TCA9406 I²C Translator Evaluation Module

The TCA9406EVM evaluation module (EVM) allows the user to connect power to and buffer and translate I²C commands to the onboard slave device, TMP102. The EVM allows the designer to load and test different capacitive loading and has the option of replacing a series resistor with an inductor to emulate the parasitic inductance of cables. Parameters such as rise time, power consumption, and delay times can easily and accurately be evaluated. For additional details on I²C buffer performance, application notes, and the data sheet, see www.ti.com/I2C.

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Trademarks

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1 Introduction

The TCA9406EVM allows designers to evaluate device performance for I^2C translation for their system. This EVM allows the designer to evaluate the TCA9406 with different pullup resistor values and with different capacitive loading. The TCA9406EVM has a TCA9406 loaded at U1. It also supports the use of a socket for when multiple parts need to be tested.

1.1 Overview

The TCA9406 is a dual-channel bidirectional translator with rise time accelerators intended for I^2C bus and SMBus/PMBus systems using larger capacitive loads. The TCA9406 provides bidirectional level shifting between two voltage nodes. Figure 1 shows the TCA9406EVM.

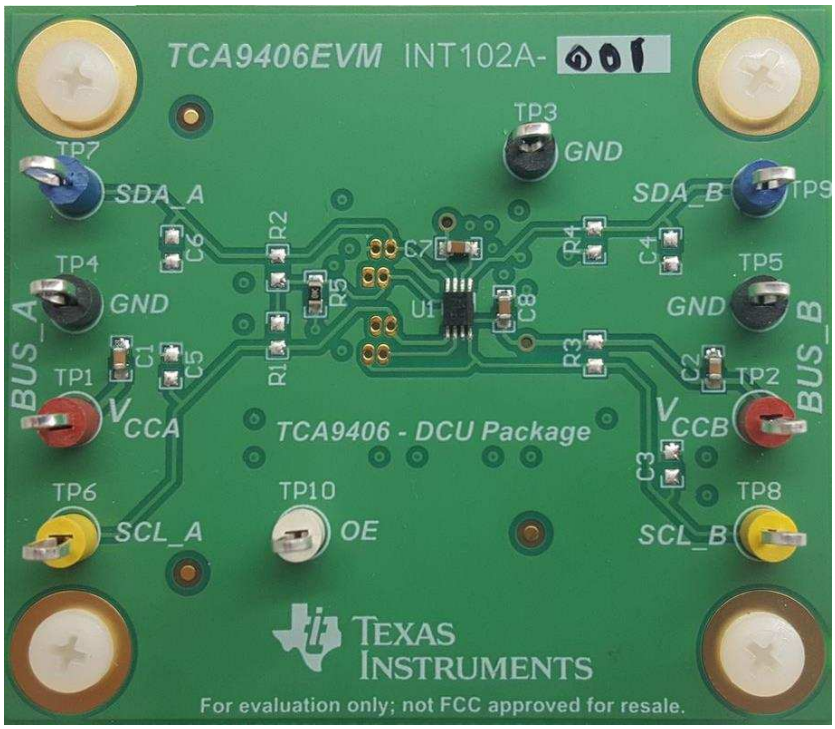

Figure 1. TCA9406EVM

1.2 EVM Features

This EVM has the following features:

- V_{CCA} input voltage range: 1.65 V to 3.6 V
- V_{CCB} input voltage range: 2.3 V to 5.5 V
- Access to the V_{CCA}, V_{CCB}, OE, SDA_A, SCL_A, SDA_B, and SCL_B pins
- Footprint for a socket for evaluating multiple TCA9406 devices
- Footprints to test different capacitive loads
- Footprints to test different pullup resistor values
- Different load options allow for the testing of different translator configurations

2 EVM Hardware Block Diagram and Images

The TCA9406EVM is designed to perform voltage level translation between two buses. The two voltage nodes are VCC on the A side (V_{CCA}) and VCC on B side (V_{CCB}). The EVM divides the buses into BUSA and BUSB. All the pull-ups and capacitive loads are reference to the bus they are used on, for example resistor pull-up A (R_{PUA}) is on BUSA. Figure 2 shows the high level block diagram for the TCA9406EVM with respect to how it is connected between I^2C devices. Figure 3 illustrates the TCA9406EVm schematic.

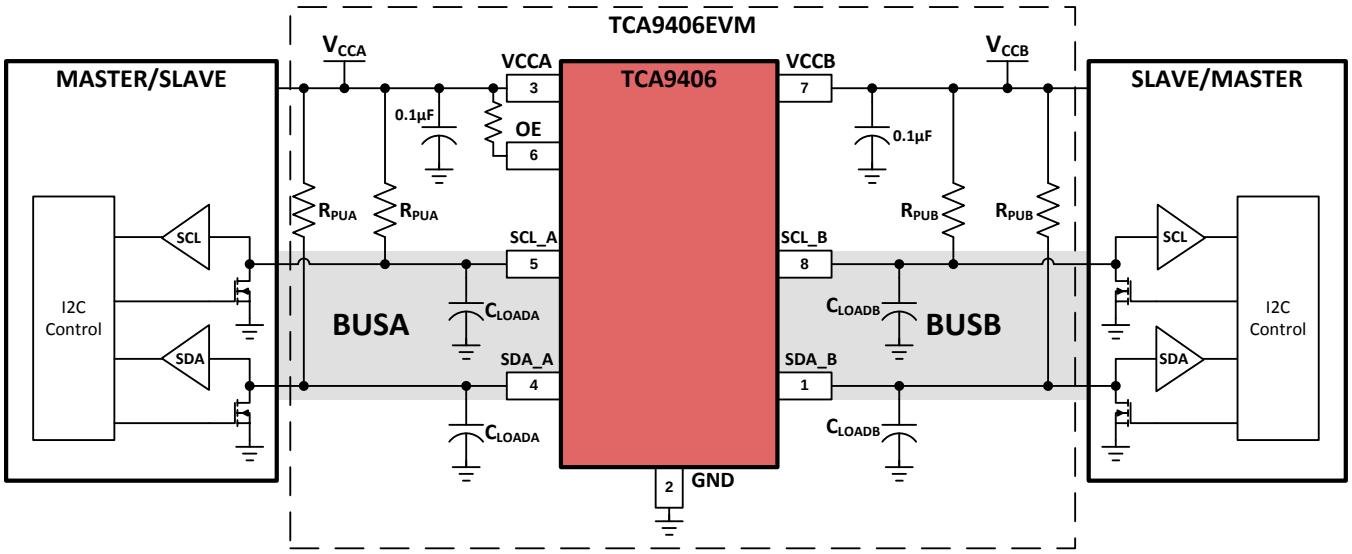

Figure 2. TCA9406EVM Block Diagram

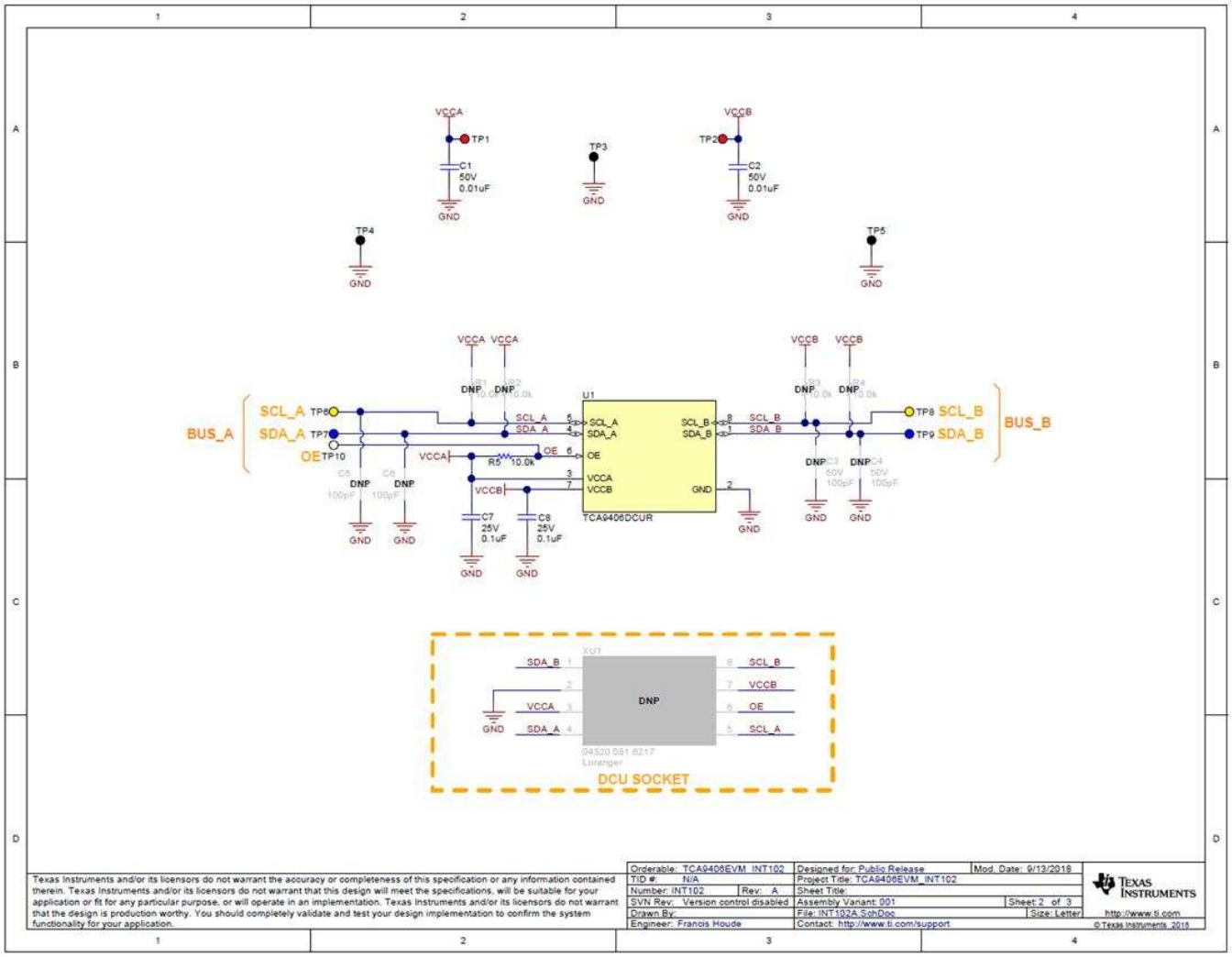

Figure 3. TCA9406EVM Schematic

3 Hardware Description

The TCA9406 EVM is designed to allow the user to easily evaluate the I^2C buffer for a variety of conditions. The breakdown of all the features and design of the EVM follows:

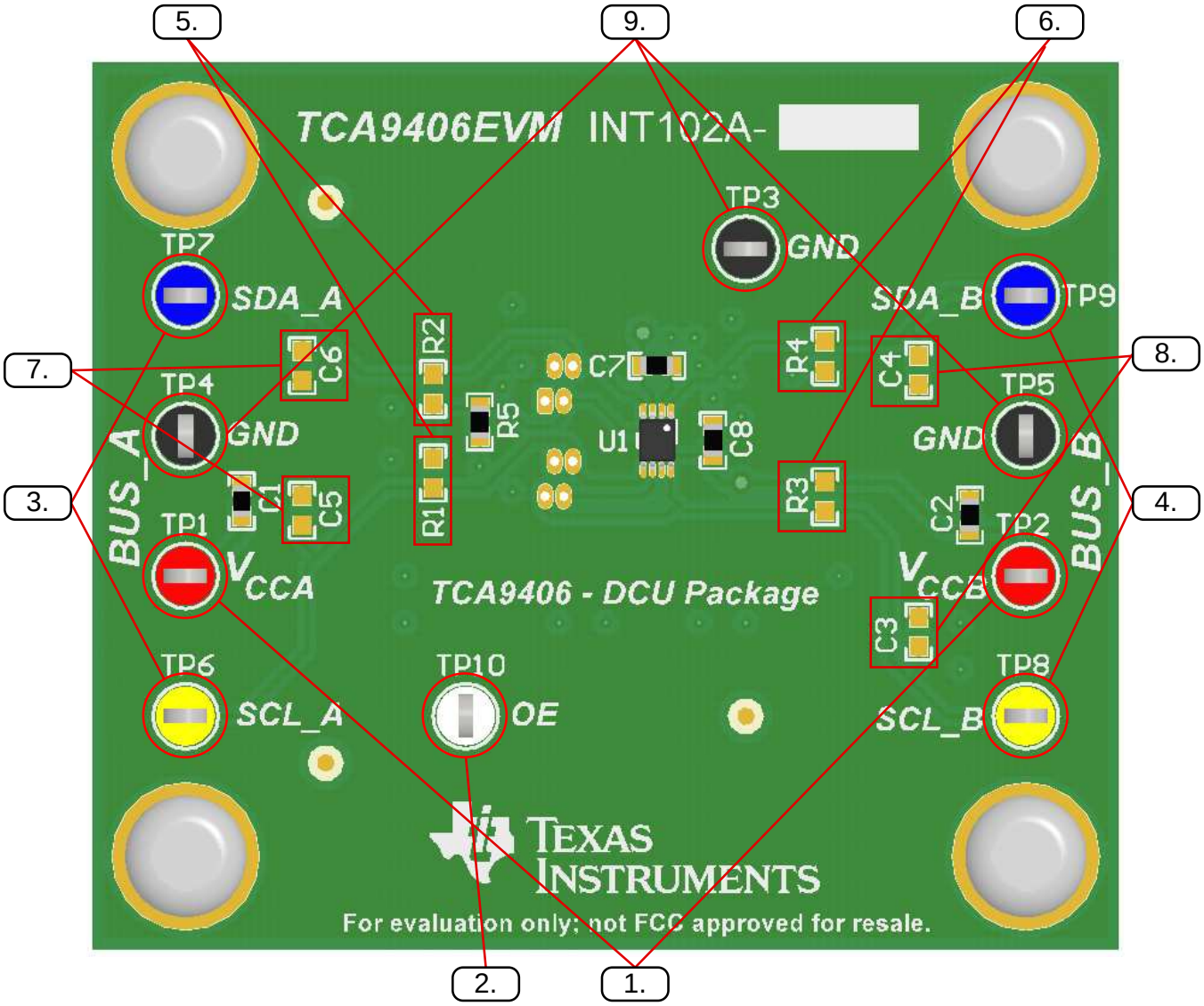

Figure 4. TCA9406EVM test points, devices, resistors, and capacitor map

1. V_{CCA} is the supply for BUSA and V_{CCB} is the supply for BUSB. V_{CCA} must be less than or equal to V_{CCB}.
2. Test point for OE pin, which allows the user to disable the translator.
3. Test points for SCL_A and SDA_A on BUS1 side of translator, which is referenced to V_{CCA}.
4. Test points for SCL_B and SDA_B on BUS2 side of translator, which is referenced to V_{CCB}.
5. Footprint for additional pullup resistors (R1 and R2) on SCL_A and SDA_A, which allows increasing pullup strength by placing a resistor in parallel with the internal 10k pullup.
6. Footprint for additional pullup resistors (R3 and R4) on SCL_B and SDA_B, which allows increasing pullup strength by placing a resistor in parallel with the internal 10k pullup.
7. Footprint for adding capacitor to SCL_A and SDA_A(C5 and C6) to test desired capacitive load.
8. Footprint for adding capacitor to SCL_B and SDA_B(C3 and C4) to test desired capacitive load.
9. Test points for ground.

4 Layout

Figure 5 and Figure 6 show the PCB layout images.

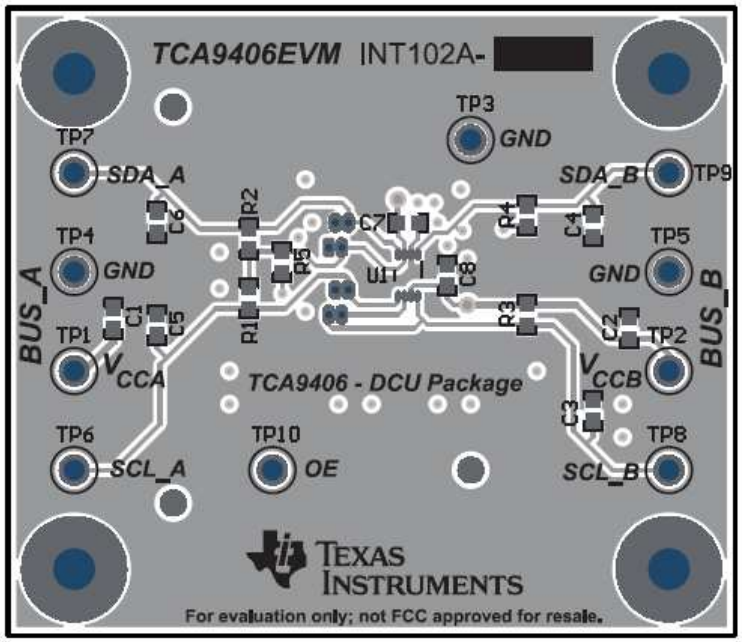

Figure 5. TCA9406EVM Top Layout

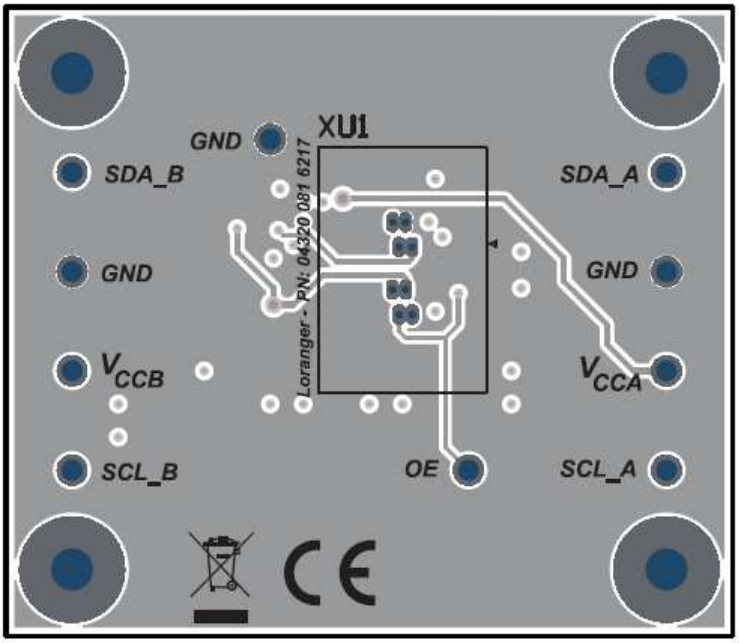

Figure 6. TCA9406EVM Bottom Layout

4.1 Setup

The TCA9406EVM can be used with other master and slave devices to perform voltage level translation. Figure 7 shows an example configuration using a computer with a microcontroller using the TCA9406EVM to translator SCL and SDA to the TMP102 temp sensing I²C slave device. The lines in the diagram represent wires used to perform interconnections between the TCA9406EVM, the master (microcontroller), and the slave (TMP102).

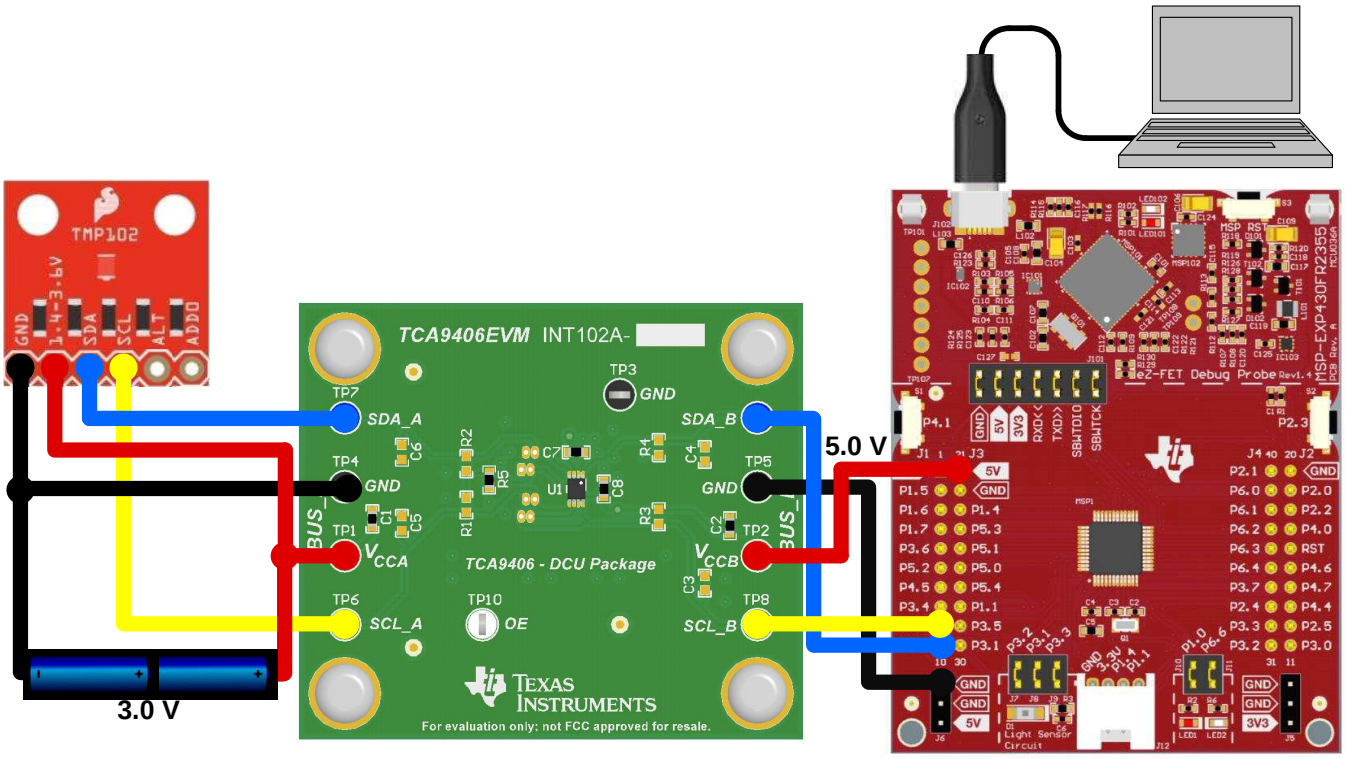

Figure 7. Computer connected to microcontroller using TCA9406EVM to translate and connect to TMP102 I²C sensor.

5 Bill of Materials (BOM)

Table 1 lists the EVM BOM.

Table 1. Bill of Materials TCA9406EVM

Qty	Designator	Value	Description	Package Reference	Manufacturer	Part Number
1	!PCB		Printed Circuit Board		Any	INT102
2	C1, C2	0.01µF	CAP, CERM, 0.01 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	Murata	GCM188R71H103KA37D
2	C7, C8	0.1µF	CAP, CERM, 0.1 µF, 25 V, ±10%, X7R, 0603	0603	Murata	GRM188R72A104KA35J
4	H1, H2, H3, H4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	B&F Fastener Supply	NY PMS 440 0025 PH
4	H5, H6, H7, H8		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	Keystone	1902C
1	R5	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	Vishay-Dale	CRCW060310K0FKEA
2	TP1, TP2		Test Point, Multipurpose, Red, TH	Red Multipurpose Testpoint	Keystone	5010
3	TP3, TP4, TP5		Test Point, Multipurpose, Black, TH	Black Multipurpose Testpoint	Keystone	5011
2	TP6, TP8		Test Point, Multipurpose, Yellow, TH	Yellow Multipurpose Testpoint	Keystone	5014
2	TP7, TP9		Test Point, Multipurpose, Blue, TH	Blue Multipurpose Testpoint	Keystone	5127
1	TP10		Test Point, Multipurpose, White, TH	White Multipurpose Testpoint	Keystone	5012
1	U1		2-Bit Bidirectional 1-MHz I2C Bus and SMBus Voltage-Level Shifter, DCU0008A (VSSOP-8)	DCU0008A	Texas Instruments	TCA9406DCUR
0	XU1		Socket, SOIC-8, 0.5mm Pitch(SOT-6)	Socket, SOP-8, 0.5mm Pitch	Loranger	04320 081 6217
0	FID1, FID2, FID3		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A

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      CAUTION

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- *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.*

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(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.

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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.

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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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