Using the UCD3138OL64EVM-031

1 Introduction
UCD3138OL64CEVM-031 EVM offers an easy to use test platform for stand-alone evaluation of Texas Instruments' UCD3138 highly integrated digital controller that is optimized for isolated power applications. Featuring a 64-pin socket and comprehensive set of test points, the EVM allows hardware and firmware engineers to manipulate signals on the different pins of the device individually and study open loop operation. The EVM also offers the flexibility to realize simple closed loop control configurations (using RC circuits to filter PWM output signals and regulate a DC voltage in closed loop control). Hardware ports available to communicate with the device include PMBus, UART and JTAG. The EVM accepts up to 5-V DC input and an on-board 3.3-V LDO can be used to bias the device. Alternately, using jumpers, the device can be biased using the PMBus communication pins.

NOTE: In order to download firmware and program the UCD3138 device in UCD3138OL64EVM-031, a separate EVM from Texas Instruments known as the USB-TO-GPIO Adapter is required. The USB-TO-GPIO Adapter is NOT supplied with UCD3138OL64EVM-031 and must be purchased separately. The USB-TO-GPIO Adapter serves as a communication interface adaptor or a bridge between a host PC and the UCD3138 via a standard type-A to mini-B USB cable. The USB-TO-GPIO Adapter is listed below in the related products section.

2 Description
UCD3138OL64EVM-031 is an EVM board, to facilitate evaluation on UCD3138RGC digital power controller. This EVM provides hardware needed to evaluate UCD3138 64-pin device. All pins of UCD3138RGC are accessible through header connections, including all GPIO pins, ADC12 pins, front end pins, DPWM pins, and Fault pins, etc. Particularly, the board has terminal of PMBus, UART DB-9 RS232, and JTAG. All headers can be jumped to configure for a particular interested evaluation need.

2.1 Typical Applications
• UCD3138RGC Function Evaluation
• Firmware Debug
• Hardware Design Assistance

2.2 Features
• Drop-In Socket to Flexible Change the Device
• External 5.0-V Supply or PMBus Bias Supply
• JTAG Connector
• UART Connector, DB-9, RS232
• LED Indicators
• 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
• Board with Jumpers to Make Flexible Configuration to Adapt Various Evaluation Target
## 3 Specifications

### Table 1. UCD3138OL64EVM-031 Specifications

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector J1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JTAG</td>
<td>Standard JTAG communication connection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connector J3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMBus connector</td>
<td>Port of connection to USB-to-GPIO, pin definition refer to TI standard USB-to-GPIO document SLLU093</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connector J4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UART</td>
<td>Female DB-9, RS232</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connector J5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JTAG</td>
<td>Standard JTAG communication connection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connector J38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J38-4</td>
<td>Port to use 3.3 V on board to bias external circuit</td>
<td>3.25</td>
<td>3.30</td>
<td>3.45</td>
<td>V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>J38-3</td>
<td>External 5.0 V to board</td>
<td>4.90</td>
<td>5.00</td>
<td>5.10</td>
<td></td>
</tr>
<tr>
<td>J38-2</td>
<td>External 3.3 V to board</td>
<td>3.27</td>
<td>3.30</td>
<td>3.33</td>
<td></td>
</tr>
<tr>
<td>J38-1</td>
<td>Digital ground DGND</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation Environment</td>
<td>Operating temperature range</td>
<td>Natural convection</td>
<td>25</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Mechanical Characteristics</td>
<td>Dimensions</td>
<td>Width</td>
<td>4.0</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Length</td>
<td>6.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Component height</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firmware for Testing</td>
<td>Filename</td>
<td>PWR031_Test_GPIO_ADC12.x0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. UCD3138OL64EVM-031 Schematics (Socket) 1 of 9
Fault Test Jumpers

Ground Strip

Figure 2. UCD3138OL64EVM-031 Schematics (Headers) 2 of 9
Figure 3. UCD3138OL64EVM-031 Schematics (Filters) 3 of 9
Figure 4. UCD3138OL64EVM-031 Schematics (Bias and LEDs) 4 of 9
Figure 5. UCD3138OL64EVM-031 Schematics (UART and JTAG) 5 of 9
Figure 6. UCD3138OL64EVM-031 Schematics (PMBus) 6 of 9
DPWM Filters

Figure 7. UCD3138OL64EVM-031 Schematics (DPWM) 7 of 9
Figure 8. UCD3138OL64EVM-031 Schematics (EADC and ADC12) 8 of 9
Figure 9. UCD3138OL64EVM-031 Schematics (Misc) 9 of 9
5 Test Equipment

5.1 PC Computer

5.1.1 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 UCC3138OL64EVM-031 and the PC computer through the PMBus and the GUI, Texas Instruments Fusion Digital Power Designer.

5.2.1 USB-to-GPIO Interface Adapter (HPA172)
Accessories including:
• USB interface adapter (HPA172).
• USB cable, 5-pin B mini male to type A male.
• Ribbon cable, socket-to-socket, 10-pin, 2 headers, polarized.

Figure 10. USB-to-GPIO Interface Adapter (HPA172)

5.3 Oscilloscope
An oscilloscope of analog or digital type is capable of 200-MHz bandwidth with Tektronix P6138 or equivalent 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-1.8.92.exe* or newer version. To get a latest version of GUI, go on TI web site, [www.ti.com](http://www.ti.com), search *TI Fusion Digital Power Designer* then download and install to one’s computer.

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 read it. Then click *install*. After the installation, click *Finish* to exit setup. Then click *Exit Program*.

6.1.3  Launch UCD3138 Device GUI
The GUI for UCD3138CC64EVM-030 board can be launched through the below steps:
Click the window *start* → click *All Programs* → click *Texas Instruments Fusion Digital Power Designer* → click *Device GUIs* → click *UCD3xxx Device GUI*.

![Device GUI Launch Path](image)

Figure 11. Device GUI Launch Path
6.2 **Hardware Setup**

6.2.1 **Setup Overview**

Shown below in Figure 12 is the connection between UCD3138OL64EVM-031 and the PC computer through USB-to-GPIO Interface Adapter.

**USB Adapter Connection**

- Connect one end of the ribbon cable to the EVM, and connect the other end to the USB interface adapter.
- Connect the Mini connector of the USB cable to the USB interface adapter, and connect the other end to the USB port of the PC computer.

![Figure 12. UCD3138OL64EVM-031 Test Connections](image-url)
Figure 13. UCD31xx Device GUI
Figure 14. Firmware Code Downloading
### 6.3 List of Test Points

Table 2. UCD3138OL64EVM-031 Test Point Functions

<table>
<thead>
<tr>
<th>TEST POINTS</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP1</td>
<td>UART J4-2</td>
<td>UART transmitting</td>
</tr>
<tr>
<td>TP2</td>
<td>UART J4-3</td>
<td>UART receiving</td>
</tr>
<tr>
<td>TP3</td>
<td>UART GND</td>
<td>DGND</td>
</tr>
<tr>
<td>TP4</td>
<td>J38-1</td>
<td>DGND</td>
</tr>
<tr>
<td>TP5</td>
<td>FLTR-DPWM2</td>
<td>DPWM2 front end connection</td>
</tr>
<tr>
<td>TP6</td>
<td>DGND</td>
<td>Digital GND</td>
</tr>
<tr>
<td>TP7</td>
<td>EAP2S</td>
<td>EAP2 before filter</td>
</tr>
<tr>
<td>TP8</td>
<td>FLTR-DPWM0</td>
<td>DPWM0 front end connection</td>
</tr>
<tr>
<td>TP9</td>
<td>FLTR-DPWM1</td>
<td>DPWM1 front end connection</td>
</tr>
<tr>
<td>TP10</td>
<td>+3.3V</td>
<td>3.3 V</td>
</tr>
<tr>
<td>TP11</td>
<td>J35-3</td>
<td>Logic analyzer pin 3</td>
</tr>
<tr>
<td>TP12</td>
<td>J35-1</td>
<td>Logic analyzer pin 1</td>
</tr>
<tr>
<td>TP13</td>
<td>J38-4</td>
<td>3.3 V to outside circuit</td>
</tr>
<tr>
<td>TP14</td>
<td>J35-4</td>
<td>Logic analyzer pin 4</td>
</tr>
<tr>
<td>TP15</td>
<td>J35-2</td>
<td>Logic analyzer pin 2</td>
</tr>
<tr>
<td>TP16</td>
<td>AGND</td>
<td>AGND</td>
</tr>
<tr>
<td>TP17</td>
<td>DGND</td>
<td>DGND</td>
</tr>
<tr>
<td>TP18</td>
<td>FFCS</td>
<td>Feed forward control selection</td>
</tr>
<tr>
<td>TP19</td>
<td>FFC_adj</td>
<td>Feed forward control adjustment</td>
</tr>
<tr>
<td>TP20</td>
<td>Q3 Gate</td>
<td>Ramp generator</td>
</tr>
<tr>
<td>TP21</td>
<td>Q3 and Q4 drain</td>
<td>Ramp generator</td>
</tr>
<tr>
<td>TP22</td>
<td>Q4 gate</td>
<td>Ramp generator</td>
</tr>
<tr>
<td>J1</td>
<td>JTAG</td>
<td></td>
</tr>
<tr>
<td>J2, 5</td>
<td>LED D1 and D2 control</td>
<td></td>
</tr>
<tr>
<td>J3, 6,9,10,42</td>
<td>PMBus</td>
<td></td>
</tr>
<tr>
<td>J4,16,17</td>
<td>UART, DB-9 female, RS232</td>
<td></td>
</tr>
<tr>
<td>J7, 8,11</td>
<td>EADC and DPWM</td>
<td></td>
</tr>
<tr>
<td>J12,13,18,20,21</td>
<td>ADC12</td>
<td></td>
</tr>
<tr>
<td>J14,15, 22, 23</td>
<td>DPWM</td>
<td></td>
</tr>
<tr>
<td>J19,41</td>
<td>Feed forward control</td>
<td></td>
</tr>
<tr>
<td>J24,25,26,27,30,31,36,37</td>
<td>UCD3138 pinout headers</td>
<td></td>
</tr>
<tr>
<td>J28,29,32</td>
<td>Faults connections</td>
<td></td>
</tr>
<tr>
<td>J33,34,38,39</td>
<td>Board bias power management</td>
<td></td>
</tr>
<tr>
<td>J35</td>
<td>Logic Analyzer Connector, not populated</td>
<td></td>
</tr>
<tr>
<td>J40</td>
<td>AGND strip</td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>UCD3138 reset, press to reset.</td>
<td></td>
</tr>
</tbody>
</table>
7 Test Procedure

7.1 Download Firmware Codes to UCD3138OL64EVM-031

Set up the EVM connection based on Figure 12.
1. Set up the EVM connection based on Figure 12. The LED of USB adapter is lighted up.
2. Use provided jumper jump across J39. The LED of the EVM is lighted on.
3. Launch the UCD31xx device GUI following the steps described in Section 6.2.1. A window shown in Figure 13 appears.
4. Check Download program flash, Download data flash and DO NOT write program checksum as shown in Figure 14.
5. Click Firmware Download; then a new window appears as shown in Figure 14. Click Select File and browse an intended firmware code file with file extension .x0; then click Download. Click Close to exit the download window.
6. After the firmware codes downloaded to the UCD3138 device, the intended test can be performed. In this user’s guide, we use PWR031_Test_GPIO_ADC12.x0 to show how to use the board.

7.2 Example Test and Steps

1. Setup hyper terminal using RS232 serial port with the settings shown. Then launch the hyper terminal.

![Hyper Terminal Settings](Figure 15. Hyper Terminal Settings)

2. Place jumpers on the following headers, jump across J1 pin-11 and pin-13, i.e., J1(11 and 13), J2(2 and 3), J5(1 and 2), J18(1 and 2, 3 and 4, 5 and 6, 7 and 8, 9 and 10, 11 and 12, 13 and 14), J28(1 and 2), J29(1 and 2), J32(1 and 2).
3. Connect J36 all pins together using single-in-line connector; then use a click-wire, hook-wire connect J36-1 and J30-4.
4. Place jumpers on J12(1 and 2), J16(1 and 2), J17(1 and 2), J20(2 and 3), J21(2 and 3).
5. Adjust R17 to make ADC12 input to 250 mV by a voltmeter to monitor the voltage between terminal J13-1 and J40-1.

Figure 16. Location of Jumpers in Use
6. Press **Reset** button once on the board. Click **Command ROM to execute its program** (*sendByte0xF0 to Address 11*). The firmware downloaded is executed, and the executed result is transmitted to the hyper terminal as shown.

![Hyper Terminal Execution Result](image)

Figure 17. Execution Result of Example Test

### 7.3 Equipment Shutdown

1. Exit the GUI and UART.
2. Disconnect the cables.
8 EVM Assembly Drawing and PCB layout

The following figures (Figure 18 through Figure 23) show the design of the UCD3138OL64EVM-031 printed circuit board. PCB dimensions: L x W = 6.0 x 4/0 in, PCB material: FR4 or compatible, four layers and 1-ounce copper on each layer.

Figure 18. UCD3138OL64EVM-031 Top Layer Assembly Drawing (top view)

Figure 19. UCD3138OL64EVM-031 Bottom Assembly Drawing (bottom view)
Figure 20. UCD3138OL64EVM-031 Top Copper (top view)

Figure 21. UCD3138OL64EVM-031 Internal Layer 1 (top view)
Figure 22. UCD3138OL64EVM-031 Internal Layer 2 (top view)

Figure 23. UCD3138OL64EVM-031 Bottom Copper (top view)
9 List of Materials
The EVM components list according to the schematics shown in Figure 1 to Figure 9

Table 3. UCD3138OL64EVM-031 List of Materials

<table>
<thead>
<tr>
<th>QTY</th>
<th>REF DES</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
<th>MFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C48, C49, C50, C54</td>
<td>Capacitor, ceramic, 16 V, X7R, 10%, 0.1 µF, 0603</td>
<td>STD</td>
<td>STD</td>
</tr>
<tr>
<td>20</td>
<td>C11, C12, C14, C16, C17, C18, C19, C22, C23, C24, C25, C26, C30, C31, C32, C33, C34, C35, C37, C39</td>
<td>Capacitor, ceramic, 50 V, X7R, 10%, 1000 pF, 0603</td>
<td>STD</td>
<td>STD</td>
</tr>
<tr>
<td>5</td>
<td>C13, C15, C44, C45, C46</td>
<td>Capacitor, ceramic, 50 V, C0G, 5%, 1000 pF, 0603</td>
<td>STD</td>
<td>STD</td>
</tr>
<tr>
<td>0</td>
<td>C20</td>
<td>Capacitor, ceramic, 50 V, X7R, 10%, no population, open, 0603</td>
<td>STD</td>
<td>STD</td>
</tr>
<tr>
<td>8</td>
<td>C21, C38, C40, C43, C47, C51, C52, C53</td>
<td>Capacitor, ceramic, 16 V, X7R, 10%, 1.0 µF, 0603</td>
<td>STD</td>
<td>STD</td>
</tr>
<tr>
<td>3</td>
<td>C27, C28, C29</td>
<td>Capacitor, ceramic, 50 V, C0G, 5%, 100 µF, 0603</td>
<td>STD</td>
<td>STD</td>
</tr>
<tr>
<td>3</td>
<td>C36, C41, C42</td>
<td>Capacitor, tantalum, 10 V, 20%, 10 µF, 3216</td>
<td>293D106X0010A2T</td>
<td>Vishay</td>
</tr>
<tr>
<td>2</td>
<td>D1, D5</td>
<td>Diode, LED, yellow, 2.1 V, 20 mA, 6 mcd, LTST-C190YKT, 0603</td>
<td>LTST-C190YKT</td>
<td>Lite On</td>
</tr>
<tr>
<td>1</td>
<td>D2</td>
<td>Diode, LED, red, 2.1 V, 20 mA, 6 mcd, LTST-C190CKT, 0603</td>
<td>LTST-C190CKT</td>
<td>Lite On</td>
</tr>
<tr>
<td>2</td>
<td>D3, D4</td>
<td>Diode, dual, Zener, 5.1 V, 300 mW, AZ23C5V1, SOT23</td>
<td>AZ23C5V1-7-F</td>
<td>Diodes</td>
</tr>
<tr>
<td>3</td>
<td>J1, J13, J18</td>
<td>Header, 2 x 7 pin, 100-mil spacing, 0.100 inch x 2 inch x 7 inch</td>
<td>PEC07DAAN</td>
<td>Sullins</td>
</tr>
<tr>
<td>1</td>
<td>J11</td>
<td>Header, male 2 x 4 pin, 100-mil spacing, 0.20 inch x 0.40 inch</td>
<td>PEC04DAAN</td>
<td>Sullins</td>
</tr>
<tr>
<td>15</td>
<td>J2, J5, J14, J15, J19, J20, J21, J22, J23, J16, J17, J28, J29, J32, J34</td>
<td>Header, 3 pin, 100-mil spacing, 0.100 inch x 3 inch</td>
<td>PEC03SAAN</td>
<td>Sullins</td>
</tr>
<tr>
<td>9</td>
<td>J24, J25, J26, J27, J30, J31, J36, J37, J40</td>
<td>Header, male 8 pin, 100-mil spacing, 0.100 inch x 8 inch</td>
<td>PEC08SAAN</td>
<td>Sullins</td>
</tr>
<tr>
<td>1</td>
<td>J3</td>
<td>Connector, male straight 2 x 10 pin, 100-mil spacing, 4 wall, 0.338 inch x 0.788 inch</td>
<td>N2510-6002-RB</td>
<td>3M</td>
</tr>
<tr>
<td>1</td>
<td>J35</td>
<td>Plug, 40 pin with hold down, 0.272 inch x 1.000 inch</td>
<td>2-5767004-2</td>
<td>Tyco</td>
</tr>
<tr>
<td>1</td>
<td>J38</td>
<td>Terminal block, 4 pin, 15 A, 5.1 mm, 0.80 inch x 0.35 inch</td>
<td>ED120/4DS</td>
<td>OST</td>
</tr>
<tr>
<td>1</td>
<td>J4</td>
<td>Connector, 9 pin D, right angle, female, 1.213 inch x 0.510 inch</td>
<td>182-009-212-171</td>
<td>Norcomp</td>
</tr>
<tr>
<td>10</td>
<td>J6, J7, J8, J9, J10, J12, J33, J39, J41, J42</td>
<td>Header, 2 pin, 100-mil spacing, 0.100 inch x 2 inch</td>
<td>PEC02SAAN</td>
<td>Sullins</td>
</tr>
<tr>
<td>2</td>
<td>Q1, Q2</td>
<td>Bipolar, NPN, 40 V, 200 mA, 200 mW, SC-75</td>
<td>MMBT3904TT1G</td>
<td>On Semi</td>
</tr>
<tr>
<td>2</td>
<td>Q3, Q4</td>
<td>MOSFET, N-channel, 60 V, 115 mA, 1.2 Ω, SOT23</td>
<td>2N7002-7-F</td>
<td>Diodes</td>
</tr>
<tr>
<td>2</td>
<td>R1, R11</td>
<td>Resistor, chip, 1/10 W, 1%, 100 Ω, 0805</td>
<td>STD</td>
<td>STD</td>
</tr>
<tr>
<td>4</td>
<td>R12, R13, R14, R20</td>
<td>Resistor, chip, 1/16 W, 5%, 33 Ω, 0603</td>
<td>STD</td>
<td>STD</td>
</tr>
<tr>
<td>4</td>
<td>R15, R16, R17, R61</td>
<td>Potentiometer, 3/8 cermet, single turn, right angle, 20 kΩ, 0.288 inch x 0.600 inch</td>
<td>3296Y-1-203 LF</td>
<td>Bourns</td>
</tr>
<tr>
<td>2</td>
<td>R2, R18</td>
<td>Resistor, chip, 1/10 W, 1%, 4.7 kΩ, 0603</td>
<td>STD</td>
<td>STD</td>
</tr>
<tr>
<td>3</td>
<td>R22, R23, R62</td>
<td>Resistor, chip, 1/16 W, 5%, 1.5 kΩ, 0603</td>
<td>STD</td>
<td>STD</td>
</tr>
</tbody>
</table>
### Table 3. UCD3138OL64EVM-031 List of Materials (continued)

<table>
<thead>
<tr>
<th>QTY</th>
<th>REF DES</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
<th>MFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>R24, R25, R32, R33, R34, R35, R40, R41, R42, R43, R45, R46, R47, R48</td>
<td>Resistor, chip, 1/16 W, 1%, 100 Ω, 0603</td>
<td>STD</td>
<td>STD</td>
</tr>
<tr>
<td>4</td>
<td>R26, R27, R30, R31</td>
<td>Resistor, chip, 1/10 W, 1%, 2 kΩ, 0603</td>
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<td>R29</td>
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<td>STD</td>
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<td>16</td>
<td>R3, R4, R5, R7, R8, R9, R10, R19, R21, R39, R44, R49, R60, R63, R64, R65</td>
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<td>STD</td>
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<td>STD</td>
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<td>R6, R50, R51, R52, R53, R54, R55, R56, R57</td>
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<td>STD</td>
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<td>KT11P2JM34LFS</td>
<td>C &amp; K</td>
</tr>
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<td>3</td>
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<td>OPA376AIDBVTT</td>
<td>TI</td>
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<td>1</td>
<td>U4</td>
<td>RS-232 Transceivers with Auto Shutdown, SSOP-16</td>
<td>SN75C3221DBR</td>
<td>TI</td>
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<td>1</td>
<td>U5</td>
<td>Micro-Power, 100-mA LDO Regulator, SOT23-5</td>
<td>TPS76333DBVT</td>
<td>TI</td>
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<td>Socket, 64-pin Clamshell, 0.800 inch x 1.080 inch</td>
<td>64QN50S19090</td>
<td>Plastronics</td>
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<td>Digital Power Controller, PFC-64</td>
<td>UCD3138RGC</td>
<td>TI</td>
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26 Using the UCD3138OL64EVM-031

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Appendix A Summary of Using Code Composer Studio v3.3

In this appendix, we describe basic steps how to use Code Composer Studio v3.3, or CCS, to compile firmware for UCD3138. 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 Set up Code Composer Studio v3.3 for UCD3138

The recommended version of Code Composer Studio is v3.3. After completing the CCS v3.3 installation, and when first time open CCS, a window as shown in Figure 24 is prompted to allow users to select the required configuration. For the UCD3138 device, please select ARM7 SIMULATOR BIG ENDIAN. Click ADD and then Save & Quit.

If CCS has existing configurations in My System, click Launch Setup under File pull-down menu. Select Remove All to remove the existing configurations; then select ARM7 SIMULATOR BIG ENDIAN as shown in Figure 24, Click ADD and then Save & Quit for UCD3138 device.
A.2 Build and Compile a Project using Code Composer Studio

After a project is created with all source codes developed, one can compile the project using CCS. On the matter how to create a project, please refer to reference 2, Code Composer Studio Development Tools v3.3 – Getting Started Guide. The example below is to describe typical compile process for UCD3138 firmware. The project file name is Cyclone.pjt in a folder named Training 02. The final result is a file with extension .x0. As the project name is Cyclone.pjt, the final file name Cyclone.x0 is naturally chosen. Cyclone.x0 is the final firmware code to be downloaded to the UCD3138 device memory for UCD3138 intended functional operation. Here are the steps for a typical compile process.

1. Copy file folder Training 02 in any desired directory inside your PC.
2. Launch CCS and open the CCS project file Cyclone.pjt from the directory where Training 02 was saved. The following window appears shown in Figure 25.
3. As project Cyclone.pjt has been created and orientated for UCD3138 functions, CCS can be launched without connecting an emulator.
4. From CCS project window, Right click on Cyclone.pjt (Debug) and then select Build Options… the window as shown in Figure 26 appears when the Linker tab is selected.
5. Figure 26 shows the project Build Options have been selected to create the file Cyclone.out from CCS.
6. The next step is to convert file Cyclone.out to Cyclone.x0. Cyclone.x0 is the final firmware code to be downloaded to the UCD3138 device memories. To convert Cyclone.out to Cyclone.x0, the first step is to click General tab under Build Options for Cyclone.pjt (Debug), as Figure 27 shown, under the Build Command, confirm the file to be converted is Cyclone.out, then click ok to close Build Options.
7. Steps 4, 5, and 6 are only necessary once per project. If using a TI developed firmware as a platform, these steps have been set up and no need to repeat.
8. As shown in Figure 28, select Project M Rebuild All. This generates the file Cyclone.x0 based on Cyclone.out, and the file of Cyclone.x0 is saved inside the folder where Cyclone.pjt is saved.
Figure 26. Open a Project File Cyclone.pjt (build options and linker tab)

Figure 27. Open a Project File Cyclone.pjt (build options and general tab)
A.3 References

1. UCD3138 Datasheet, Highly Integrated Digital Controller for Isolated Power, (Texas Instruments Literature Number SLUSAP2), 2012
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Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User’s Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User’s Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs not subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user’s sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-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.

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.

Concerning 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.

Concernant les EVMs avec antennes détaichables

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.
【Important Notice for Users of this Product in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only if you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

Texas Instruments Japan Limited
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Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.

2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.

3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.

4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to 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 use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

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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:

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3.1.1 Notice applicable to EVMs not FCC-Approved:

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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/sds/ti_ia/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/sds/ti_ia/general/eStore/notice_01.page

3.3.2 Notice for Users of EVMs Considered “Radio Frequency Products” in Japan: EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of 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.
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3.3.3 Notice for EVMs for Power Line Communication: Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

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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.

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