TCA9548AEVM

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 I^2C 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

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 (SSYA008)

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
- I^2C 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 Lauchpad 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 1. Device and Package Configurations

I2C SWITCH	IC	PACKAGE
U1	TCA9543APWR	TSSOP-14
U2	TCA9544APWR	TSSOP-20
U3	TCA9545APWR	TSSOP-20
U4	TCA9546APWR	TSSOP-16
U5	TCA9548APWR	TSSOP-24

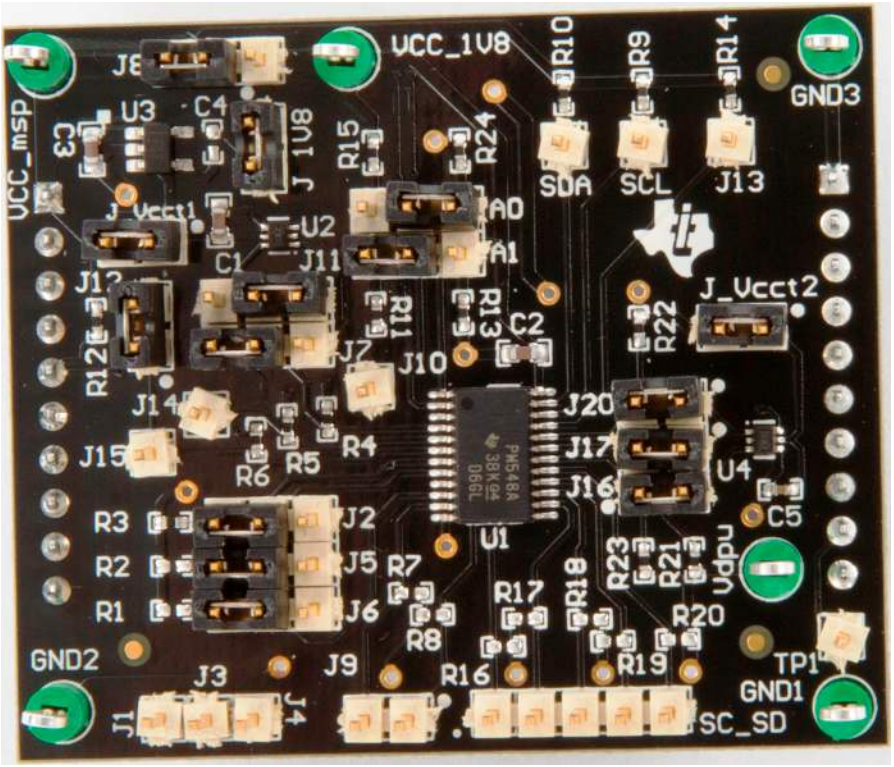


Figure 1. TCA9548AEVM

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.

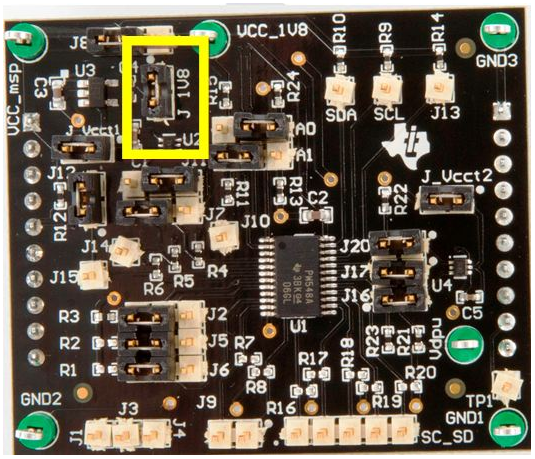


Figure 2. J_1V8 Jumper Connecting LDO Output

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.

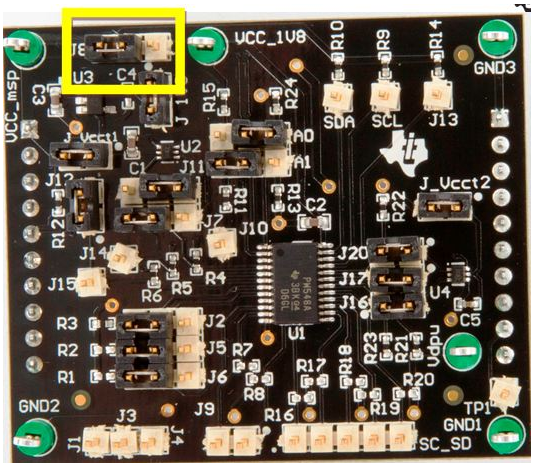


Figure 3. J8 Jumper SDA and SCL Pull Up Voltage Selection

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.

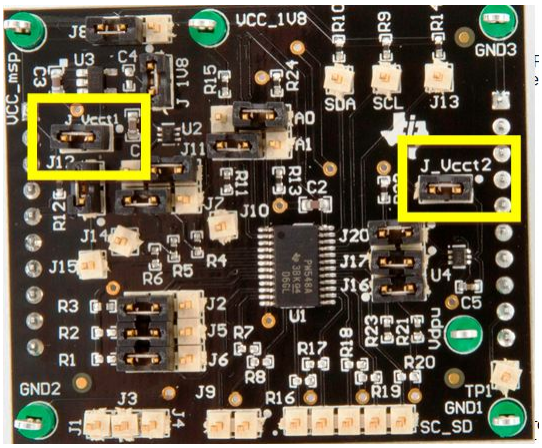


Figure 4. J_Vcct1 and J_Vcct2 Jumper Connections

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.

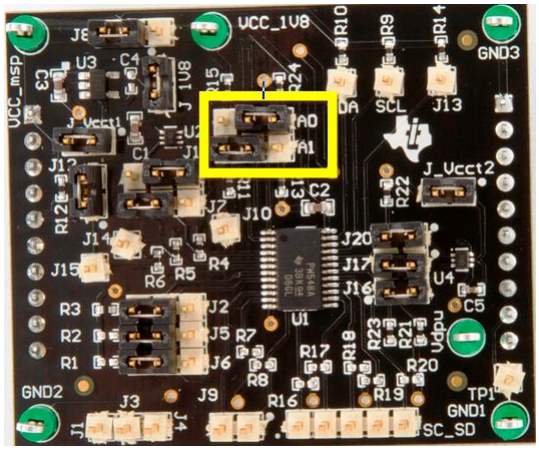


Figure 5. A0 and A1 Slave Address Configuration

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 pulls 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.

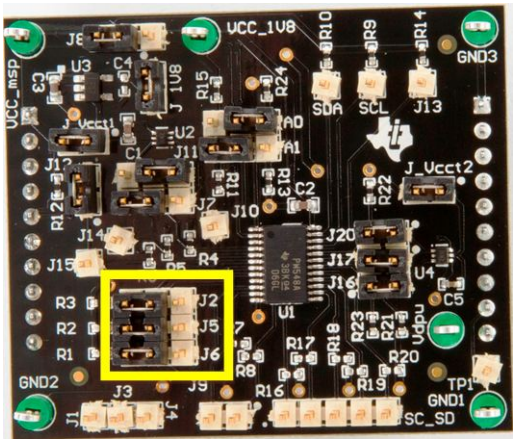


Figure 6. Grounding Configurations for Other TCA954xA Devices

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 J11confingured 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

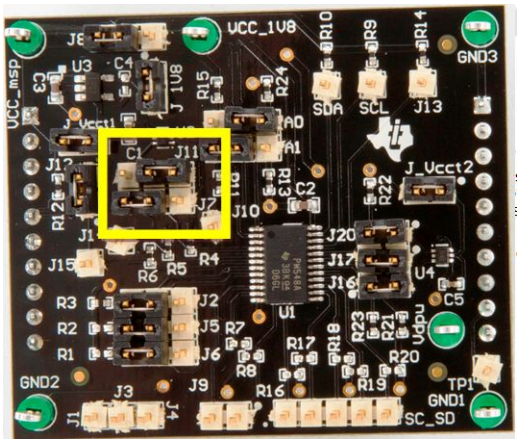


Figure 7. J7 and J11 Jumper Connections

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:

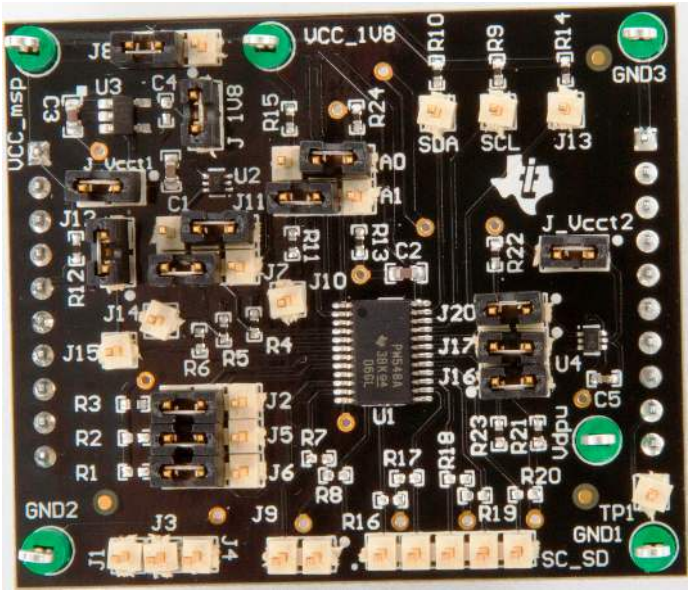


Figure 8. Jumper Configuration for TCA9548A

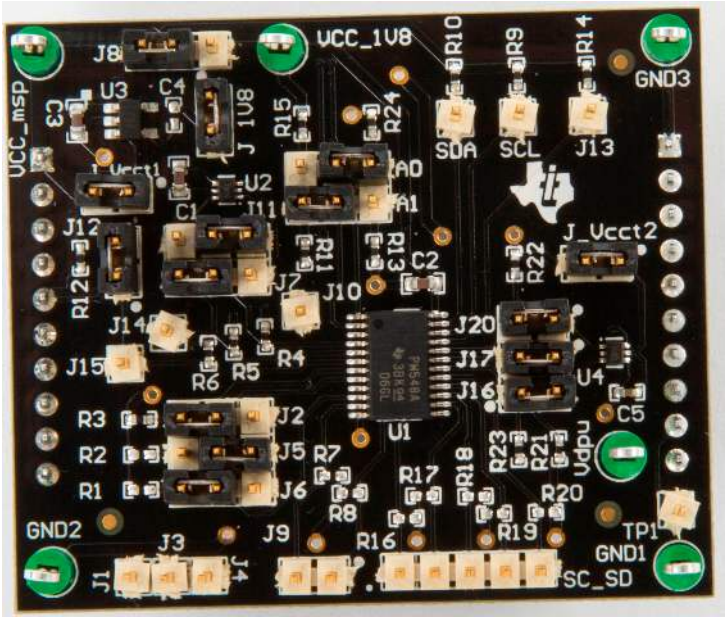


Figure 9. Jumper Configuration for TCA9546A

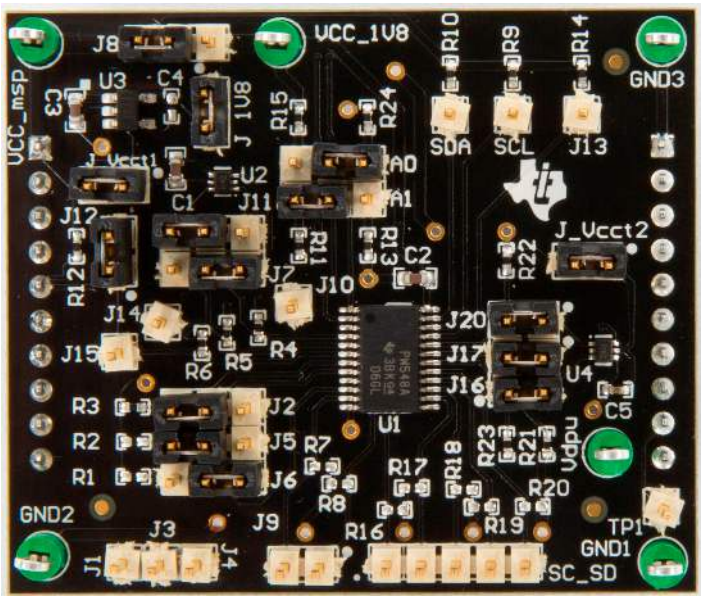


Figure 10. Jumper Configuration for TCA9545A

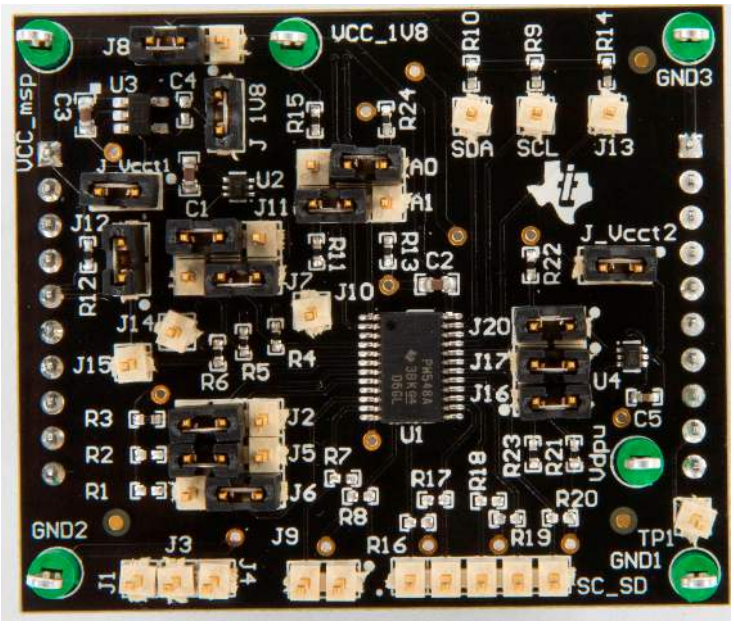


Figure 11. Jumper Configuration for TCA9544A

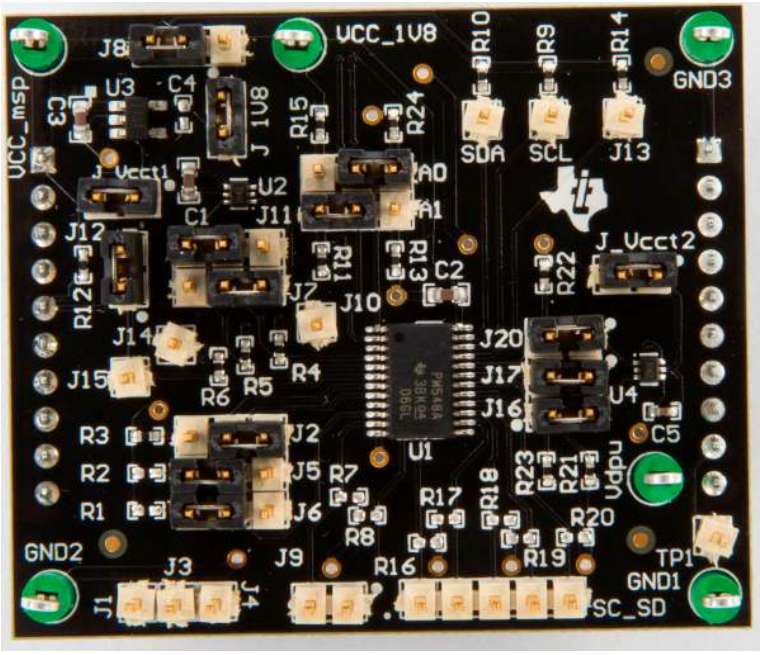
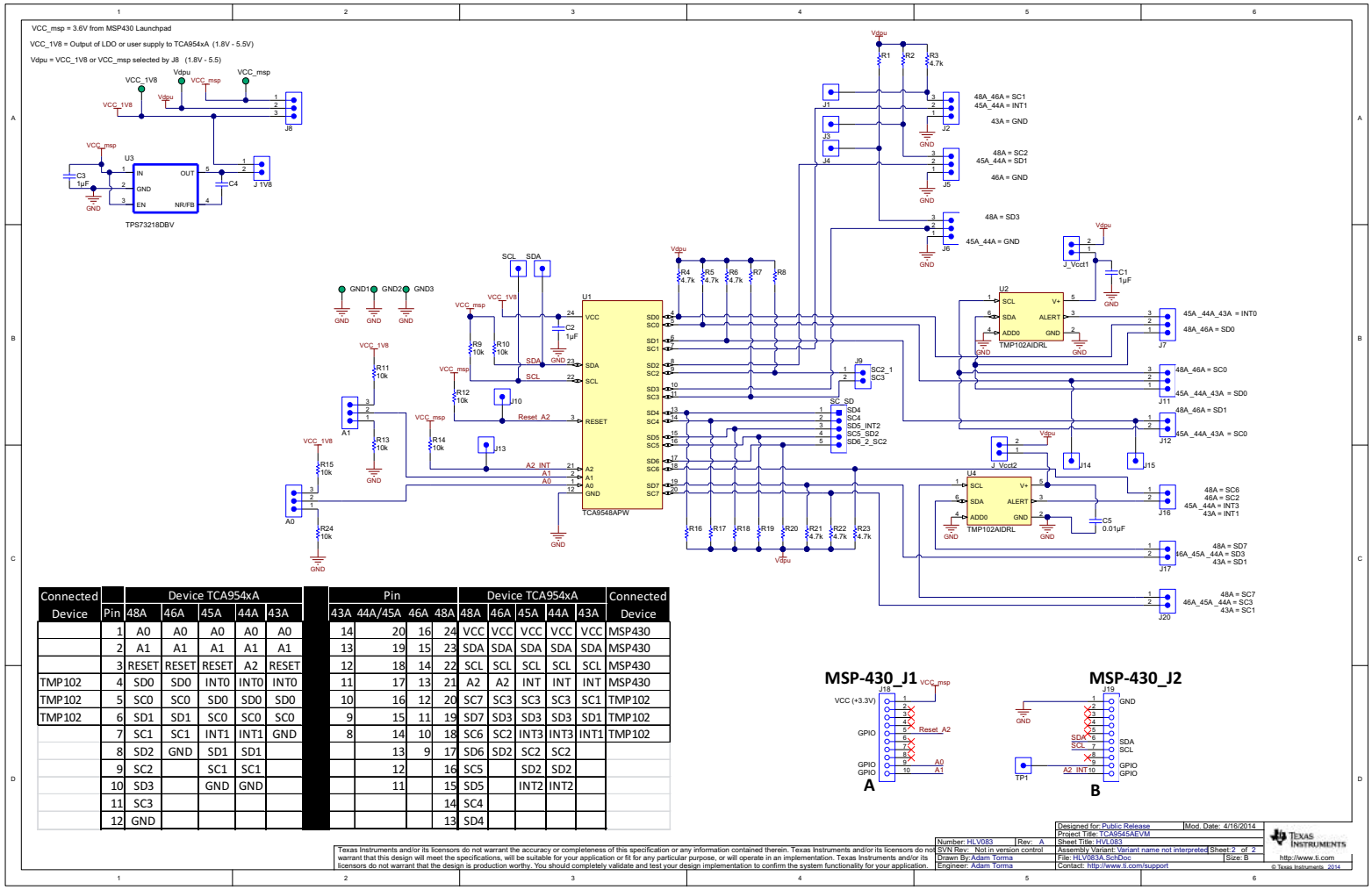


Figure 12. Jumper Configuration for TCA9543A

6 Schematic

Figure 13 shows the schematic for the TCA9548AEVM evaluation board. PDFs are available on www.ti.com.



Connected Device	Pin	Device TCA954xA 48A	46A	45A	44A	43A	Pin	43A	44A/45A	46A	48A	Device TCA954xA 48A	46A	45A	44A	43A	Connected Device
	1	A0	A0	A0	A0	A0		14	20	16	24	VCC	VCC	VCC	VCC	VCC	MSP430
	2	A1	A1	A1	A1	A1		13	19	15	23	SDA	SDA	SDA	SDA	SDA	MSP430
	3	RESET	RESET	RESET	A2	RESET		12	18	14	22	SCL	SCL	SCL	SCL	SCL	MSP430
TMP102	4	SD0	SD0	INT0	INT0	INT0		11	17	13	21	A2	A2	INT	INT	INT	MSP430
TMP102	5	SC0	SC0	SD0	SD0	SD0		10	16	12	20	SC7	SC3	SC3	SC3	SC1	TMP102
TMP102	6	SD1	SD1	SC0	SC0	SC0		9	15	11	19	SD7	SD3	SD3	SD3	SD1	TMP102
	7	SC1	SC1	INT1	INT1	GND		8	14	10	18	SC6	SC2	INT3	INT3	INT1	TMP102
	8	SD2	GND	SD1	SD1				13	9	17	SD6	SD2	SC2	SC2		
	9	SC2		SC1	SC1				12		16	SC5		SD2	SD2		
	10	SD3		GND	GND				11		15	SD5		INT2	INT2		
	11	SC3									14	SC4					
	12	GND									13	SD4					

Figure 13. TCA9548AEVM Schematic

6.1 Pin Map

Table 2 shows the TCA954xA pin map.

Table 2. TCA954xA Pin Map

Connected Device	Pin	Device TCA954xA 48A	46A	45A	44A	43A		Pin 43A	44A/45A	46A	48A	Device TCA954xA 48A	46A	45A	44A	43A	Connected Device
	1	A0	A0	A0	A0	A0		14	20	16	24	VCC	VCC	VCC	VCC	VCC	MSP430
	2	A1	A1	A1	A1	A1		13	19	15	23	SDA	SDA	SDA	SDA	SDA	MSP430
	3	RESET	RESET	RESET	A2	RESET		12	18	14	22	SCL	SCL	SCL	SCL	SCL	MSP430
TMP102	4	SD0	SD0	INT0	INT0	INT0		11	17	13	21	A2	A2	INT	INT	INT	MSP430
TMP102	5	SC0	SC0	SD0	SD0	SD0		10	16	12	20	SC7	SC3	SC3	SC3	SC1	TMP102
TMP102	6	SD1	SD1	SC0	SC0	SC0		9	15	11	19	SD7	SD3	SD3	SD3	SD1	TMP102
	7	SC1	SC1	INT1	INT1	GND		8	14	10	18	SC6	SC2	INT3	INT3	INT1	TMP102
	8	SD2	GND	SD1	SD1				13	9	17	SD6	SD2	SC2	SC2		
	9	SC2		SC1	SC1				12		16	SC5		SD2	SD2		
	10	SD3		GND	GND				11		15	SD5		INT2	INT2		
	11	SC3									14	SC4					
	12	GND									13	SD4					

7 Board Layout

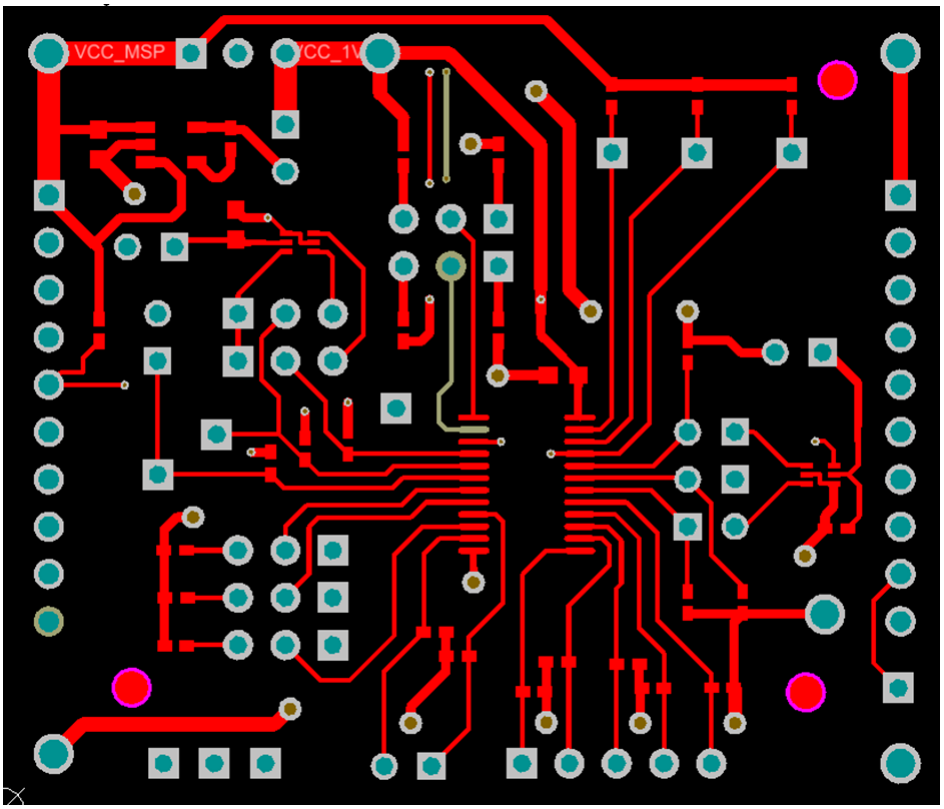


Figure 14. PCB Layer 1 (Top Layer)

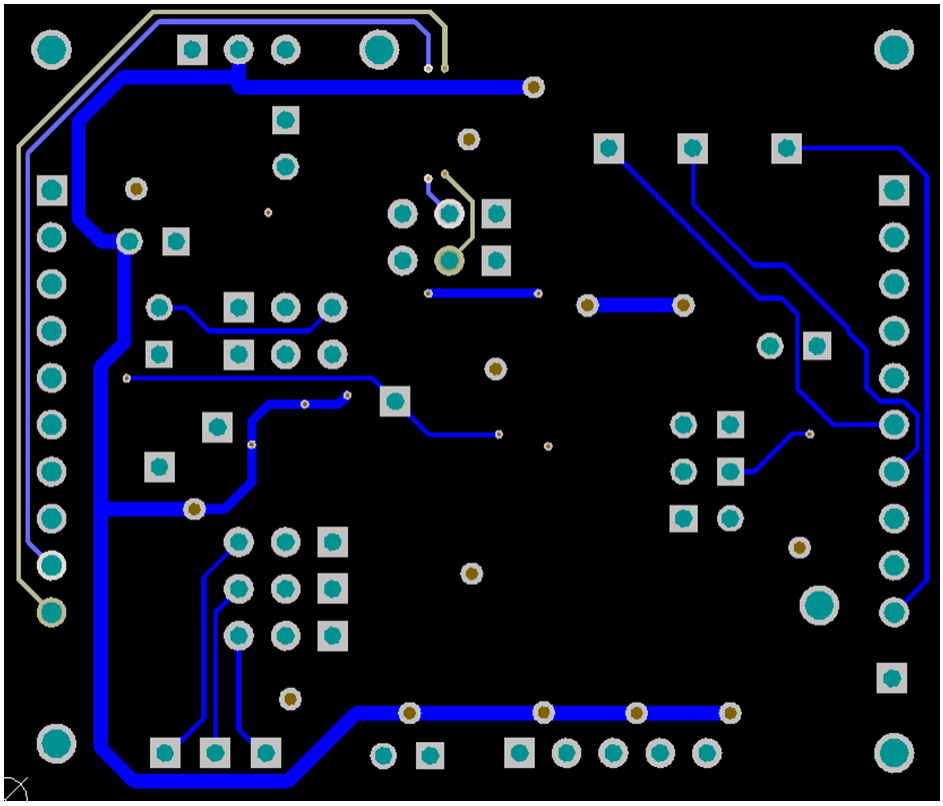


Figure 15. PCB Layer 2 (Bottom Layer)

8 Bill of Materials

Table 3 lists the BOM.

Table 3. Bill of Materials

Designator	Qty.	Value	Description	Package Reference	Part Number	Manufacturer
PCB	1		Printed Circuit Board		TCA954xA	Any
A0, A1, J3, J7, J9, J11, J13, J14	8	1x3	Header, TH, 100mil, 1x3, Gold plated, 230 mil above insulator	PBC03SAAN	PBC03SAAN	Sullins Connector Solutions
C1, C3, C4	3	1µF	CAP, CERM, 1µF, 16V, ±10%, X7R, 0603	603	C1608X7R1C105K	TDK
C2, C5	2	0.01µF	CAP, CERM, 0.01µF, 25V, ±10%, X7R, 0402	402	C1005X7R1E103K	TDK
GND1–GND3, VCC_1V8, VCC_msp, Vdpu	6	Green	Test Point, Multipurpose, Green, TH	Green Multipurpose Testpoint	5126	Keystone
J1, J2	2		Connector, Receptacle, 100mil, 10x1, Gold plated, TH	HEADER, RECEPTACLE, 100mil, 10x1	SSW-110-23-F-S	Samtec, Inc.
J1V8, J12, J16, J18, J19, J20, Vcct1, Vcct2	8		Header, 100mil, 2x1, Tin plated, TH	Header, 2 PIN, 100mil, Tin	PEC02SAAN	Sullins Connector Solutions
J4, J5, J6, J8, J10, J15, J17, SCL, SDA, TP	10		Header, TH, 100mil, 1pos, Gold plated, 230 mil above insulator	Testpoint	TSW-101-07-G-S	Samtec, Inc.
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650"H x 0.200"W	THT-14-423-10	Brady
R1–R8	8	10k	RES, 10kΩ, 5%, 0.063W, 0402	402	CRCW040210K0JNED	Vishay-Dale
R9–R11, R16, R22–R24	7	4.7k	RES, 4.7kΩ, 5%, 0.063W, 0402	402	CRCW04024K70JNED	Vishay-Dale
SC_SD	1		Header, TH, 100mil, 5x1, Gold plated, 230 mil above insulator	5x1 Header	TSW-105-07-G-S	Samtec
SH-J1–SH-J16	16	1x2	Shunt, 100mil, Gold plated, Black	Shunt	969102-0000-DA	3M
U1	1		LOW VOLTAGE 8-CHANNEL I2C SWITCH WITH RESET, PW0024A	PW0024A	TCA9548APW	Texas Instruments
U2, U3	2		Low Power Digital Temperature Sensor With SMBus/Two-Wire Serial Interface in SOT563, DRL0006A	DRL0006A	TMP102AIDRL	Texas Instruments
U4	1	TPS732xxDBV	IC, Cap-Free NMOS 250-mA LDO Regulator With Reverse-Current Protection	SOT23-5	TPS732xxDBV	TI
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A
R12–R15, R17–R21	0		RES, 1.0kΩ, 5%, 0.063W, 0402	402	CRCW04021K00JNED	Vishay-Dale

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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. 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.

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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

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.

http://www.tij.co.jp

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