User's Guide

TMUX1575 Evaluation Module

ABSTRACT

This user's guide describes the characteristics, operation, and use of the TMUX1575 Evaluation Module (EVM). A complete schematic diagram, printed-circuit board layouts, and bill of materials are included in this document

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1 Information About Cautions and Warnings

The information in the warning statement is provided for personal protection and the information in the caution statement is provided to protect the equipment from damage. Read each caution and warning statement carefully.

1.1 Introduction

The TMUX1575 is a low-voltage 4 channel 2:1 multiplexer. The device operates off of a supply voltage of 1.08 V to 3.6 V. The signal pathways can accept either 2 × VDD or 3.6 V whichever is lower. It has high bandwidth at a nominal rating of 1.5 GHz allowing for high-speed applications to be utilized with this device. The device also features powered off protection, in which the switch will be high impedance when VDD = 0 V. Fail-safe logic is also integrated into the integrated (IC) allowing for a voltage to be applied to the logic pins before power is applied to the device. The device is featured in a very small WSCP package with dimensions of 1.34 mm × 1.34 mm.

1.2 Description

The TMUX1575EVM allows for quick DC testing of the TMUX1575 device with easily configurable loads and SMA connectors for a variety of different tests.

1.3 Features

The EVM has the following features:

- A TMUX1575 device in a small WSCP (YKB) package
- Two power-supply decoupling capacitors (1 µF and 0.1 µF)
- Quick prototyping and testing of the 16-pin TMUX1575 in the WSCP (YKB) package
- All 16 signal paths have test point and jumper access
- All 12 source and drain pins have two 0805 pads each for an easily-configurable test setup
- SMA Connectors on channels 2 and 3 of the device for high-speed evaluation of the TMUX1575

2 EVM Setup

Figure 2-1 shows the topside view of the TMUX1575EVM.

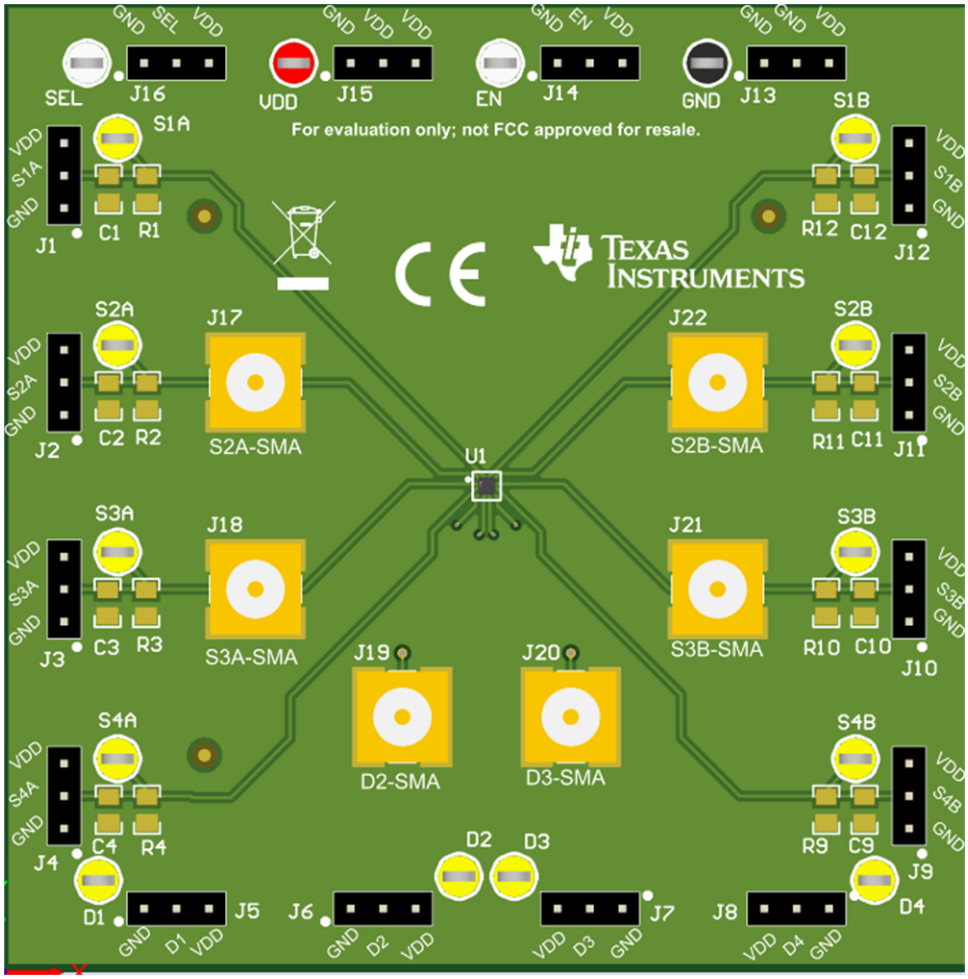


Figure 2-1. TMUX1575EVM Topside View

Use the information in Table 2-1 to power up the board. VDD is indicated by the only red test point on the board with an overlay stating "VDD" next to it; it is closest to the J15 jumper on the topside of the PCB. This is where the positive (+) terminal of the power source is connected. The negative (–) terminal is connected to the only black test point on the PCB labeled ground; it is closest to the J13 jumper on the upper right side of the board. To test DC characteristics, adjust the input voltage between 1.08 V to 3.6 V.

Table 2-1. Power Supplies Connection Points

Connector	Connector Color	Adjacent Jumper	Operating Voltage (VDD With Regard to GND)
VDD	Red	J15	1.08 V–3.6 V
GND	Black	J13	

The IC is controlled through the two white test points at the top of the board. Using Table 2-2, external signals can be applied to the white test points to meet the logic thresholds as Table 2-3 shows. Table 2-3 shows the truth table for the TMUX1575 device.

Table 2-2. Control Lines Connection Points

Connector	Connector Color	Adjacent Jumper	Logic Low Voltage Range	Logic High Voltage Range
EN	White	J14	0 V–0.45 V	0.8 V–3.6 V
SEL	White	J16		

Table 2-3. TMUX1575EVM Truth Table

EN	SEL	Channels Selected
0	x	Device Disabled
1	0	SxA <-> Dx Connected
		SxB <-> Disconnected
1	1	SxB <-> Dx Connected
		SxA <-> Dx Disconnected

Table 2-4 describes the component pads of the TMUX1575EVM 0805 and which pin of the TMUX1575 IC is connected to those pads. This is to allow for configuring different loading conditons depending on the end user's application.

Table 2-4. TMUX1575 Pins to Component Pads

Pin Name	0805 Capacitor Pad ID	0805 Resistor Pad ID	Pad Location	Adjacent Jumper
S1A	C1	R1	Top Layer	J1
S1B	C12	R12	Top Layer	J12
D1	C5	R5	Bottom Layer	J5
S2A	C2	R2	Top Layer	J2
S2B	C11	R11	Top Layer	J11
D2	C6	R6	Bottom Layer	J6
S3A	C3	R3	Top Layer	J3
S3B	C10	R10	Top Layer	J10
D3	C7	R7	Bottom Layer	J7
S4A	C4	R4	Top Layer	J4
S4B	C9	R9	Top Layer	J9
D4	C8	R8	Bottom Layer	J8

3 EVM Connectors and Test Points

Before using the EVM, make sure to connect an external power supply to the following points on the board. The power supply provides VDD at every jumper that can be further configured by the user.

Table 3-1. Required External Connections

Signal	Voltage with Regard to Ground	Signal Input Point
VDD (Power Supply)	1.08 V to 3.6 V - Operating 0 V - Powered Off Protection	Red Test Point Labled VDD
Ground (Power Supply)	0 V	Black Test Point Labled GND

The user controls the board using the 16 configurable jumpers laid along the perimeter of the board. Table 3-2 shows the generic jumper position definitions as well as the different configurations that can be utilized with these 16 jumpers.

All jumpers on the TMUX1575EVM use the same numbering system: 1 = Ground, 2 = Signal Pathway, and 3 = VDD.

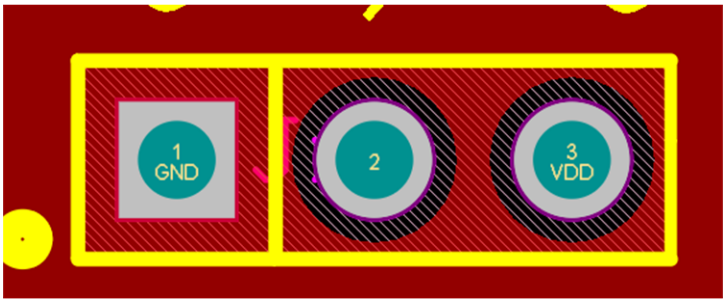


Figure 3-1. TMUX1575EVM Jumper Position Defintion

Table 3-2. TMUX1575EVM Jumper Position Definition

Test Point Name	Test Point Function	Test Point Color	Associated Connectors
S1A	External Signal I/O or Test Point	Yellow	J1
S2A	External Signal I/O or Test Point	Yellow	J2 and J17
S3A	External Signal I/O or Test Point	Yellow	J3 and J18
S4A	External Signal I/O or Test Point	Yellow	J4
D1	External Signal I/O or Test Point	Yellow	J5
D2	External Signal I/O or Test Point	Yellow	J6
D3	External Signal I/O or Test Point	Yellow	J7
D4	External Signal I/O or Test Point	Yellow	J8
S4B	External Signal I/O or Test Point	Yellow	J9
S3B	External Signal I/O or Test Point	Yellow	J10 and J21
S2B	External Signal I/O or Test Point	Yellow	J11 and J22
S1B	External Signal I/O or Test Point	Yellow	J12
GND	Power Supply Input (- Terminal)	Black	J13
EN	Control Signal Input or Test Point	White	J14
VDD	Power Supply Input (+ Terminal)	Red	J15
SEL	Control Signal Input or Test Point	White	J16

4 Testing Procedures

The TMUX1575EVM was tested against the *TMUX1575 2:1 (SPDT) 4-Channel, Powered-Off Protected Switch in WCSP with 1.2 V Logic Data Sheet* for charge injection. The voltage supply was set to 3.6 V. For the test, the jumpers and external signals in Table 4-1 are supplied.

Table 4-1. Jumper Configuration for Charge Injection Test

Jumper	Connection	Signal, Description	External Signal Input Test Point
J15	J15.3 shorted to J15.2	VDD (3.6 V)	Test Point: VDD Color: Red Voltage: 3.6 V
J13	J13.1 shorted to J13.2	Ground (0 V)	Test Point: GND Color: Black Voltage: 0 V
J14	J14.3 shorted to J14.2	Enable (3.6 V)	N/A
J16	J16.2 left floating	External Signal To Be Applied	Test Point: SEL Color: White Voltage: 0 V–1.8 V
J1	J1.2 left floating	External Signal to Be Applied	Test Point: S1A Color: Yellow Voltage: 1.8V
J5	J5.2 left floating	Output Signal Path	N/A
JX Where X is in Set: {2,3,4,9,10,11, or 12 }	JX.1 shorted to JX.2	All Other Source Pins Grounded (0 V)	N/A
JY Where Y is in Set: {6,7, or 8}	JY.2 left floating	Unused Drain Pins Left Floating	N/A

The load was capacitive with a total output capacitance of about 12 pF. The charge injection was quantified by measuring the voltage transient after switching between 0 V and 1.8 V. Charge injection can be calculated by multiplying the output capacitance by the change in voltage to get charge injection results.

5 Test Results

Figure 5-1 shows the charge injection test results. The first picture shows about three cycles of switching; while the second picture details a close up view of the charge injection spike. The test resulted in a voltage transient of 450 mV; when multipled by 12 pF, the result is 5.4 pC which is right around the typical value of 5 pC expected for this device in typical operating conditions.

The top scope shows the square wave being sent through the device. The bottom scope shows a close up of the charge injection event.

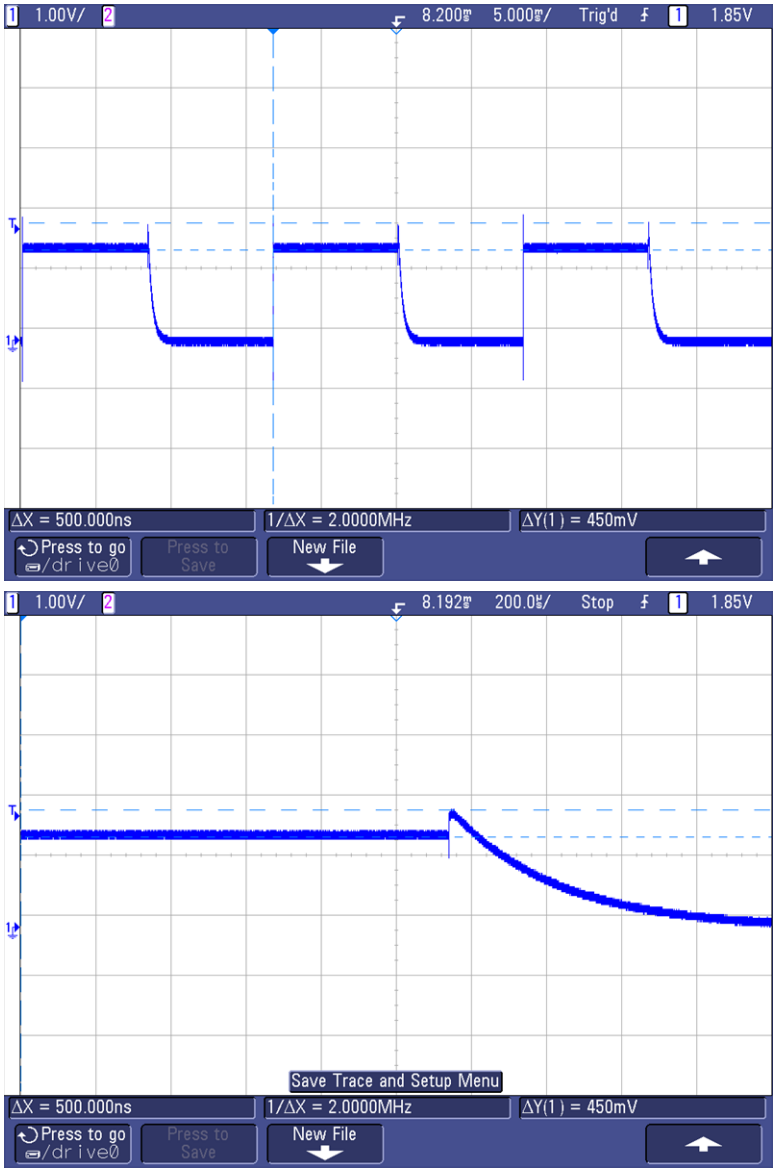


Figure 5-1. Charge Injection

6 PCB Layouts

Figure 6-1 and Figure 6-2 show the EVM PCB layout images.

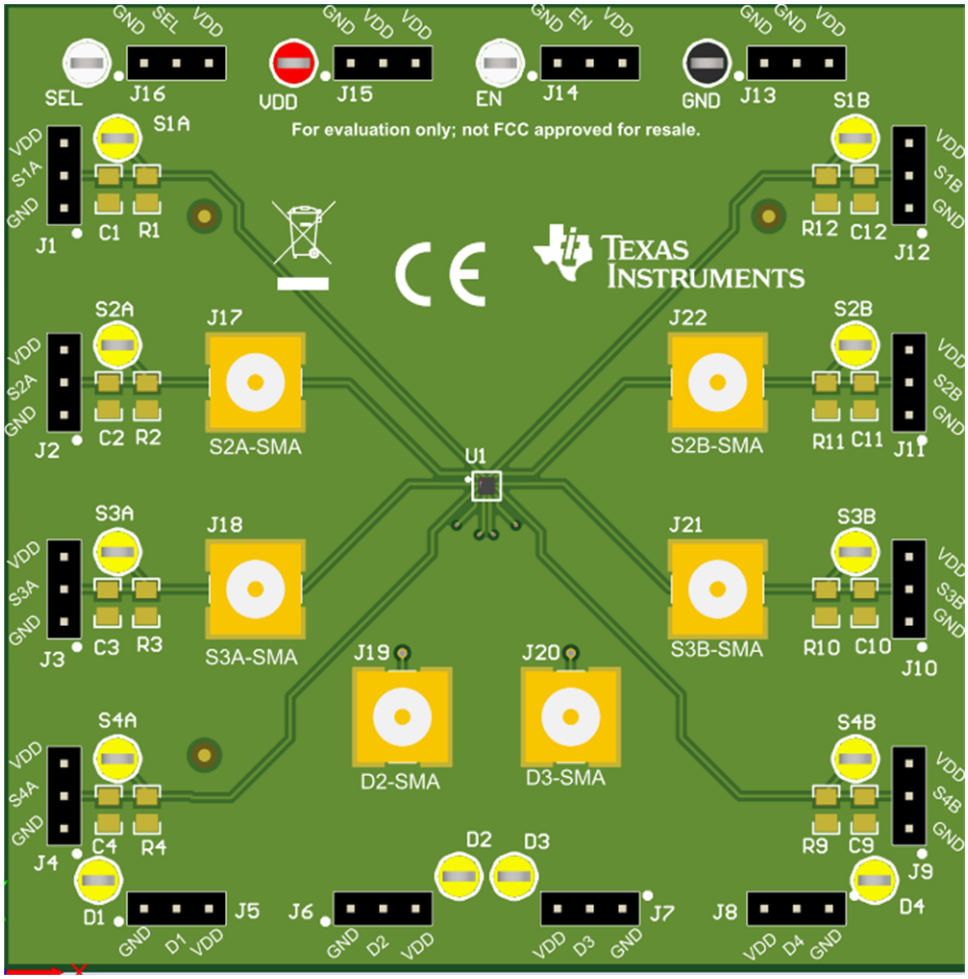


Figure 6-1. TMUX1575EVM Layout (Front)

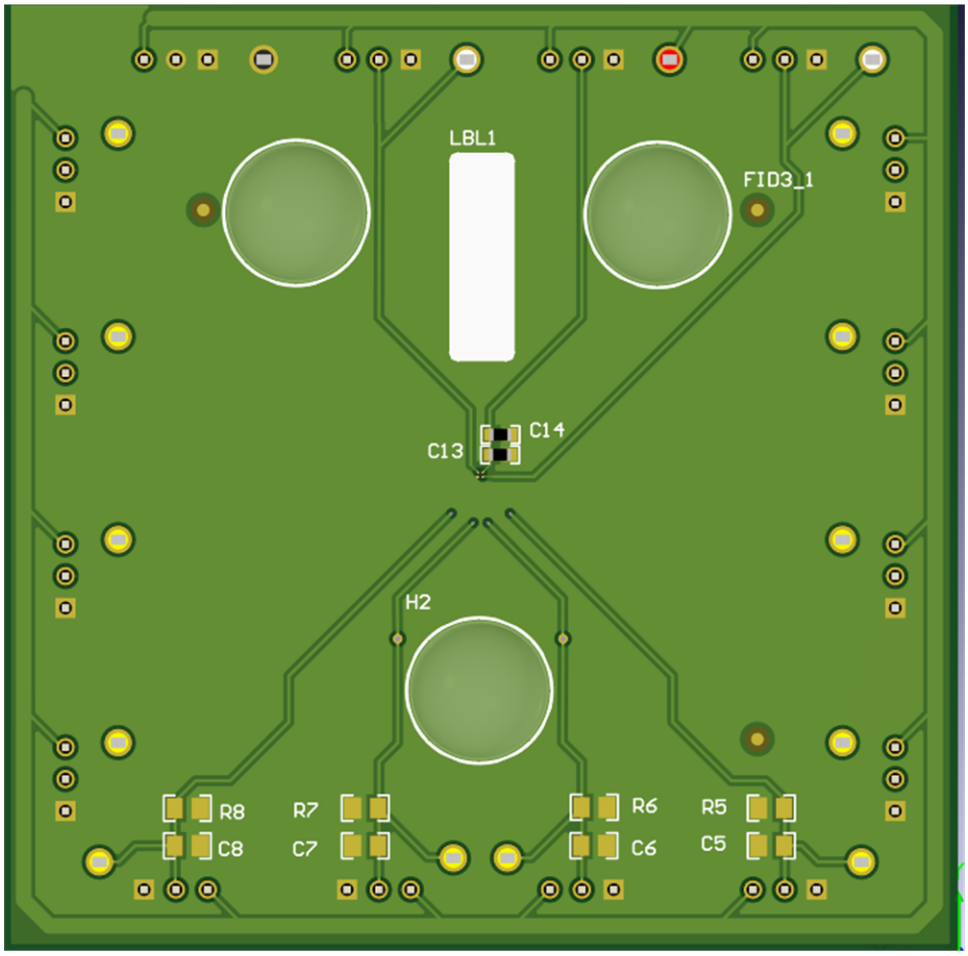
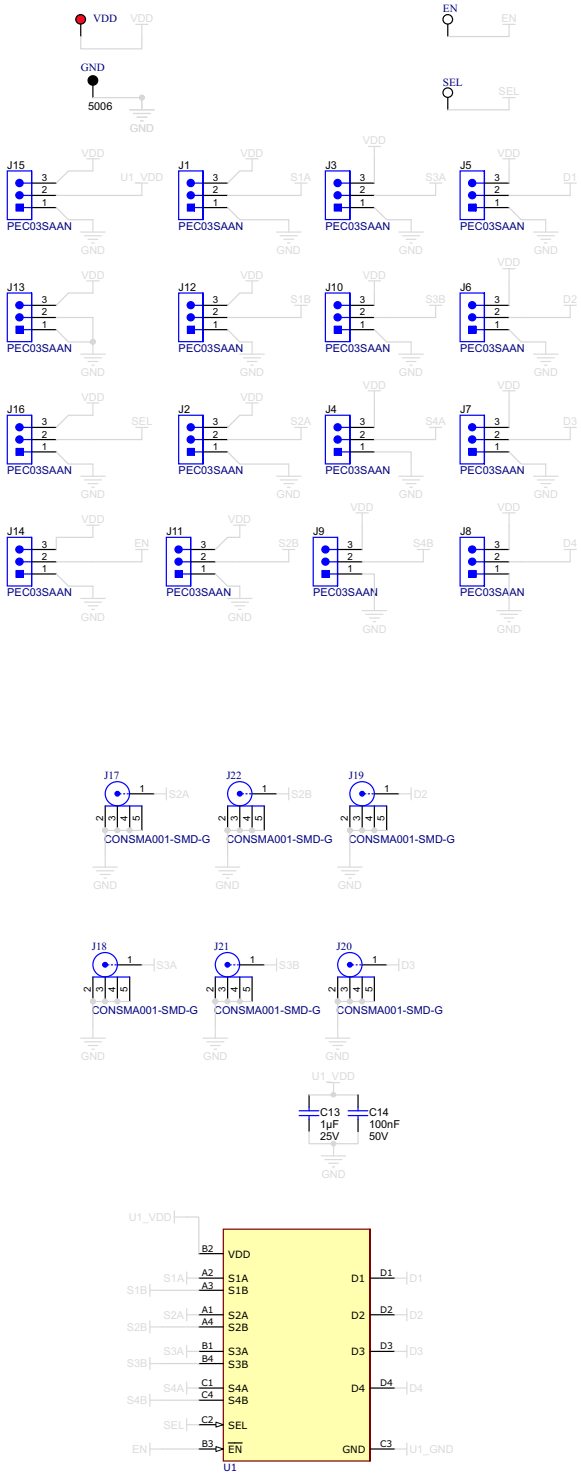


Figure 6-2. TMUX1575EVM Layout (Back)

7 Schematics

Figure 7-1 illustrates the EVM schematic.



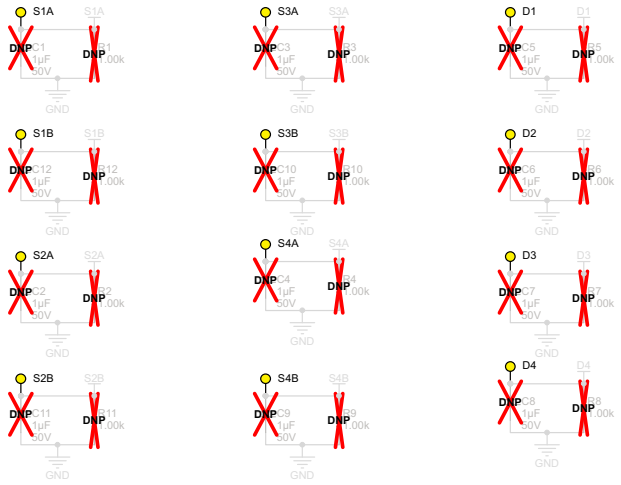


Figure 7-1. TMUX1575 Schematic Print

8 Bill of Materials

Table 8-1 details the EVM bill of materials.

Table 8-1. TMUX1575EVM Bill of Materials

Designator	Part Number	Description	QTY	Manufacturer 1
U1	TMUX1575YCJR	2:1 (SPDT) 4-Channel, Powered-Off Protected Switch in WCSP with 1.8 V Logic	1	Texas Instruments
H1, H2, H3, H4	SJ-5303 (CLEAR)	Bumpon, Hemisphere, 0.44 X 0.20, Clear	4	3M
C2	C0603C104K5RACAUTO	CAP, CERM, 0.1 µF, 50 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	1	Murata
C1	GCM188R71E105KA64D	CAP, CERM, 1 uF, 25 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	1	Murata
J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, J11, J12, J13, J14, J15, J16	PEC03SAAN	Header, 100mil, 3x1, Tin, TH	16	Sullins
J18, J23, J24, J27, J28, J29	CONSMA001-SMD-G	Jack, SMA, PCB, Gold, SMT	6	Linx Technologies
R10, R12, R14, R15, R16, R18, R19, R20, R22, R24, R26, R30, R31, R34, R35, R36	ERJ-6GEY0R00V	RES, 0, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	16	Panasonic
GND	5006	Test Point, Compact, Black, TH	1	Keystone Electronics
VDD	5005	Test Point, Compact, Red, TH	1	Keystone Electronics
EN, SEL	5007	Test Point, Compact, White, TH	2	Keystone Electronics
D1, D2, D3, D4, S1A, S1B, S2A, S2B, S3A, S3B, S4A, S4B	5009	Test Point, Compact, Yellow, TH	12	Keystone Electronics

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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.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

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Concernant les EVMs avec appareils radio:

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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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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.

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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.

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