This document is the user's guide for the TCA9548AEVM. The TCA9548AEVM is designed to evaluate and demonstrate the functionality of TI's TCA954xA family of I²C switches. The TCA9548A comes installed on the board and the 24-pin TSSOP footprint also supports TCA9543A, TCA9544A, TCA9545A, and TCA9546A.

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1 About this Manual

This user’s guide describes the TCA9548AEVM. This guide contains an introduction, setup instructions, the EVM schematic, top and bottom board layouts, and a bill of materials.

2 Information About Cautions and Warnings

![ATTENTION STATIC SENSITIVE DEVICES](image)

CAUTION
This EVM contains components that can potentially be damaged by electrostatic discharge. Always transport and store the EVM in its supplied ESD bag when not in use. Handle using an antistatic wristband. Operate on an antistatic work surface. For more information on proper handling, see the Electrostatic Discharge (ESD) application note (SSYA009).

The information in a caution or a warning is provided for your protection. Read each caution and warning carefully.

3 Items Required for Operation

The following items are required to use the TCA9548AEVM:

- TCA9548AEVM
- Power supply 1.8 V–5 V 500 mA
- I²C master controller

4 Introduction

This document is the user’s guide for the TCA9548AEVM. The TCA9548AEVM is designed to evaluate and demonstrate the functionality of TI’s TCA954xA family of I²C switches. The TCA9548AEVM can be used as a standalone evaluation module to interface with an existing system or paired with the MSP430 Launchpad which serves as the I²C master and power supply for the TCA9548AEVM. The TCA9548AEVM also has several jumpers that can be adjusted to accommodate 5 different Texas Instruments I²C switches with varying numbers of channels: TCA9543A, TCA9544A, TCA9545A, TCA9546A, and TCA9548A. Other devices in the TCA954xA family with fewer channels can be ordered separately and placed on the TCA9548AEVM for evaluation.

<table>
<thead>
<tr>
<th>I²C SWITCH</th>
<th>IC</th>
<th>PACKAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>TCA9543APWR</td>
<td>TSSOP-14</td>
</tr>
<tr>
<td>U2</td>
<td>TCA9544APWR</td>
<td>TSSOP-20</td>
</tr>
<tr>
<td>U3</td>
<td>TCA9545APWR</td>
<td>TSSOP-20</td>
</tr>
<tr>
<td>U4</td>
<td>TCA9546APWR</td>
<td>TSSOP-16</td>
</tr>
<tr>
<td>U5</td>
<td>TCA9548APWR</td>
<td>TSSOP-24</td>
</tr>
</tbody>
</table>
5 Setup

This section describes the header/jumper connections on the EVM, installation of the firmware on the MSP430 LaunchPad, and getting started using the TCA9548AEVM with other TCA954xA supported devices.

5.1 Header and Jumper Connections Description

5.1.1 J1 and J2: MSP430 LaunchPad interface

Headers J1 and J2 allow the EVM to interface with the MSP430 LaunchPad.
5.1.2 J_1V8: LDO output

Jumper J_1V8 shorts the output of the LDO to Vcc 1V8 which powers the TCA954xA IC and the pull up voltage for the ICs address pins. The J_1V8 jumper allows the user to remove the LDO from the circuit and supply external power to the TCA954xA device and address pins. External power to the TCA954xA device must be between 1.8V-5V. Figure 2 shows the J_1V8 jumper installed connecting the LDO output to the TCA954xA supply.

Figure 2. J_1V8 Jumper Connecting LDO Output

5.1.3 J8: SDA and SCL Pull Up Voltage Selection

J8 allows the user to select the voltage for all of the slave signal path pull ups. J8 can select the slave signal lines pulled up to VCC_1V8 voltage which is the same as the TCA954xA IC voltage or select the slave signal lines pulled up to VCC_msp voltage which is the same as the master side pull up voltage. This gives the user the flexibility to operate the master and slave signals with different pull up voltages showing the TCA954xA devices’ level translation ability. Figure 3 shows the J8 jumper selecting the slave signals’ pull up voltage the same as VCC_msp.

Figure 3. J8 Jumper SDA and SCL Pull Up Voltage Selection
5.1.4 J_Vcct1 and J_Vcct2: Temp Senor Power Supply

J_Vcct1 and J_Vcct2 allow the user to disconnect the Vdpu power supply to the two TMP102 temperature sensors. Figure 4 shows J_Vcct1 and J_Vcct2 jumpers installed connecting power to the TMP102 temperature sensors.

Figure 4. J_Vcct1 and J_Vcct2 Jumper Connections

5.1.5 A0 and A1: Slave Address Configuration

Jumpers A0 and A1 allow the user to configure the TCA954xA IC slave address both through hardware and software. The jumpers connect the A0 and A1 address pins of the TCA954xA either to VCC_1V8 or ground. If the jumpers are removed the user can configure the A0 and A1 pins through software. Figure 5 shows A0 connected to ground and A1 connected to VCC_1V8.

Figure 5. A0 and A1 Slave Address Configuration

NOTE: The A2 address pin for the TCA954xA devices are pulled up to VCC_msp on the board and does not offer hardware configurability.
5.1.6 J2, J5, and J6: IC Grounding Configurations for Other TCA954xA Devices

J2, J5, and J6 provide alternate grounds if the user decides to install other TCA954xA devices on the TCA9548AEVM. J2, J5, and J6 jumpers either ground the pin from the IC or pull it up to Vdpu for signal path communication. While the TCA9548A IC is installed, in order to use the signal paths, all three jumpers must be placed pulling up the IC pins to Vdpu as shown in Figure 6.

![Figure 6. Grounding Configurations for Other TCA954xA Devices](image)

5.1.7 J1, J3, J4, J9, J10, J13, J14, J15, SDA, SCL, SC_SD: IC Signal Path Headers

J1, J3, and J4 are headers for signal pins when jumpers J2, J5, and J6 are not configured to ground one of the TCA954xA devices. Figure 6 shows J2, J5, and J6 configured for the TCA9548A which make J1, J3, J4, J9, J10, J13, J14, J15, SDA, SCL, SC_SD headers for signal paths.

J10, J13, SDA, SCL are headers for signal paths on the mater side of the TCA954xA.

J9, J14, J15, and SC_SD are headers for signal paths on the slave side of the TCA954xA.

5.1.8 J7, J11, J12, J16, J17, J20: IC Signal Path Configurations for TCA954xA Devices

J7 and J11 are jumpers that configure the TCA9548AEVM to accommodate the various signal paths for the TCA954xA devices to the TMP102 temperature sensor. Table 1 shows the pinouts of the TCA954xA family. Figure 7 shows J7 and J11 configured to communicate to the two temperature sensors from the TCA9548A.

J12, J16, J17, J20 jumpers allow the user to disconnect the Temperature sensor from the TCA954xA device and use the I2C channel for their system.

![Figure 7. J7 and J11 Jumper Connections](image)
5.1.9 Replacing TCA9548A with Another TCA954xA

When replacing the TCA9548A device, make sure you solder pin 1 of the TCA954xA device in the upper left hand corner of the pad. When this is done correctly, there will be unused pads below the IC. Before powering on the device ensure the jumpers are set according to the configurations shown in Figure 8 through Figure 12:

Figure 8. Jumper Configuration for TCA9548A

Figure 9. Jumper Configuration for TCA9546A
Figure 10. Jumper Configuration for TCA9545A

Figure 11. Jumper Configuration for TCA9544A
Figure 12. Jumper Configuration for TCA9543A
Figure 13 shows the schematic for the TCA9548AEVM evaluation board. PDFs are available on www.ti.com.
### 6.1 Pin Map

Table 2 shows the TCA954xA pin map.

#### Table 2. TCA954xA Pin Map

<table>
<thead>
<tr>
<th>Connected Device</th>
<th>Pin</th>
<th>Device TCA954xA</th>
<th>Pin</th>
<th>Device TCA954xA</th>
<th>Connected Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A0</td>
<td>48A 46A 45A 44A 43A 43A 44A/45A 46A 48A 48A 46A 45A 44A 43A</td>
<td>14</td>
<td>20 16 24 VCC VCC VCC VCC VCC</td>
<td>MSP430</td>
</tr>
<tr>
<td>2</td>
<td>A1</td>
<td>43A 44A/45A 46A 48A 48A 46A 45A 44A 43A</td>
<td>13</td>
<td>19 15 23 SDA SDA SDA SDA SDA</td>
<td>MSP430</td>
</tr>
<tr>
<td>3</td>
<td>RESET</td>
<td>RESET</td>
<td>A2</td>
<td>RESET</td>
<td>12</td>
</tr>
<tr>
<td>TMP102</td>
<td>4</td>
<td>SD0 SD0 INTO INTO INTO INTO</td>
<td>11</td>
<td>17 13 21 A2 A2 INT INT INT</td>
<td>MSP430</td>
</tr>
<tr>
<td>TMP102</td>
<td>5</td>
<td>SC0 SC0 SD0 SD0 SD0 SD0</td>
<td>10</td>
<td>16 12 20 SC7 SC3 SC3 SC3 SC1</td>
<td>TMP102</td>
</tr>
<tr>
<td>TMP102</td>
<td>6</td>
<td>SD1 SD1 SC0 SC0 SC0 SC0</td>
<td>9</td>
<td>15 11 19 SD7 SD3 SD3 SD3 SD1</td>
<td>TMP102</td>
</tr>
<tr>
<td>7</td>
<td>SC1</td>
<td>SC1</td>
<td>INTO INTO INTO INTO</td>
<td>8</td>
<td>14 10 18 SC6 SC2 INT3 INT3 INT1</td>
</tr>
<tr>
<td>8</td>
<td>SD2</td>
<td>GND</td>
<td>SD1 SD1</td>
<td>13</td>
<td>9 17 SD6 SD2 SC2 SC2</td>
</tr>
<tr>
<td>9</td>
<td>SC2</td>
<td>SC1</td>
<td>SC1</td>
<td>12</td>
<td>16 SC5 SD2 SD2</td>
</tr>
<tr>
<td>10</td>
<td>SD3</td>
<td>GND</td>
<td>GND</td>
<td>11</td>
<td>15 SD5 INT2 INT2</td>
</tr>
<tr>
<td>11</td>
<td>SC3</td>
<td></td>
<td></td>
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<td>14</td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 7 Board Layout

![Figure 14. PCB Layer 1 (Top Layer)](image-url)
Figure 15. PCB Layer 2 (Bottom Layer)
Table 3 lists the BOM.

<table>
<thead>
<tr>
<th>Designator</th>
<th>Qty.</th>
<th>Value</th>
<th>Description</th>
<th>Package Reference</th>
<th>Part Number</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB</td>
<td>1</td>
<td></td>
<td>Printed Circuit Board</td>
<td>TCA954xA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A0, A1, J3, J7, J9, J11, J13, J14</td>
<td>8</td>
<td>1x3</td>
<td>Header, TH, 100mil, 1x3, Gold plated, 230 mil above insulator</td>
<td>PBC03SAAN</td>
<td>PBC03SAAN</td>
<td>Sullins Connector Solutions</td>
</tr>
<tr>
<td>C1, C3, C4</td>
<td>3</td>
<td>1µF</td>
<td>CAP, CERM, 1µF, 16V, ±10%, X7R, 0603</td>
<td>603</td>
<td>C1608X7R1C105K</td>
<td>TDK</td>
</tr>
<tr>
<td>C2, C5</td>
<td>2</td>
<td>0.01µF</td>
<td>CAP, CERM, 0.01µF, 25V, ±10%, X7R, 0402</td>
<td>402</td>
<td>C1005X7R1E103K</td>
<td>TDK</td>
</tr>
<tr>
<td>GND1–GND3, VCC_1V8, VCC_msp, Vdpv</td>
<td>6</td>
<td>Green</td>
<td>Test Point, Multipurpose, Green, TH</td>
<td>Green Multipurpose Testpoint</td>
<td>5126</td>
<td>Keystone</td>
</tr>
<tr>
<td>J1, J2</td>
<td>2</td>
<td></td>
<td>Connector, Receptacle, 100mil, 10x1, Gold plated, TH</td>
<td>HEADER, RECEPTACLE, 100mil, 10x1</td>
<td>SSW-110-23-F-S</td>
<td>Samtec, Inc.</td>
</tr>
<tr>
<td>J1V8, J12, J16, J18, J19, J20, Vcc1, Vcc2</td>
<td>8</td>
<td></td>
<td>Header, 100mil, 2x1, Tin plated, TH</td>
<td>Header, 2 PIN, 100mil, Tin</td>
<td>PEC02SAAN</td>
<td>Sullins Connector Solutions</td>
</tr>
<tr>
<td>J4, J5, J6, J8, J10, J15, J17, SCL, SDA, TP</td>
<td>10</td>
<td></td>
<td>Header, TH, 100mil, 1pos, Gold plated, 230 mil above insulator</td>
<td>Testpoint</td>
<td>TSW-101-07-G-S</td>
<td>Samtec, Inc.</td>
</tr>
<tr>
<td>LBL1</td>
<td>1</td>
<td></td>
<td>Thermal Transfer Printable Labels, 0.650” W x 0.200” H - 10,000 per roll</td>
<td>PCB Label 0.650”W x 0.200”H</td>
<td>THT-14-423-10</td>
<td>Brady</td>
</tr>
<tr>
<td>R1–R6</td>
<td>8</td>
<td>10k</td>
<td>RES, 10kΩ, 5%, 0.063W, 0402</td>
<td>402</td>
<td>CRCW04024K0JNED</td>
<td>Vishay-Dale</td>
</tr>
<tr>
<td>R9–R11, R16, R22–R24</td>
<td>7</td>
<td>4.7k</td>
<td>RES, 4.7kΩ, 5%, 0.063W, 0402</td>
<td>402</td>
<td>CRCW04024K0JNED</td>
<td>Vishay-Dale</td>
</tr>
<tr>
<td>R12–R15, R17–R21</td>
<td>0</td>
<td></td>
<td>RES, 1.0kΩ, 5%, 0.063W, 0402</td>
<td>402</td>
<td>CRCW04021K0JNED</td>
<td>Vishay-Dale</td>
</tr>
<tr>
<td>R17–R21</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Note:**
- **Designator** refers to the component or connector designation used in the circuit.
- **Qty.** indicates the quantity of each component.
- **Value** specifies the component's value (if applicable).
- **Description** provides a brief description of the component or connector.
- **Package Reference** and **Part Number** are the component's package and part number, respectively.
- **Manufacturer** lists the manufacturer of the component.
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11. User shall employ reasonable safeguards to ensure that user's use of EVMs will not result in any property damage, injury or death, even if EVMs should fail to perform as described or expected.

12. User shall be solely responsible for proper disposal and recycling of EVMs consistent with all applicable federal, state, and local requirements.

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Agreement to Defend, Indemnify and Hold Harmless. User agrees to defend, indemnify, and hold TI, its directors, officers, employees, agents, representatives, affiliates, 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 and/or use of EVMs. User's indemnity shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if EVMs fail to perform as described or expected.

Safety-Critical or Life-Critical Applications. If user intends to use EVMs in evaluations of safety critical applications (such as life support), and a failure of a TI product considered for purchase by user for use in user's product would reasonably be expected to cause severe personal injury or death such as devices which are classified as FDA Class III or similar classification, then user must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.
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Texas Instruments Incorporated (TI) evaluation boards, kits, and/or modules (EVMs) and/or accompanying hardware that is marketed, sold, or loaned to users may or may not be subject to radio frequency regulations in specific countries.

General Statement for EVMs Not Including a Radio

For EVMs not including a radio and not subject to the U.S. Federal Communications Commission (FCC) or Industry Canada (IC) regulations, TI intends EVMs to be used only for engineering development, demonstration, or evaluation purposes. EVMs are not finished products typically fit for general consumer use. EVMs may nonetheless generate, use, or radiate radio frequency energy, but have not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or the ICES-003 rules. Operation of such EVMs 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: For EVMs including a radio, the radio included in such EVMs is intended for development and/or professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability in such EVMs and their development application(s) must comply with local laws governing radio spectrum allocation and power limits for such EVMs. 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 TI unless user has obtained appropriate experimental and/or development licenses from local regulatory authorities, which is the sole responsibility of the user, including its acceptable authorization.

U.S. Federal Communications Commission Compliance

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 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 its 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. 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.

Industry Canada Compliance (English)

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.
Canada Industry Canada Compliance (French)

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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.

Important Notice for Users of EVMs Considered “Radio Frequency Products” in Japan

EVMs entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

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

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

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