1A
TP15	DPWM-1B	DPWM1B
TP16	TCAP	TCAP
TP17	DPWM-2A	DPWM2A
TP18	DPWM-2B	DPWM2B
TP19	DPWM-3A	DPWM3A
TP20	DPWM-3B	DPWM3B
TP21	AD-00	A to D converter channel AD01
TP22	EADC-N2	EAN2
TP23	EADC-P2	EAP2
TP24	AD-01	A to D converter channel AD00
TP25 to TP36	AD-02 to -13	A to D converter channels AD02 to AD13
TP37	12V_EXT	External 12 V
J1	PMBus Connection	PMBus connector, 10 pins
J2	3.3VD	Jumper header, if jump across, 3.3 V supplied from USB connection
J3	Analog Connection	40-pin header, analog signals
J4	Digital Connection	40-pin header, digital signals
J5	JTAG Connection	14-pin header, JTAG connector
J6	3.3VD	Jumper header, if jump across, 3.3 V supplied to outside need
J7	TDI	Jump across to use JTAG
J8	TDO	Jump across to use JTAG
S1	Reset	UCD3138 reset, press to reset.

7 Test Procedure

7.1 Download Firmware Codes to UCD3138ACCEVM149

Set up the EVM connection based on [Figure 5](#).

1. Set up the EVM connection based on [Figure 5](#). The LED of USB adapter is light on.
2. Use provided jumper to jump across J2. The LED of the EVM will light up.
3. Launch the UCD3XXX / UCD9XXX Device GUI following the steps described in [section 6.1.3](#). A window shown in [Figure 6](#) appears.
4. Click **Firmware Download**; then a new window appears as shown in [Figure 7](#). Click **Select File** and browse an intended firmware code file with file extension **.x0** (eg. **cyclone.x0**), then click **Download**. The firmware of **cyclone.x0** will be downloaded to the UCD3138A device on the UCD3138ACCEVM149 EVM. When prompted, click **Yes** to complete the download. Click **Close** to exit the download window.
5. After the firmware code downloads to the UCD3138A device, the intended test can be performed.

7.2 Erasing Firmware Code from UCD3138ACCEVM149

Erasing the downloaded firmware from the UCD3138A flash memory can be done by following the steps below and referencing [Figure 6](#):

1. Click **Device ID**
2. Click **Command Program to jump to ROM (SendByte 0xD9)**
3. Click **Set PFlash: 0xFF**

7.3 Equipment Shutdown

1. Exit the GUI.
2. Disconnect the USB cable and the ribbon cable.

8 EVM Assembly Drawing and PCB Layout

Figure 8 through Figure 13 show the design of the UCD3138ACCEVM149 printed circuit board. PCB dimensions: L x W = 3.400 x 1.8 inch, PCB material: FR4 or compatible, four layers and 1oz copper on each layer.

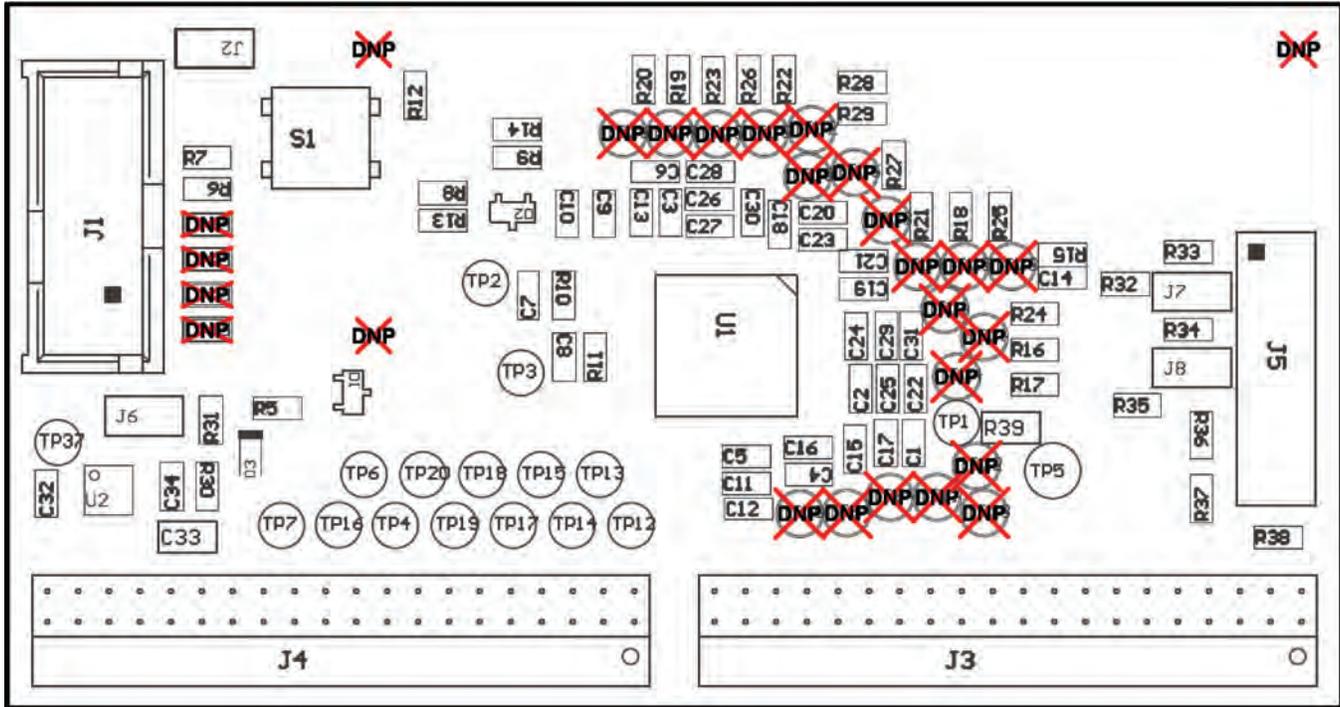


Figure 8. UCD3138ACCEVM149 Top Layer Assembly Drawing (top view)

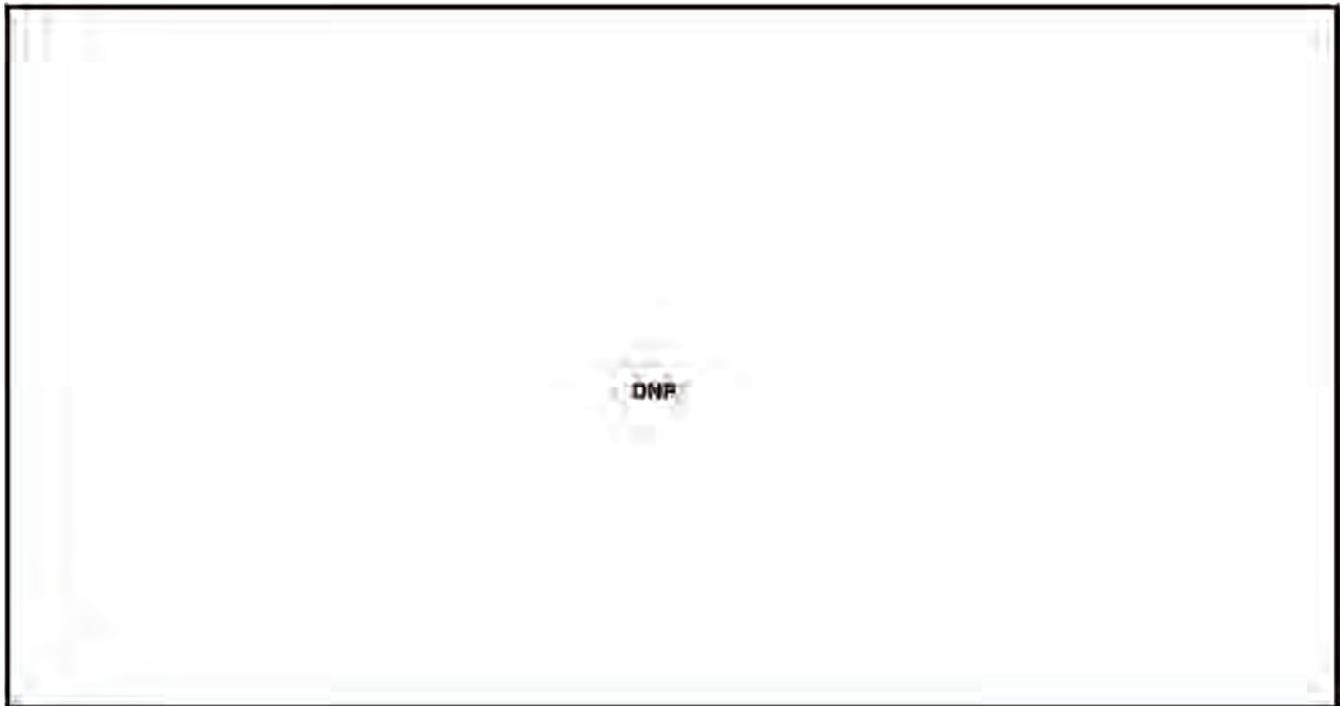


Figure 9. UCD3138ACCEVM149 Bottom Assembly Drawing (no components on this side)

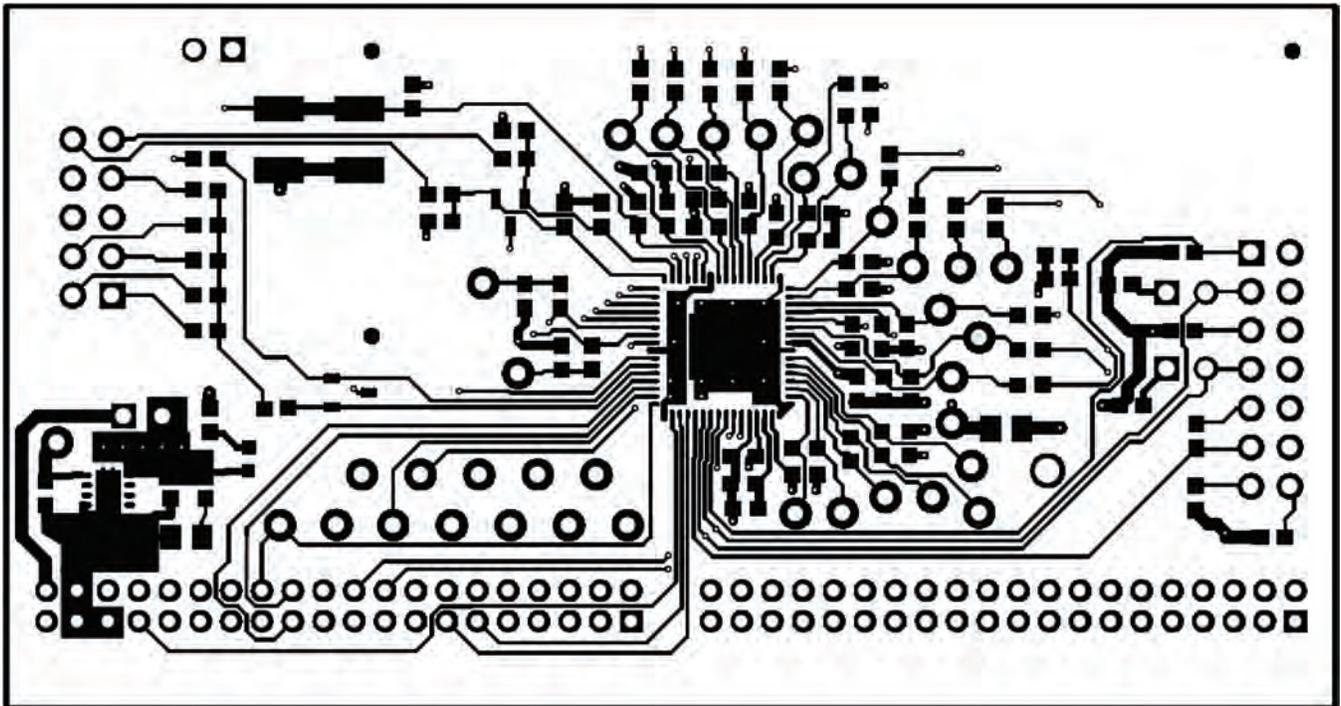


Figure 10. UCD3138ACCEVM149 Top Copper (top view)

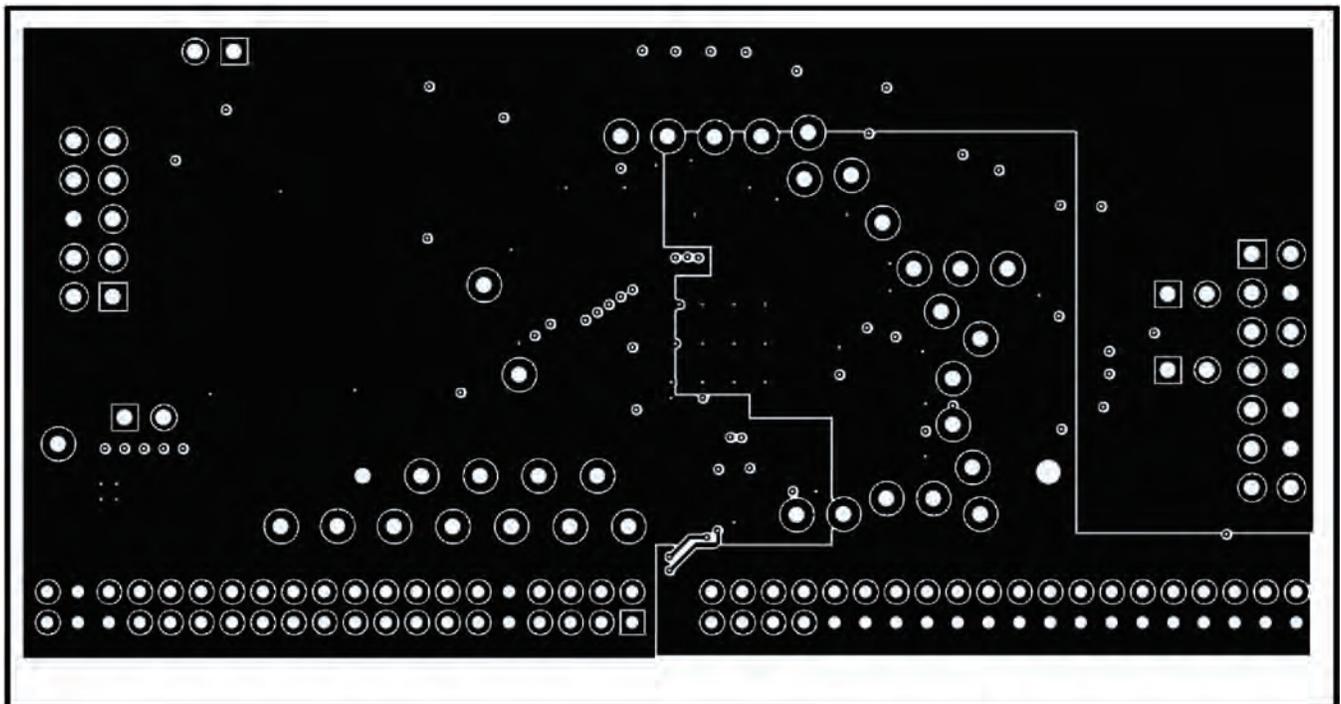


Figure 11. UCD3138ACCEVM149 Internal Layer 1 (top view)

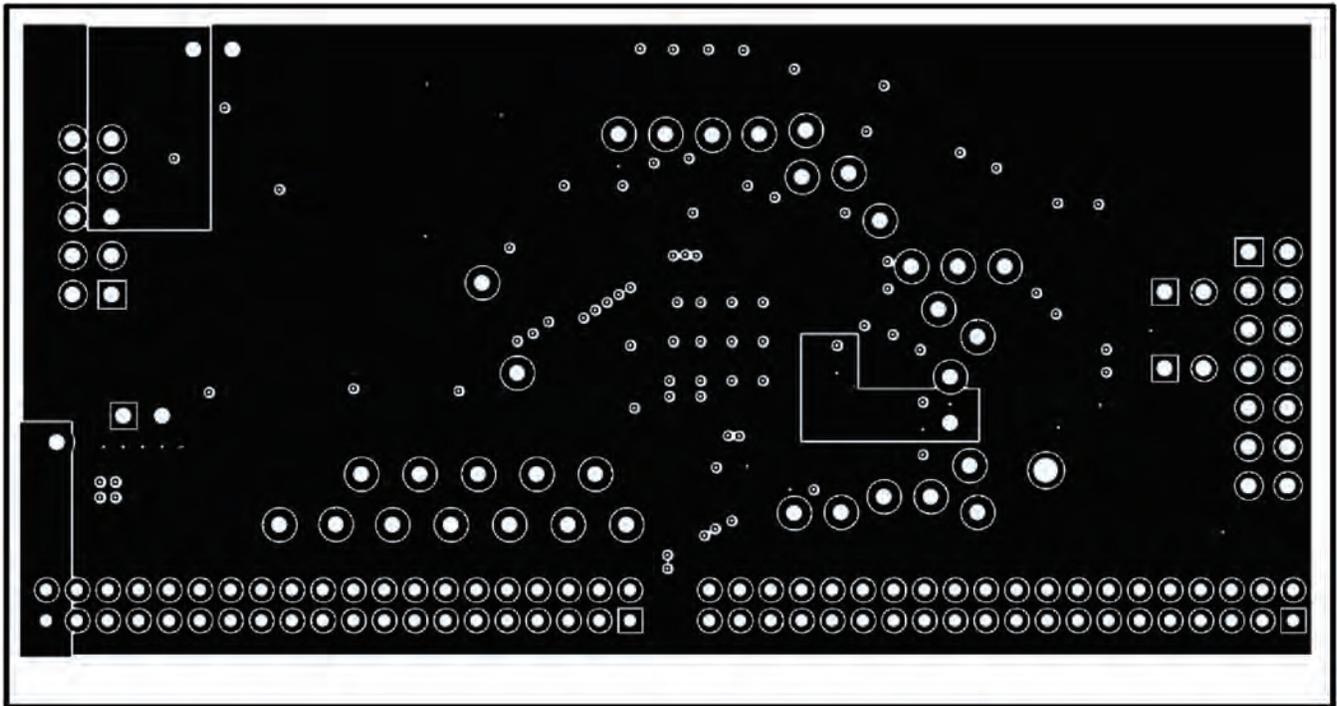


Figure 12. UCD3138ACCEVM149 Internal Layer 2 (top view)

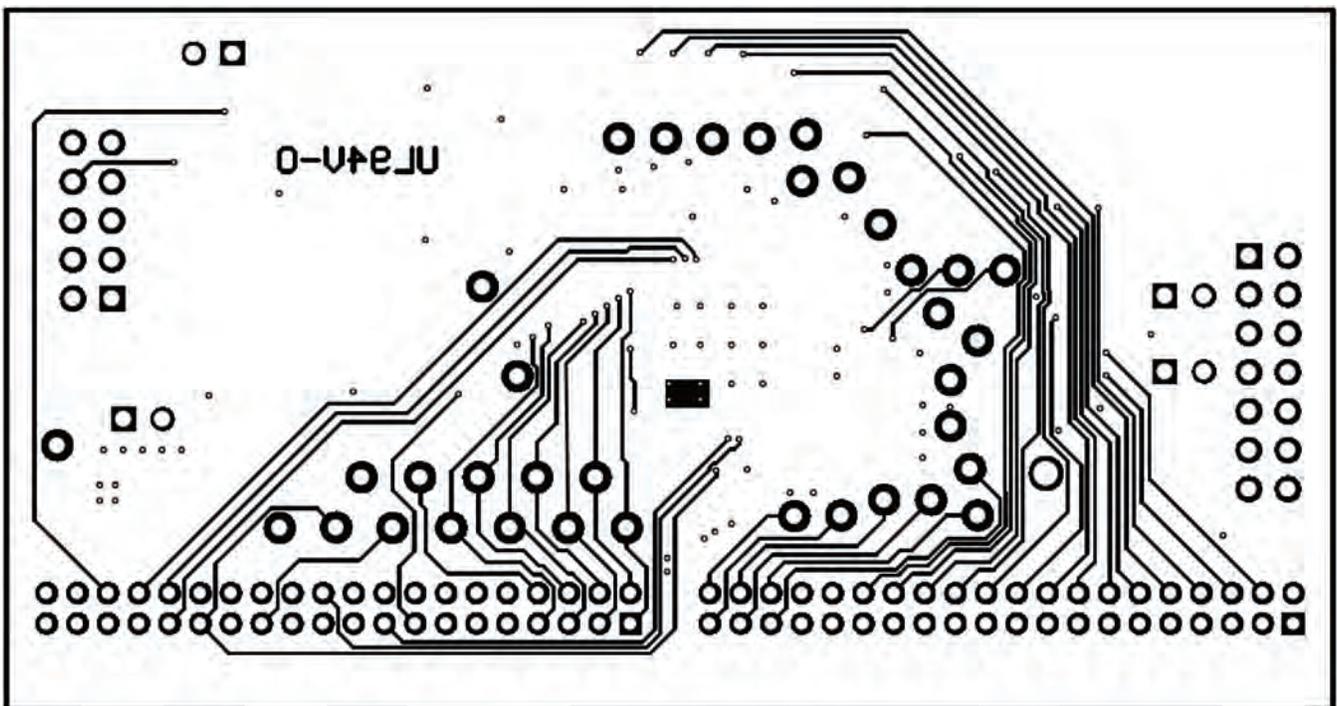


Figure 13. UCD3138ACCEVM149 Bottom Copper (top view)

9 List of Materials

The EVM components list according to the schematics shown in [Figure 1](#), [Figure 2](#) and [Figure 3](#) are listed in [Table 3](#).

Table 3. List of Materials

QTY	DESIGNATOR	DESCRIPTION	PART NUMBER	MANUFACTURER
3	C1, C6, C32	Capacitor, ceramic, 1 μ F, 16 V, \pm 10%, X5R, 0603	C0603C105K4PACTU	Kemet
7	C2–C5, C11, C13, C34	Capacitor, ceramic, 0.1 μ F, 16 V, \pm 10%, X7R, 0603	C0603C104K4RACTU	Kemet
1	C7	Capacitor, ceramic, 100 pF, 50 V, \pm 5%, C0G/NP0, 0603	CGA3E2NP01H101J080AA	TDK
16	C8, C14, C18–C31	Capacitor, ceramic, 1000 pF, 50 V, \pm 10%, X7R, 0603	C0603C102K5RACTU	Kemet
5	C9, C10, C15–C17	Capacitor, ceramic, 33 pF, 50 V, \pm 5%, C0G/NP0, 0603	06035A330JAT2A	AVX
1	C12	Capacitor, ceramic, 2.2 μ F, 10 V, \pm 10%, X5R, 0603	C0603C225K8PACTU	Kemet
1	C33	Capacitor, ceramic, 10 μ F, 10 V, \pm 10%, X5R, 0805	C0805C106K8PACTU	Kemet
2	D1, D2	Diode, Schottky, 40 V, 0.3 A, SOT-23	BAT54AFILM	ST Microelectronics
1	D3	LED, green, SMD, 1.6 x 0.8 x 0.8 mm	LTST-C190GKT	Lite-On
1	J1	Header (shrouded), 100 mil, 5 x 2, gold, TH	5103308-1	TE Connectivity
4	J2, J6, J7, J8	Header, 100mil, 2 x 1, tin, TH	PEC02SAAN	Sullins Connector Solutions
2	J3, J4	Receptacle, 2 mm, 20x2, R/A, TH	NPPN202FJFN-RC	Sullins Connector Solutions
1	J5	Header, 100 mil, 7 x 2, tin, TH	PEC07DAAN	Sullins Connector Solutions
0	R1–R4	Resistor, 0, 5%, 0.1 W, 0603	CRCW06030000Z0EA	Vishay-Dale
12	R5, R7–R9, R16–R20, R23, R25, R26	Resistor, 100 Ω , 1%, 0.1 W, 0603	CRCW0603100RFKEA	Vishay-Dale
3	R6, R34, R36	Resistor, 0 Ω , 5%, 0.1 W, 0603	CRCW06030000Z0EA	Vishay-Dale
6	R10, R32, R33, R35, R37, R38	Resistor, 10.0 k Ω , 1%, 0.1 W, 0603	CRCW060310K0FKEA	Vishay-Dale
1	R11	Resistor, 16.0 k Ω , 1%, 0.1 W, 0603	RC0603FR-0716KL	Yageo America
1	R12	Resistor, 1.65 k Ω , 1%, 0.1 W, 0603	CRCW06031K65FKEA	Vishay-Dale
2	R13, R14	Resistor, 1.50 k Ω , 1%, 0.1 W, 0603	CRCW06031K50FKEA	Vishay-Dale
1	R15	Resistor, 100 k Ω , 1%, 0.1 W, 0603	CRCW0603100KFKEA	Vishay-Dale
6	R21, R22, R24, R27–R29	Resistor, 2.0 k Ω , 5%, 0.1 W, 0603	CRCW06032K00JNEA	Vishay-Dale
1	R30	Resistor, 0.5 Ω , 1%, 0.1 W, 0603	RL0603FR-070R5L	Yageo America
1	R31	Resistor, 301 Ω , 1%, 0.1 W, 0603	CRCW0603301RFKEA	Vishay-Dale
1	R39	Resistor, 10.0 Ω , 1%, 0.125W, 0805	CRCW080510R0FKEA	Vishay-Dale
1	S1	Switch, tactile, SPST-NO, 1VA, 32 V, 6.3 x 5.36 x 6.6 mm, SMT	KT11P2JM34LFS	C&K Components
1	SH-J1	Shunt, 100 mil, flash gold, black, 1 x 2, Closed Top	SPC02SYAN	Sullins Connector Solutions
16	TP1–TP4, TP6, TP7, TP12–TP20, TP37	Test point, miniature, white, TH	5002	Keystone
1	TP5	Test point, compact, black, TH	5006	Keystone
1	U1	Highly Integrated Digital Controller for Isolated Power, RGC0064B	UCD3138ARGC	Texas Instruments
1	U2	Single Output LDO, 80 mA, fixed 3.3 V output, 2.5 to 24 V input, with low IQ, 8-pin SON (DRB), –40°C to 125°C, Green (RoHS & no Sb/Br)	TPS715A33DRBR	Texas Instruments
0	FID1–FID3	Fiducial mark. There is nothing to buy or mount.	N/A	N/A
0	TP8–TP11, TP21–TP36	Test Point, Miniature, White, TH	5002	Keystone
1	PCB	Printed Circuit Board	SV601149	Any

10 References

1. *UCD3138A Data Manual*, Texas Instruments Literature Number: [SLUSC66](#) – January 2015
2. *UCD3138 Monitoring and Communications Programmer's Manual*, Texas Instruments Literature Number: [SLUU996](#) – July 2012
3. *UCD3138 Digital Power Peripherals Programmer's Manual*, Texas Instruments Literature Number: [SLUU995](#) – July 2012
4. *UCD3138 ARM and Digital System Programmer's Manual*, Texas Instruments Literature Number: [SLUU994](#) – July 2012
5. *Fusion Digital Power Designer GUI for Isolated Power Applications User Guide* (for UCD3138, UCD3138064, UCD3138A applications), Texas Instruments Literature Number: [SLUA676](#) – June 2014
6. **Code Composer Studio v6 Wiki**, Texas Instruments, http://processors.wiki.ti.com/index.php/Category:Code_Composer_Studio_v6
7. *UCD3138A Migration Guide*, Texas Instruments Literature Number: [SLUA741](#) – October 2015

Summary of Using Code Composer Studio v6

In this appendix, the basic steps of how to use Code Composer Studio v6 to compile firmware for UCD3138 family of devices is described. A design flow is described while detailed steps for firmware code creation, and firmware debugging along with hardware are obviously beyond the scope of this user's guide and this appendix.

A.1 Importing a CCSv6 project

Upon running CCSv6 for the first time, the **Workspace Launcher** window will appear as shown in [Figure 14](#). It is left to the user to decide whether or not to use a workspace, where it is located, and/or to check the box that says **Use this as the default and do not ask again**. For this guide, a workspace will not be used, so click **OK**.

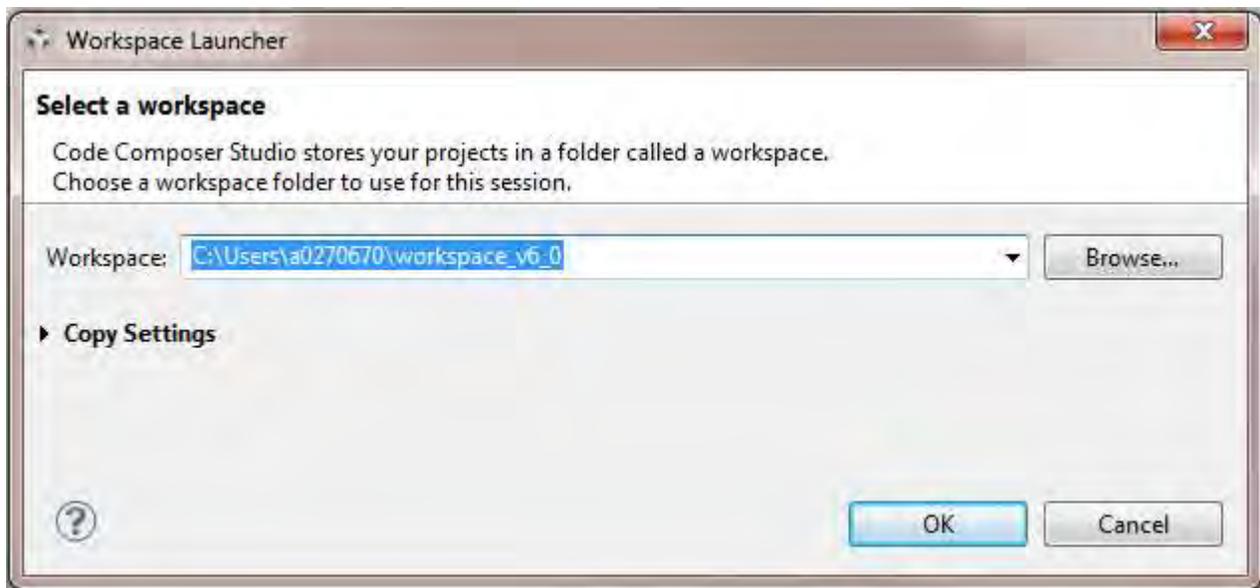


Figure 14. CCSv6 Workspace Launcher

When the main window opens, click **Project** in the top navigation menu, then choose **Import CCS Project...** as shown in window as shown in [Figure 15](#).

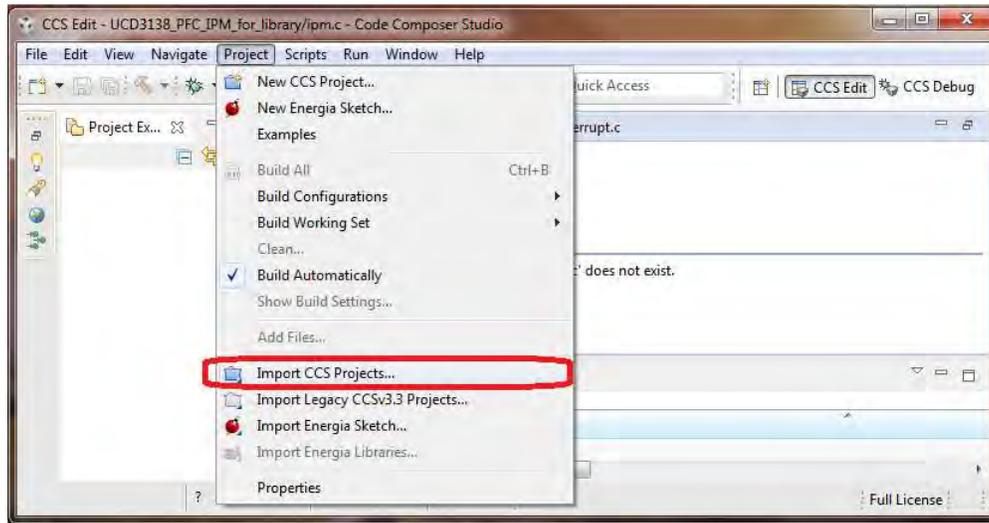


Figure 15. Import Existing CCS Project

This will open the window shown in [Figure 16](#). Under **Select-search directory**, click **Browse**, navigate to the target project, and click **OK**. For this example, the project is called **UCD3138_Lab_02_solution**. Check the box next to the discovered project, and do not check **Copy projects into workspace**, or **Automatically import referenced projects**. Click **Finish**.

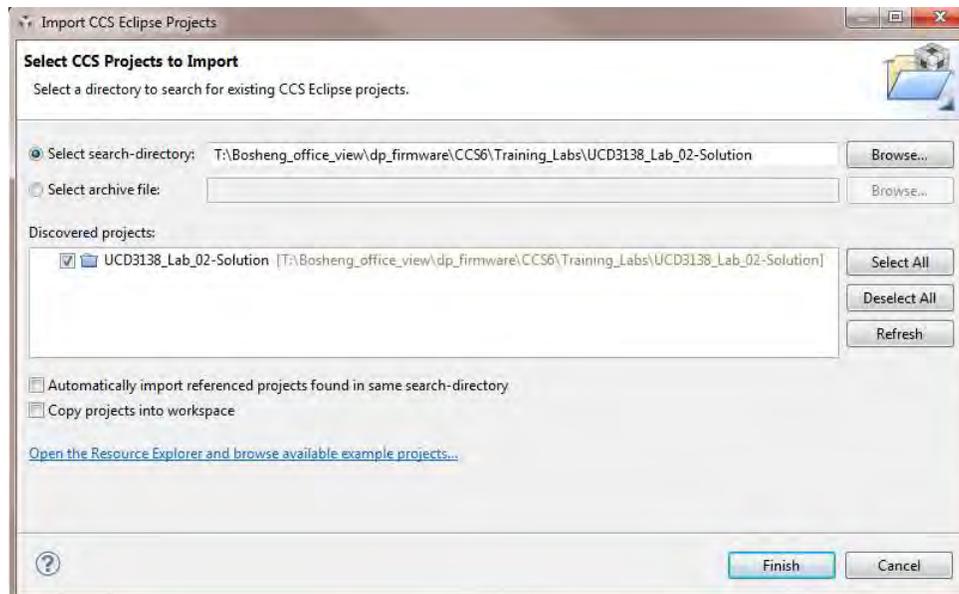


Figure 16. Importing a CCSv6 Project

The project should be imported into CCSv6 and should be shown in the **Project Explorer** as shown in **Figure 17**. At this point, files in the project can be edited as required.

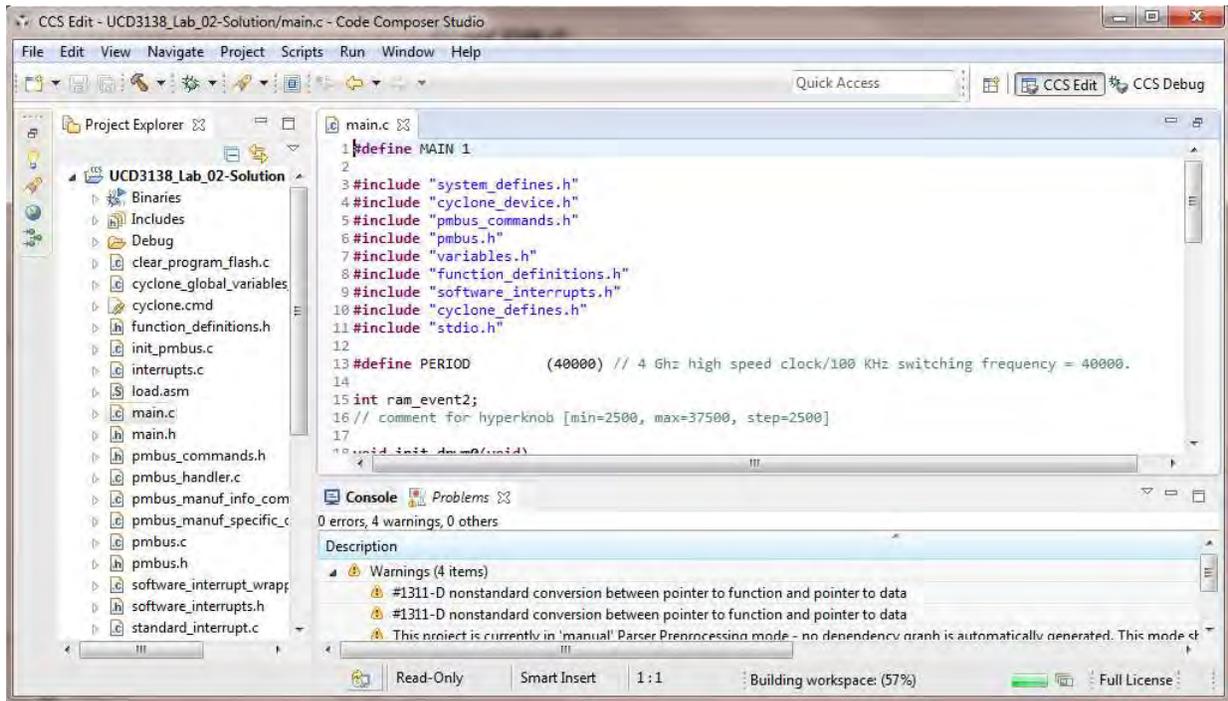


Figure 17. Project Explorer

A.2 Build/Compile a Project using Code Composer Studio v6

For the UCD3138 family of devices, compiling a project produces an **Intel-hex (.x0)** firmware file that can be downloaded to, and run on the UCD3138 or related target device using the **UCD3XXX / UCD9XXX Device GUI** (part of the Fusion Design Online software from TI).

After finished editing the project files, Right-Click on the project in the Project explorer, and choose **Build Project**.

NOTE: If this is the first time building a UCD3138 or related project, and Cygwin is also installed on the PC that is performing the compilation, the instructions in Section 3.3 of the Application Note entitled “*Converting UCD3138 Firmware Project from Code Composer Studio Version 3.3 to 6.0*” must be followed. Mainly, the C:\CYGWIN or other similarly named directory must be renamed temporarily during this first build. This will allow the new ARM library to be built properly. After this first build, the CYGWIN directory can be rolled back to its original name, and future builds can compile successfully.

Builds may take up to a minute to compile, or longer for a first time build. [Figure 18](#) shows the state of a successful build:

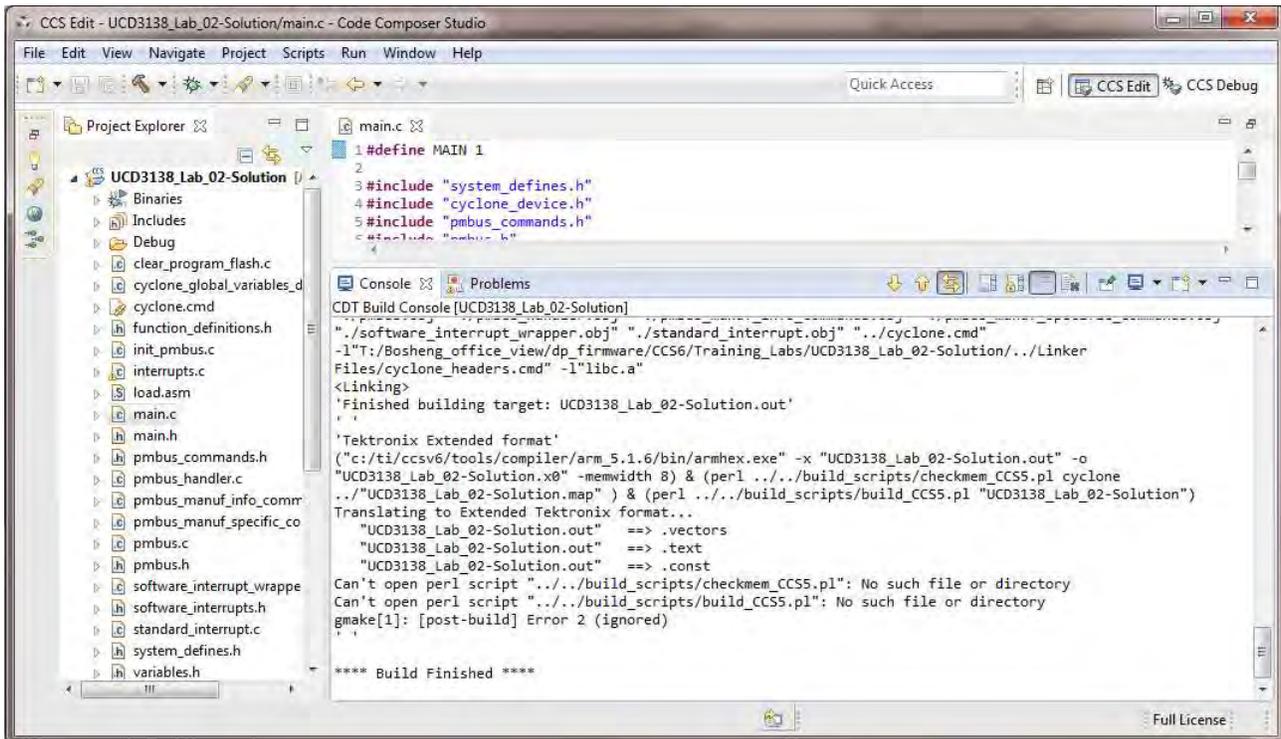


Figure 18. Successful Build of UCD3138 Related Source Code

When the build has finished, the **.x0** file should be created and will be placed in the project directory's **debug** folder. The filename that prefaces the **.x0** will be the name of the project that was built (i.e. a project named **UCD3138_Lab_02_solution** will create **UCD3138_Lab_02_solution.x0** as its firmware file). However, it must be noted that *the project name must have no spaces*, otherwise the **.x0** file will not be generated.

This **.x0** file can be and run on the UCD3138 target device using the **UCD3XXX / UCD9XXX Device GUI**.

STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms and conditions that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms and conditions do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.
 - 2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.
3. *Regulatory Notices:*
 - 3.1 *United States*
 - 3.1.1 *Notice applicable to EVMs not FCC-Approved:*

This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.
 - 3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】

本開発キットは技術基準適合証明を受けておりません。

本製品のご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

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日本テキサス・インスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/llds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。http://www.tij.co.jp/llds/ti_ja/general/eStore/notice_02.page

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY WRITTEN DESIGN MATERIALS PROVIDED WITH THE EVM (AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS AND CONDITIONS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT MADE, CONCEIVED OR ACQUIRED PRIOR TO OR AFTER DELIVERY OF THE EVM.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS AND CONDITIONS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS AND CONDITIONS OR THE USE OF THE EVMS PROVIDED HEREUNDER, REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED.

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9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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