# Contents

1. General Description ................................................................. 5
2. EVM Package Contents .......................................................... 7
3. Quick Start ........................................................................... 9
4. Software Installation ............................................................. 11
   4.1 Graphical User Interface (GUI) ........................................ 11
5. TDC1000-TDC7200EVM Setup and Operation ................... 13
   5.1 EVM Connections .......................................................... 13
   5.2 Launching the Software .................................................. 14
6. Troubleshooting ..................................................................... 20
   6.1 Jumpers .......................................................................... 20
   6.2 LEDs ............................................................................. 21
   6.3 Driver Errors ................................................................... 21
7. Firmware Upgrade .................................................................. 24
8. Board Layout ......................................................................... 27
9. Schematic .............................................................................. 35
10. Bill of Materials .................................................................... 39

Revision History ........................................................................ 44
## List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-1</td>
<td>TDC1000-TDC7200EVM Evaluation Board</td>
<td>9</td>
</tr>
<tr>
<td>4-1</td>
<td>TDC1000-TDC7200EVM Installation Directory</td>
<td>11</td>
</tr>
<tr>
<td>5-1</td>
<td>Transducer Connected to Channel 1 (TX1/RX2)</td>
<td>13</td>
</tr>
<tr>
<td>5-2</td>
<td>TDC1000_7200EVM Graph</td>
<td>14</td>
</tr>
<tr>
<td>5-3</td>
<td>Plot of TOF of Water in Test Cell</td>
<td>15</td>
</tr>
<tr>
<td>5-4</td>
<td>EVM GUI - TDC1000 Tab</td>
<td>16</td>
</tr>
<tr>
<td>5-5</td>
<td>EVM GUI – Debug Tab</td>
<td>16</td>
</tr>
<tr>
<td>5-6</td>
<td>TDC1000-TDC7200EVM Board Connected to Oscilloscope</td>
<td>17</td>
</tr>
<tr>
<td>5-7</td>
<td>START and STOP Signals on Oscilloscope</td>
<td>18</td>
</tr>
<tr>
<td>6-1</td>
<td>Jumpers</td>
<td>20</td>
</tr>
<tr>
<td>6-2</td>
<td>TDC1000-TDC7200EVM LEDs</td>
<td>21</td>
</tr>
<tr>
<td>6-3</td>
<td>Device Manager with COM Port Name</td>
<td>22</td>
</tr>
<tr>
<td>7-1</td>
<td>Connection Error Pop-up Window</td>
<td>24</td>
</tr>
<tr>
<td>7-2</td>
<td>USB Firmware Upgrade Window</td>
<td>25</td>
</tr>
<tr>
<td>8-1</td>
<td>Top Overlay</td>
<td>27</td>
</tr>
<tr>
<td>8-2</td>
<td>Top Solder Mask</td>
<td>28</td>
</tr>
<tr>
<td>8-3</td>
<td>Top Layer</td>
<td>29</td>
</tr>
<tr>
<td>8-4</td>
<td>Mid Layer 1</td>
<td>30</td>
</tr>
<tr>
<td>8-5</td>
<td>Mid Layer 2</td>
<td>31</td>
</tr>
<tr>
<td>8-6</td>
<td>Bottom Layer</td>
<td>32</td>
</tr>
<tr>
<td>8-7</td>
<td>Bottom Solder Mask</td>
<td>32</td>
</tr>
<tr>
<td>8-8</td>
<td>Board Dimensions</td>
<td>33</td>
</tr>
<tr>
<td>9-1</td>
<td>TDC1000-TDC7200EVM Schematic 1</td>
<td>35</td>
</tr>
<tr>
<td>9-2</td>
<td>TDC1000-TDC7200EVM Schematic 2</td>
<td>36</td>
</tr>
<tr>
<td>9-3</td>
<td>TDC1000-TDC7200EVM Schematic 3</td>
<td>37</td>
</tr>
</tbody>
</table>
List of Tables

6-1. Jumpers .......................................................................................................................... 20
10-1. TDC1000-TDC7200EVM Bill of Materials ............................................................... 39
This guide details the use of the TDC1000-TDC7200EVM evaluation module (referred to as EVM for the remainder of this document). The TDC1000 analog-front-end (AFE) is an ultrasonic analog-front-end for Time-of-Flight (TOF) applications operating with ultrasound frequencies up to 4MHz. The TDC7200 is a Time to Digital Converter (TDC) that performs the function of a stopwatch and measures the elapsed time between up to five events.

In addition to the EVM, a Steminc 15mm 1Mhz transducer is included in the evaluation kit. It has been provided for experimentation with liquid level applications and liquid identification/concentration applications. This transducer is not suitable for flow meter applications. For instructions how to mount the transducer on a tank, please refer to Application Note SNAA266 (http://www.ti.com/lit/pdf/snaa266).

The EVM can be used for many time-of-flight applications such as gas, water, and heat flow meter, fluid level detection, concentration and fluid identification, and proximity or distance measurement. The EVM allows for two ultrasonic transducer connections, and two RTD connections for temperature measurements. It uses the on-board MSP430F5528 to process data and a user-friendly GUI interface to display the data.
EVM Package Contents

The TDC1000-TDC7200EVM evaluation kit comes with the following:

- On-board TDC7200 and TDC1000
- On-board MPS430 microcontroller
- Steminc 15mm 1Mhz transducer (SMD15T21R111WL)
- USB Mini-B to USB-A plug cable

The example in this document uses a "test cell" which is comprised of an acrylic container with an ultrasonic transducer mounted on the side of the container. The acrylic container can be purchased from Tap Plastics at http://www.tapplastics.com/product/plastics/plastic_containers/clear_plastic_boxes/222, and/or STEMINC's transducer (p/n: SMD10T2R11) (http://www.steminc.com/PZT/en/piezo-ceramic-disc-10x2mm-r-215-khz-wire-leads-smd10t2r111wl) can be mounted on the side of the test cell. For instructions to assemble your own "Test cell" please refer to Application Note SNAA266 (http://www.ti.com/lit/pdf/snaa266).
Quick Start

1. Download the TDC1000-TDC7200EVM software
2. Install the GUI. For detailed information, see Chapter 4.
3. Fill the test cell with water; ensure the water level is above the transducer. Description of this test cell can be found in Chapter 2.
4. Connect the transducer to TX1 (J5, pin 8) and GND (J5, pin 7). For more information, see Section 5.1.
5. Connect the EVM board with a mini USB cable (J2).
6. Launch the GUI.
7. On the GRAPH tab, press the START GRAPH button.
8. The time of flight should be read in the TDC AVG VALUE section, and should be around 39.7 us (this result is only applicable if using the test cell discussed in Chapter 2).

Figure 3-1. TDC1000-TDC7200EVM Evaluation Board
4.1 Graphical User Interface (GUI)

Installing the TDC1000-TDC7200EVM GUI software:

1. Download the TDC1000-TDC7200EVM_Installer-v???.zip into a known directory. This software can be found in http://www.ti.com/tool/tdc1000-tdc7200evm.
2. Make sure that the EVM has the latest firmware. For detail information, refer to Chapter 7.
3. Run the setup.exe file located in [Unzip location]\TDC1000_7200EVM_Installer-v???.zip\TDC1000_7200EVM_Installer\Installer\Volume.
4. Follow the pop-up screen instructions by clicking the Next button to install the software.

5. When the installation is done, click Finish.
5.1 EVM Connections

1. Connect the USB cable (J2) from the EVM to the PC.
2. Obtain a test cell (see image below) with an attached transducer. Fill the test cell with water until it is above the transducer. Description of this test cell can be found in Chapter 2.
3. Attach the transducer wires to the terminals TX1/RX2 (J5, pin 8) and GND (J5, pin 7) on the EVM board (see Figure 5-1).

![Transducer Connected to Channel 1 (TX1/RX2)](image)
5.2 Launching the Software

1. Run the TDC1000_TDC7200EVM GUI software by clicking on Start >> All Programs >> Texas Instruments >> TDC1000_7200.

2. The message at the bottom of Figure 5-2, "Read All No Errors", indicates that the GUI is up and running and all the registers and hardware connection are correct; otherwise, refer to Chapter 6 to troubleshoot.

3. Go to the GRAPH tab on the TDC1000-7200EVM GUI and click START GRAPH. The time of flight (TOF) displays in the TDC AVG VALUE window (see Figure 5-3). Note: the default settings work correctly for the test cell discussed in Chapter 2.

4. If the substance under test experiences any disturbance, either by impurities being added or by shaking the container, the graph represents this as a change on TOF.
5. Follow these steps to verify the TOF of the GUI on the oscilloscope:
   (a) In the GUI, click on the "TDC1000" tab, then click to enable "CONTINUOUS TRIGGER". Refer to Figure 5-4. The message "Start Continuous Trigger successful!!" should appear at the bottom of the GUI.
   (b) Connect the oscilloscope to the following connector:
      (i) START (J4)
      (ii) STOP (J3)
      (iii) COMP_IN (J7)
   (c) If the signal on the oscilloscope is flickering, ensure that the "ENABLE POWER CYCLE" is disabled on the DEBUG tab. Refer to Figure 5-5.
Figure 5-4. EVM GUI - TDC1000 Tab

Figure 5-5. EVM GUI – Debug Tab
Figure 5-6. TDC1000-TDC7200EVM Board Connected to Oscilloscope
6. Observe the START (yellow), STOP (Green), and COMP_IN (purple) signals on the oscilloscope and measure the time difference between the rising edge of the START signal to the rising edge of the STOP signal. Verify the time difference matches the TDC AVG VALUE on the GUI.

7. Find the width of the test cell with the following equations:

\[ d = \frac{t}{2}v \]

- \( d \): distance
- \( t \): time of flight (TOF)
- \( v \): speed of sound through the medium (water = 1484 m/s at 20°C.)

For example, the TOF of the test cell filled with water is 39.755 us, so

\[ d = \frac{(39.755 \text{us} \times 1484 \text{ m/s})}{2} = 29.5 \text{ mm} \]

The test cell is therefore 29.5 mm wide.
6.1 Jumpers

Table 6-1. Jumpers

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>JP1</td>
<td>Connects VDD_TDC7200 to V3p3</td>
</tr>
<tr>
<td>JP2</td>
<td>Connects AVCC1 to V3p3</td>
</tr>
<tr>
<td>JP3</td>
<td>Connects AVDD to VDD</td>
</tr>
<tr>
<td>JP4</td>
<td>Connects V3p3 to VIO</td>
</tr>
<tr>
<td>JP5</td>
<td>Trigger source selector: MPS430 trigger or TDC7200 trigger</td>
</tr>
<tr>
<td>JP6</td>
<td>Oscillator source selector: i.e. CPU clock or external oscillator</td>
</tr>
</tbody>
</table>

For default operation, place jumpers on the following:
1. JP1.P3 and JP1.P4 - OSC
6.2 LEDs

1. The Power LED (D4) and Link (D2) are ON if the board is powered.
2. If the D4 and D2 are OFF, check the physical connection to the PC.
3. The LINK LED is ON if there is an established communication with the PC.
   (a) If the LINK LED is blinking when the EVM is connected to the PC without the GUI running, then the crystal oscillator has a fault.
   (b) If the LINK LED is OFF, check the physical connection to the PC then verify if the correct firmware has been downloaded if the jumpers have been connected correctly.
   Note: The LINK LED blinks during graphing mode.

6.3 Driver Errors

If there is a driver error when running the GUI, check the Device Manager for COM port name TDC1000_7200_EVM.
If you do not see TDC1000_7200_EVM and instead see MSP430-USB Example, complete the following steps:

1. Open the Device Manager and find the MSP430-USB Example device.
2. Right-click and choose Update Driver Software.
3. Select Browse my Computer for driver installation. Navigate and select the folder containing the TDC1000_7200_EVM_DRIVER.inf file.
4. Close the setup window when the installation is complete. The Device Manager should now display TDC1000_7200_EVM followed by a COM port number. Take note of this number as it will be required to connect to the board from the GUI.
Note: This section is only necessary if the firmware needs to be changed. The TDC1000-TDC7200EVM comes preloaded with firmware already.

To change the firmware, complete the following steps:
1. Connect the TDC1000-TDC7200EVM to a PC.
2. Open the TDC1000-7200EVM GUI then go to the DEBUG tab. Press OK if a connection error window pops up. Click on the Update Firmware button.

3. The MSP430 USB Firmware Upgrade window pops up. Click Next to proceed on the first prompt; read and accept the license agreement and click Next to continue.

Figure 7-1. Connection Error Pop-up Window
4. Disconnect and reconnect the LaunchPad to PC while holding down the BSL button.
5. Select the Select Firmware button and browse to the firmware file.
6. Click on the Upgrade Firmware button to program the EVM. Close the application when done and restart the TDC1000_7200EVM GUI.
Figure 8-1. Top Overlay
Figure 8-2. Top Solder Mask
Figure 8-3. Top Layer
Figure 8-4. Mid Layer 1
Figure 8-5. Mid Layer 2
Figure 8-6. Bottom Layer

Figure 8-7. Bottom Solder Mask
Figure 8-8. Board Dimensions
Figure 9-1. TDC1000-TDC7200EVM Schematic 1
Figure 9-2. TDC1000-TDC7200EVM Schematic 2
Component value = DNP means do not populate.
## Table 10-1. TDC1000-TDC7200EVM Bill of Materials

<table>
<thead>
<tr>
<th>Designator</th>
<th>Description</th>
<th>Value</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPCB1</td>
<td>Printed Circuit Board</td>
<td></td>
<td>Any</td>
<td>SV601098</td>
</tr>
<tr>
<td>C1, C24, C44</td>
<td>CAP, CERM, 0.01 uF, 25 V, +/-10%, X7R, 0603</td>
<td>0.01 uF</td>
<td>MuRata</td>
<td>GRM188R71E103KA01D</td>
</tr>
<tr>
<td>C2, C26, C29, C30, C34, C38, C41, C45</td>
<td>CAP, CERM, 0.1 uF, 10 V, +/-10%, X5R, 0402</td>
<td>0.1 uF</td>
<td>TDK</td>
<td>C1005X5R1A104K</td>
</tr>
<tr>
<td>C3, C23, C31</td>
<td>CAP, CERM, 1 uF, 25 V, +/-10%, X7R, 0603</td>
<td>1 uF</td>
<td>MuRata</td>
<td>GRM188R71E105KA12D</td>
</tr>
<tr>
<td>C6, C7</td>
<td>CAP, CERM, 30 pF, 100 V, +/-5%, C0G/NP0, 0603</td>
<td>30 pF</td>
<td>MuRata</td>
<td>GRM188SC2A300JA01D</td>
</tr>
<tr>
<td>C8, C11</td>
<td>CAP, CERM, 0.22 uF, 25 V, +/-10%, X5R, 0603</td>
<td>0.22 uF</td>
<td>AVX</td>
<td>0603D224KAT2A</td>
</tr>
<tr>
<td>C9</td>
<td>CAP, CERM, 2200 pF, 50 V, +/-10%, X7R, 0603</td>
<td>2200 pF</td>
<td>Kemet</td>
<td>C0603X222K5RACTU</td>
</tr>
<tr>
<td>C10</td>
<td>CAP, CERM, 0.47 uF, 16 V, +/-10%, X7R, 0603</td>
<td>0.47 uF</td>
<td>MuRata</td>
<td>GRM188R71C474KA88D</td>
</tr>
<tr>
<td>C12, C13, C14, C19</td>
<td>CAP, CERM, 0.1 uF, 100 V, +/-10%, X7R, 0603</td>
<td>0.1 uF</td>
<td>MuRata</td>
<td>GRM188R72A104KA35D</td>
</tr>
<tr>
<td>C15</td>
<td>CAP, CERM, 6.8 pF, 50 V, +/-4%, C0G/NP0, 0603</td>
<td>6.8 pF</td>
<td>AVX</td>
<td>0603S5A6R8CAT2A</td>
</tr>
<tr>
<td>C16, C21</td>
<td>CAP, CERM, 2.2 uF, 16 V, +/-10%, X7R, 0805</td>
<td>2.2 uF</td>
<td>Kemet</td>
<td>C0805C225K4RACTU</td>
</tr>
<tr>
<td>C17</td>
<td>CAP, CERM, 1 uF, 16 V, +/-10%, X5R, 0805</td>
<td>1 uF</td>
<td>AVX</td>
<td>0805YD105KAT2A</td>
</tr>
<tr>
<td>C18, C46</td>
<td>CAP, CERM, 10 uF, 10 V, +/-10%, X5R, 0805</td>
<td>10 uF</td>
<td>Kemet</td>
<td>C0805C106K8PACTU</td>
</tr>
<tr>
<td>C20</td>
<td>CAP, CERM, 220 pF, 50 V, +/-1%, C0G/NP0, 0603</td>
<td>220 pF</td>
<td>AVX</td>
<td>0603S5A221FAT2A</td>
</tr>
<tr>
<td>C22</td>
<td>CAP, CERM, 22 uF, 16 V, +/-20%, X5R, 1206</td>
<td>22 uF</td>
<td>AVX</td>
<td>1206YD226MAT2A</td>
</tr>
<tr>
<td>C25, C33, C37, C40</td>
<td>CAP, CERM, 0.01 uF, 10 V, +/-10%, X5R, 0402</td>
<td>0.01 uF</td>
<td>MuRata</td>
<td>GRM155R61A103KA01D</td>
</tr>
<tr>
<td>C27, C32</td>
<td>CAP, CERM, 51 pF, 100 V, +/-5%, C0G/NP0, 0603</td>
<td>51 pF</td>
<td>MuRata</td>
<td>GRM188SC2A510JA01D</td>
</tr>
<tr>
<td>C28</td>
<td>CAP, CERM, 0.01 uF, 25 V, +/-5%, C0G/NP0, 0603</td>
<td>0.01 uF</td>
<td>TDK</td>
<td>C1608C0G1E103J</td>
</tr>
<tr>
<td>Designator</td>
<td>Description</td>
<td>Value</td>
<td>Manufacturer</td>
<td>Part Number</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
<td>-------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>C35, C39, C47</td>
<td>CAP, CERM, 10 pF, 50 V, +/-5%, C0G/NP0, 0603</td>
<td>10 pF</td>
<td>AVX</td>
<td>06035A100JAT2A</td>
</tr>
<tr>
<td>C36</td>
<td>CAP, CERM, 1000 pF, 50 V, +/-5%, C0G/NP0, 0603</td>
<td>1000 pF</td>
<td>TDK</td>
<td>C1608C0G1H102J</td>
</tr>
<tr>
<td>C42, C43</td>
<td>CAP, CERM, 300 pF, 50 V, +/-5%, C0G/NP0, 0603</td>
<td>300 pF</td>
<td>MuRata</td>
<td>GRM1885C1H301JA01D</td>
</tr>
<tr>
<td>D2, D4</td>
<td>LED, Green, SMD</td>
<td>Green</td>
<td>Lite-On</td>
<td>LTST-C190GKT</td>
</tr>
<tr>
<td>D3</td>
<td>LED, Orange, SMD</td>
<td>Orange</td>
<td>Lite-On</td>
<td>LTST-C190FKKT</td>
</tr>
<tr>
<td>D5</td>
<td>Diode, Zener, 7.5 V, 550 mW, SMD</td>
<td>7.5 V</td>
<td>ON Semiconductor</td>
<td>1SMB922BT3G</td>
</tr>
<tr>
<td>FB1, FB2, FB3, FB4</td>
<td>0.8A Ferrite Bead, 60 ohm @ 100MHz, SMD</td>
<td>60 ohm</td>
<td>Taiyo Yuden</td>
<td>BK1608HS600-T</td>
</tr>
<tr>
<td>H1, H2, H3, H4</td>
<td>Bump, Cylindrical, 0.312 X 0.200, Black</td>
<td></td>
<td>3M</td>
<td>SJ61A1</td>
</tr>
<tr>
<td>J2</td>
<td>MINI USB 2.0 SMT TYPE AB 5 CONTACTS R/A, SMD</td>
<td></td>
<td>Wurth Elektronik eiSos</td>
<td>651-305-142-821</td>
</tr>
<tr>
<td>J5</td>
<td>Receptacle, 7x2, 2.54 mm, R/A, TH</td>
<td></td>
<td>Samtec</td>
<td>SSW-107-02-G-D-RA</td>
</tr>
<tr>
<td>J8</td>
<td>Connector, TH, SMA</td>
<td></td>
<td>Emerson Network Power</td>
<td>142-0701-201</td>
</tr>
<tr>
<td>JP5</td>
<td>Header, TH, 100mil, 3x1, Gold plated, 230 mil above insulator</td>
<td></td>
<td>Samtec</td>
<td>TSW-103-07-G-S</td>
</tr>
<tr>
<td>JP6</td>
<td>Header, TH, 100mil, 3x2, Gold plated, 230 mil above insulator</td>
<td></td>
<td>Samtec</td>
<td>TSW-103-07-G-D</td>
</tr>
<tr>
<td>L1</td>
<td>Inductor, Shielded Drum Core, Ferrite, 22 uH, 0.7 A, 0.155 ohm, SMD</td>
<td>22 uH</td>
<td>Wurth Elektronik eiSos</td>
<td>744043220</td>
</tr>
<tr>
<td>LBL1</td>
<td>Thermal Transfer Printable Labels, 0.650” W x 0.200” H - 10,000 per roll</td>
<td></td>
<td>Brady</td>
<td>THT-14-423-10</td>
</tr>
<tr>
<td>R1, R3, R6, R7, R21, R22, R29, R33, R45, R48</td>
<td>RES, 33 ohm, 5%, 0.063W, 0402</td>
<td>33</td>
<td>Vishay-Dale</td>
<td>CRCW040233R0JNED</td>
</tr>
<tr>
<td>R2, R40, R43, R47</td>
<td>RES, 10.0k ohm, 1%, 0.1W, 0603</td>
<td>10.0k</td>
<td>Yageo America</td>
<td>RC0603FR-0710KL</td>
</tr>
<tr>
<td>R9, R12</td>
<td>RES, 261 ohm, 1%, 0.1W, 0603</td>
<td>261</td>
<td>Vishay-Dale</td>
<td>CRCW0603261RFKEA</td>
</tr>
<tr>
<td>R13, R15, R16, R27, R41, R42, R49</td>
<td>RES, 0 ohm, 5%, 0.1W, 0603</td>
<td>0</td>
<td>Vishay-Dale</td>
<td>CRCW0603000000Z0EA</td>
</tr>
<tr>
<td>R14, R26</td>
<td>RES, 33k ohm, 5%, 0.1W, 0603</td>
<td>33k</td>
<td>Vishay-Dale</td>
<td>CRCW060333K0JNEA</td>
</tr>
<tr>
<td>R17</td>
<td>RES, 51.1k ohm, 1%, 0.1W, 0603</td>
<td>51.1k</td>
<td>Vishay-Dale</td>
<td>CRCW060351K1FKEA</td>
</tr>
<tr>
<td>R18</td>
<td>RES, 102k ohm, 1%, 0.1W, 0603</td>
<td>102k</td>
<td>Vishay-Dale</td>
<td>CRCW0603102KFKEA</td>
</tr>
<tr>
<td>R19</td>
<td>RES, 1.0k ohm, 5%, 0.1W, 0603</td>
<td>1.0k</td>
<td>Vishay-Dale</td>
<td>CRCW06031K00JNEA</td>
</tr>
<tr>
<td>Designator</td>
<td>Description</td>
<td>Value</td>
<td>Manufacturer</td>
<td>Part Number</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
<td>-------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>R20</td>
<td>RES, 240k ohm, 5%, 0.1W, 0603</td>
<td>240k</td>
<td>Vishay-Dale</td>
<td>CRCW0603240KJNEA</td>
</tr>
<tr>
<td>R23</td>
<td>RES, 100k ohm, 5%, 0.1W, 0603</td>
<td>100k</td>
<td>Vishay-Dale</td>
<td>CRCW0603100KJNEA</td>
</tr>
<tr>
<td>R24</td>
<td>RES, 1.5k ohm, 5%, 0.063W, 0402</td>
<td>1.5k</td>
<td>Vishay-Dale</td>
<td>CRCW04021K50JNED</td>
</tr>
<tr>
<td>R25</td>
<td>RES, 1.0Meg ohm, 5%, 0.1W, 0603</td>
<td>1.0 Meg</td>
<td>Vishay-Dale</td>
<td>CRCW06031M00JNEA</td>
</tr>
<tr>
<td>R28</td>
<td>RES, 1.2Meg ohm, 5%, 0.1W, 0603</td>
<td>1.2 M</td>
<td>Vishay-Dale</td>
<td>CRCW06031M20JNEA</td>
</tr>
<tr>
<td>R30, R32</td>
<td>RES, 200 ohm, 0.1%, 0.1W, 0603</td>
<td>200</td>
<td>Susumu Co Ltd</td>
<td>RG1608P-201-B-T5</td>
</tr>
<tr>
<td>R31</td>
<td>RES, 5.36k ohm, 1%, 0.1W, 0603</td>
<td>5.36k</td>
<td>Vishay-Dale</td>
<td>CRCW06035K36FKEA</td>
</tr>
<tr>
<td>R34, R37, R38, R44</td>
<td>RES, 1.00k ohm, 1%, 0.1W, 0603</td>
<td>1.00k</td>
<td>Vishay-Dale</td>
<td>CRCW06031K00FKEA</td>
</tr>
<tr>
<td>R35, R36</td>
<td>RES, 10.0Meg ohm, 1%, 0.1W, 0603</td>
<td>10.0 Meg</td>
<td>Vishay-Dale</td>
<td>CRCW060310M0FKEA</td>
</tr>
<tr>
<td>R39, R46</td>
<td>RES, 0 ohm, 5%, 0.1W, 0603</td>
<td>50</td>
<td>Vishay-Dale</td>
<td>CRCW06030000Z0EA</td>
</tr>
<tr>
<td>R50</td>
<td>RES, 51.1 ohm, 1%, 0.1W, 0603</td>
<td>51.1</td>
<td>Vishay-Dale</td>
<td>CRCW060351R1FKEA</td>
</tr>
<tr>
<td>R51</td>
<td>RES, 33.0 ohm, 1%, 0.1W, 0603</td>
<td>33.0</td>
<td>Vishay-Dale</td>
<td>CRCW060333R0FKEA</td>
</tr>
<tr>
<td>SW1</td>
<td>Switch, Tactile, SPST-NO, 0.05A, 12 V, TH</td>
<td></td>
<td>C&amp;K Components</td>
<td>PTS635SL50LFS</td>
</tr>
<tr>
<td>TP1, TP6, TP8, TP11, TP16, TP18</td>
<td>Test Point, TH, Compact, Black</td>
<td></td>
<td>Keystone</td>
<td>5006</td>
</tr>
<tr>
<td>TP5, TP7, TP10, TP15</td>
<td>Test Point, Miniature, Red, TH</td>
<td></td>
<td>Keystone</td>
<td>5000</td>
</tr>
<tr>
<td>U1</td>
<td>STOPWATCH IC FOR TIME MEASUREMENT BETWEEN TWO EVENTS, PW0014A</td>
<td></td>
<td>Texas Instruments</td>
<td>TDC7200PW</td>
</tr>
<tr>
<td>U2</td>
<td>Mixed Signal MicroController, RG0064B</td>
<td></td>
<td>Texas Instruments</td>
<td>MSP430F5528IRGC</td>
</tr>
<tr>
<td>U3</td>
<td>Micropower 50 mA Ultra Low-Dropout Adjustable Voltage Regulator, 5-pin SOT-23</td>
<td></td>
<td>Texas Instruments</td>
<td>LP2980IM5X-ADJ</td>
</tr>
<tr>
<td>U4</td>
<td>PRECISION ADJUSTABLE CURRENT-LIMITED POWER-DISTRIBUTION SWITCHES, DBV0006A</td>
<td></td>
<td>Texas Instruments</td>
<td>TPS2553DBV-1</td>
</tr>
<tr>
<td>U5</td>
<td>ESD-Protection Array for High-Speed Data Interfaces, 4 Channels, -40 to +85 degC, 6-pin SON (DRY), Green (RoHS &amp; no Sb/Br)</td>
<td></td>
<td>Texas Instruments</td>
<td>TPD4E004DRYR</td>
</tr>
</tbody>
</table>
Table 10-1. TDC1000-TDC7200EVM Bill of Materials (continued)

<table>
<thead>
<tr>
<th>Designator</th>
<th>Description</th>
<th>Value</th>
<th>Manufacturer</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>U6</td>
<td>Micropower 150 mA Low-Noise Ultra Low-Dropout Regulator, 5-pin SOT-23, Pb-Free</td>
<td></td>
<td>Texas Instruments</td>
<td>LP2985AIM5-3.3/NOPB</td>
</tr>
<tr>
<td>U7, U8</td>
<td>3.3 V and 2.5 V LVCMOS High-Performance Clock Buffer Family, PW0008A</td>
<td></td>
<td>Texas Instruments</td>
<td>CDCLVC1102PW</td>
</tr>
<tr>
<td>U9, U12</td>
<td>2.4V R-R Out CMOS Video Op Amp with Shutdown</td>
<td>LMH6601MG</td>
<td>Texas Instruments</td>
<td>LMH6601MG</td>
</tr>
<tr>
<td>U10</td>
<td>TDC1000 Precision AFE for Time of Flight, PW0028A</td>
<td></td>
<td>Texas Instruments</td>
<td>TDC1000PW</td>
</tr>
<tr>
<td>U11</td>
<td>ESD Array For Portable Space-Saving Applications, 8 Channels, -40 to +85 degC, 8-pin WSON (DQD), Green (RoHS &amp; no Sb/Br)</td>
<td></td>
<td>Texas Instruments</td>
<td>TPD8E003DQDR</td>
</tr>
<tr>
<td>Y1</td>
<td>Crystal, 24.000 MHz, 18 pF, SMD</td>
<td></td>
<td>Abracon Corporation</td>
<td>ABMM-24.000MHZ-B2-T</td>
</tr>
<tr>
<td>Y2</td>
<td>OSC, 8 MHz, 1.8 - 3.3 V, SMD</td>
<td></td>
<td>Abracon Corporation</td>
<td>ASEMB-8.000MHZ-LY-T</td>
</tr>
<tr>
<td>C4, C5</td>
<td>CAP, CERM, 2200 pF, 50 V, +/-10%, X7R, 0603</td>
<td>2200 pF</td>
<td>Kemet</td>
<td>C0603X222K5RACTU</td>
</tr>
<tr>
<td>D1</td>
<td>Diode, Ultrafast, 100 V, 0.15 A, SOD-123</td>
<td>100 V</td>
<td>Diodes Inc.</td>
<td>1N4148W-7-F</td>
</tr>
<tr>
<td>FID1, FID2, FID3</td>
<td>Fiducial mark. There is nothing to buy or mount.</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>J1</td>
<td>Header, TH, 100mil, 7x2, Gold plated, 230 mil above insulator</td>
<td></td>
<td>Samtec Inc.</td>
<td>TSW-107-07-G-D</td>
</tr>
<tr>
<td>J3, J4, J7</td>
<td>Connector, TH, SMA</td>
<td></td>
<td>Emerson Network Power</td>
<td>142-0701-201</td>
</tr>
<tr>
<td>J6</td>
<td>Connector, Receptacle, 100mil, 5x2, Gold plated, R/A, TH</td>
<td></td>
<td>Sullins Connector Solutions</td>
<td>PPPC052LJBNS-RC</td>
</tr>
<tr>
<td>R4, R11</td>
<td>RES, 0 ohm, 5%, 0.1W, 0603</td>
<td>0</td>
<td>Vishay-Dale</td>
<td>CRCW06030000Z0EA</td>
</tr>
<tr>
<td>R5, R8, R10</td>
<td>RES, 1.05k ohm, 1%, 0.1W, 0603</td>
<td>1.05k</td>
<td>Vishay-Dale</td>
<td>CRCW06031K05FKEA</td>
</tr>
</tbody>
</table>
# Revision History

**Changes from Original (October 2014) to A Revision**

<table>
<thead>
<tr>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Added info about transducer that is now included in the EVM kit</td>
<td>5</td>
</tr>
</tbody>
</table>

**NOTE:** Page numbers for previous revisions may differ from page numbers in the current version.
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/sds/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/sds/ti_ja/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.
【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】開発キットの中には技術基準適合証明を受けていないものがあります。技術基準適合証明を受けていないも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。上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。

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24番1号
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](http://www.tij.co.jp/lsds/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.

8.2 **Specific Limitations.** IN NO EVENT SHALL TI’S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND CONDITIONS SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2015, Texas Instruments Incorporated
IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to additional restrictions.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have not been so designated is solely at the Buyer’s risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated components, TI will not be responsible for any failure to meet ISO/TS16949.

Products

**Audio**
- [www.ti.com/audio](http://www.ti.com/audio)

**Amplifiers**
- [amplifier.ti.com](http://amplifier.ti.com)

**Data Converters**
- [dataconverter.ti.com](http://dataconverter.ti.com)

**DLP® Products**
- [www.dlp.com](http://www.dlp.com)

**DSP**
- [dsp.ti.com](http://dsp.ti.com)

**Clocks and Timers**
- [www.ti.com/clocks](http://www.ti.com/clocks)

**Interface**
- [interface.ti.com](http://interface.ti.com)

**Logic**
- [logic.ti.com](http://logic.ti.com)

**Power Mgmt**
- [power.ti.com](http://power.ti.com)

**Microcontrollers**
- [microcontroller.ti.com](http://microcontroller.ti.com)

**RFID**
- [www.ti-rfid.com](http://www.ti-rfid.com)

**OMAP Applications Processors**
- [www.ti.com/omap](http://www.ti.com/omap)

**Wireless Connectivity**
- [www.ti.com/wirelessconnectivity](http://www.ti.com/wirelessconnectivity)

Applications

**Audio, Video, and Imaging**
- [www.ti.com/video](http://www.ti.com/video)

**Computers and Peripherals**
- [www.ti.com/computers](http://www.ti.com/computers)

**Consumer Electronics**
- [www.ti.com/consumer-apps](http://www.ti.com/consumer-apps)

**Energy and Lighting**
- [www.ti.com/energy](http://www.ti.com/energy)

**Industrial**
- [www.ti.com/industrial](http://www.ti.com/industrial)

**Medical**
- [www.ti.com/medical](http://www.ti.com/medical)

**Security**
- [www.ti.com/security](http://www.ti.com/security)

**Space, Avionics and Defense**
- [www.ti.com/space-avionics-defense](http://www.ti.com/space-avionics-defense)

**Video and Imaging**
- [www.ti.com/video](http://www.ti.com/video)

**Automotive and Transportation**
- [www.ti.com/automotive](http://www.ti.com/automotive)

**Communications and Telecom**
- [www.ti.com/communications](http://www.ti.com/communications)

**Computers and Peripherals**
- [www.ti.com/computers](http://www.ti.com/computers)

**Energy and Lighting**
- [www.ti.com/energy](http://www.ti.com/energy)

**Industrial**
- [www.ti.com/industrial](http://www.ti.com/industrial)

**Medical**
- [www.ti.com/medical](http://www.ti.com/medical)

**Security**
- [www.ti.com/security](http://www.ti.com/security)

**Space, Avionics and Defense**
- [www.ti.com/space-avionics-defense](http://www.ti.com/space-avionics-defense)

**Video and Imaging**
- [www.ti.com/video](http://www.ti.com/video)

**Automotive and Transportation**
- [www.ti.com/automotive](http://www.ti.com/automotive)

**Communications and Telecom**
- [www.ti.com/communications](http://www.ti.com/communications)

**Computers and Peripherals**
- [www.ti.com/computers](http://www.ti.com/computers)

**Energy and Lighting**
- [www.ti.com/energy](http://www.ti.com/energy)

**Industrial**
- [www.ti.com/industrial](http://www.ti.com/industrial)

**Medical**
- [www.ti.com/medical](http://www.ti.com/medical)

**Security**
- [www.ti.com/security](http://www.ti.com/security)

**Space, Avionics and Defense**
- [www.ti.com/space-avionics-defense](http://www.ti.com/space-avionics-defense)

**Video and Imaging**
- [www.ti.com/video](http://www.ti.com/video)

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2015, Texas Instruments Incorporated