

TSU6721EVM Micro-USB Switch Evaluation Module

This document is the user's guide for the TSU6721EVM micro-USB switch evaluation module (EVM). The TSU6721EVM is designed to evaluate and demonstrate the functionality of TI's TSU6721 micro-USB switch.

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

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1 About This Manual

1.1 Information about Cautions and Warnings

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



CAUTION

This EVM contains components that can potentially be damaged by electrostatic discharge (ESD). Always transport and store the EVM in its supplied ESD bag when not in use. Handle while using an antistatic wristband. Operate on an antistatic work surface. For more information on proper handling, see the *Electrostatic Discharge (ESD)* application note (<u>SSYA008</u>).

1.2 Items Required for Operation

The following items are required to use the TSU6721EVM:

- TSU6721EVM
- TSU6721 datasheet (<u>SCDS338</u>) from <u>www.ti.com</u>
- Two power supplies for VBAT and VDDIO
 - 3.3 V at 100 mA recommended for each

1.3 Items Recommended for Operation

The following items are recommended for use with the TSU6721EVM:

- MSP430[™] LaunchPad[™]
 - Recommended rev 1.5
 - MSP430G2553 installed
- USB standard-A to mini-B cable
- Computer running Microsoft® Windows® 7 with 2 available USB ports
- TSU6721EVM software, available from the <u>TSU6721EVM</u> webpage

MSP430, LaunchPad are trademarks of Texas Instruments. Microsoft, Windows are registered trademarks of Microsoft Corporation.



2 Introduction

The TSU6721EVM can be used as a standalone board or paired with the MSP-EXP430G2 LaunchPad to facilitate power and I²C communication. When paired with the LaunchPad, The TSU6721EVM graphical user interface (GUI) can be used to read from or write to internal registers of the TSU6721 micro-USB switch, allowing the user to observe or control the switching of the device through I²C.

MICRO-USB Switch	IC	Package
U1	TSU6721YFFR	DSBGA-32

Table 1. Device and Package Configurations



Figure 1. TSU6721EVM

3 Setup

This section describes the header and jumper connections on the TSU6721EVM, installation of the firmware on the MSP430 LaunchPad, installation of the software (GUI) on the computer, and getting started using the TSU6721EVM.

3.1 Header and Jumper Connection Descriptions

3.1.1 J2, J4, and J7: Power Input Selectors

Header J2 allows VBAT input from the LaunchPad or external supply. The range is 3 V to 4.4 V.

Header J4 allows VDDIO input from the LaunchPad or external supply. The range is 1.65 V to 3.6 V.

Header J7 allows VBUS input from an external supply or input from micro-USB connector J15 (V_USB). The range is 4 V to 6.5 V.

3.1.2 J1, J3, and J6: External Power Inputs

Terminal J1 is the external supply connector for J2.



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Terminal J3 is the external supply connector for J4.

Terminal J6 is the external supply connector for J7.

3.1.3 J8 and J9: MSP430 LaunchPad Interface Headers

Headers J8 and J9 are the connectors for the MSP430 LaunchPad to the TSU6721EVM.

3.1.4 J12 and J15: USB Device Path

Connector J12 is a mini-USB connector at the output of the TSU6721. Connector J15 is a micro-USB connector at the input of the TSU6721.

3.1.5 J5 and J22: USB Through-Path

Connectors J5 and J22 are wired as a short-circuit for through-path evaluation.

3.1.6 J13, J14, J17, and J27: USB Connector-Side Test Points

Test point J13 is for the DP pin/lines. Test point J14 is for the DM pin/lines. Test point J17 is for the ID pin/lines. Test point J27 is for the VBUS pin/lines.

3.1.7 J10, J11, J16, and J28: USB Host-Side Test Points

Test point J10 is for the DP_HT pin/lines. Test point J11 is for the DM_HT pin/lines. Test point J16 is for the IDBP pin/lines. Test point J28 is for the OUT pin/lines (indicated as VBUS_HT on the board).

3.1.8 J19, J23, and J26: Non-USB Host-Side Output Test Points

Test point J19 is for the TxD and RxD (UART) pin/lines. Test point J23 is for the S_L and S_R (Audio) pin/lines. Test point J17 is for the MIC output pin/lines.

3.1.9 J21 and J24: VBUS OUT Path Jumpers

Header J21 connects the TSU6721's OUT pin to VBUS_HT on the board. Header J24 connects the TSU6721's OUT pin to a green LED.

3.1.10 J20: I²C Interface

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Header J20 is for the SDA and SCL I2C lines. They can be used to probe I2C communications between the TSU6721 and the LaunchPad, or they can be used as I2C inputs/outputs when the LaunchPad is not present.

3.1.11 J18 and J29: Hardware Interface Output Test Points

Header J18 is for the JIG, BOOT, and ISET hardware outputs.

Test point J29 is for the INTB interrupt output.



3.2 LaunchPad Hardware and Firmware Setup

If using the TSU6721EVM GUI, the MSP430 LaunchPad board must be configured properly in order to flash the processor with the TSU6721EVM firmware. The following steps are provided to use the TSU6721EVM in conjunction with the LaunchPad.

1. With the LaunchPad unplugged, configure the headers on the LaunchPad to be in HW UART mode by attaching jumpers on the headers indicated by the yellow boxes in Figure 2:

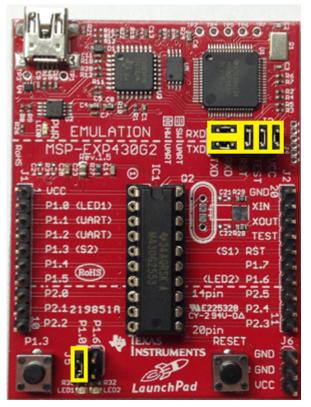


Figure 2. Proper Jumper Configuration on the LaunchPad

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2. Place the TSU6721EVM on top of the LaunchPad (see Figure 3) so that all connectors on J1 and J2 of the LaunchPad are inserted into J8 and J9 of the TSU6721EVM and the mini-USB connectors on both boards are facing the same direction.

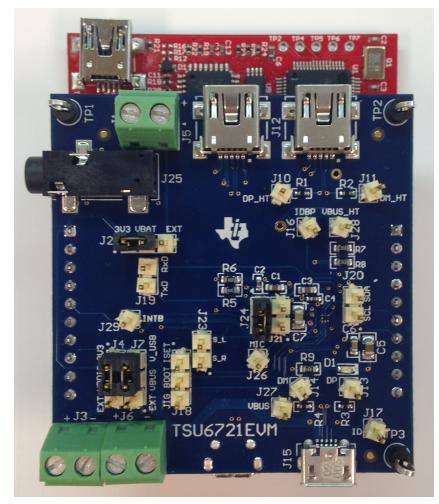
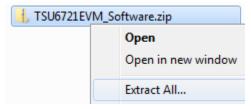


Figure 3. Proper Orientation for the TSU6721EVM on the LaunchPad.

- 3. The following jumper configurations on the TSU6721EVM are required for power to be supplied from the LaunchPad:
 - (a) J2: 3V3 to VBAT
 - (b) J4: 3V3 to VDDIO
- 4. Download the firmware (for the MSP430) and graphical user interface (GUI) software in a zipped folder located on the <u>TSU6721EVM</u> webpage on <u>www.ti.com</u>.
- 5. Extract the zip folder.



6. Plug the MSP430 LaunchPad into the computer.

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7. Open the *Device Manager* by typing "devmgmt.msc" into the Start Menu and pressing ENTER.

See more results	
devmgmt.msc	×

8. Select the MSP430 Application, right click → Properties, and click *Update Driver Software...*. The MSP430 Application may appear either in *Ports* or *Other Devices*.

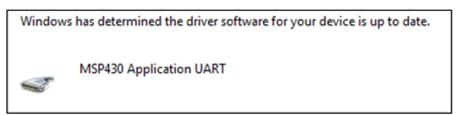
- Port	s (COM & LPT)
-17 1	ntel(R) Active Management Technology - SOL (COM3)
-191	MSP430 Application UART (COM7)
191	Prolific USB-to-Serial Comm Port (COM4)
	Update Driver Software

9. Select the Browse... button in the Browse my computer for driver software dialog box.

Disable



- 10. Select the folder where you extracted TSU6721EVM_Software.zip
- 11. Click the Next button. Click Close after you see the following image:



12. Flash the MSP430 by double-clicking *TSU6721_Flasher.bat* in the *TSU6721EVM LaunchPad files* folder where you extracted TSU6721EVM_Software.zip.





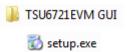
13. Verify that the command window says *no errors*, the device has been recognized as the MSP430G2, and TSU6721.txt has been programmed into the MSP430, as seen in the following image. A successful flash of the firmware results in the following command line prompt:

C\windows\system32\cmd.exe rograming TSU6721.txt into MSP430G2553	
og directory already exist	*
MSP430 Flasher v1.2.1	*
+	×
 Found USB FET @ HIDØØ58:COM8. Initializing interface on TIUSB portdone Checking firmware compatibility: 	
« FET firmware is up to date. « Reading FW versiondone « Reading HW versiondone	
Powering updone Accessing devicedone Reading device informationdone	
Loading device into devicedone Verifying transferdone	
≫ « UseCase : MSP430Flasher.exe « Arguments : -n MSP430G2553 -w TSU6721.txt -v -g -z [UCC] « ATTENTION: Default options used due to invalid argument list.	
* * Driver : loaded * D11 Version : 20409001 * FwVersion : 30394216	
+ Interface : IIUSB + Hudersion : E 2.0 + Mode : AUTO	
<pre>* Mode : AUIO * Mode : AUIO * Device : MSP430G2xx3 * EEM : Level 1, ClockCntrl 1 * Prog.File : ISU6721.txt (ERASE_ALL, verified = IRUE) * BSL Unlock : FALSE * LofoA Access: FALSE</pre>	
BSL Unlock : FALSE InfoA Access: FALSE VCC ON : TRUE	
Disconnecting from devicedone	
Driver : closed (No error)	

14. Close the window by pressing any key.

3.3 GUI Software Setup

1. Run *setup.exe* located in the TSU6721_GUI folder. From now on, the TSU6721 software is available under the Start menu in Programs \rightarrow Texas Instruments, Inc \rightarrow TSU6721.exe.



2. If the GUI does not launch automatically, run the installed *TSU6721-EVM GUI* program from the Start Menu.

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3. The GUI looks like Figure 4 when it is opened and the LaunchPad is connected:

Address					Register Map							
	Register	Reg Value	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit0	Rea	d Al
0x01	Device ID	0x00	Version[4]	Version[3]	Version[2]	Version[1]	Version[0]	Vendor[2]	Vendor[1]	Vendor[0]	Read	
0x02	Control	0x00	Reserved	Reserved	MCPC Mode	SW Open	Raw Data	Manual SW	Wait	INT Mask	Read	Write
0x03	Interrupt 1	0x00	OVP_OCP_OTP	OCP_EN	OVP_EN	LKR	LKP	KP	Detach	Attach	Read	
0x04	Interrupt 2	0x00	VBUS	OTP_EN	CONNECT	Stuck_Key RCV	Stuck Key	ADC Change	RSVD Attach	AV Change	Read	
0x05	Int Mask 1	0x00	OVP_OCP_OTP	OCP_EN Mask	OVP_EN Mask	LKR Mask	LKP Mask	KP Mask	Detach Mask	Attach Mask	Read	Write
0x06	Int Mask 2	0x00	VBUS Mask	OTP_EN Mask	CONNECT Mask	Stuck_Key RCK	Stuck Key Mask	ADC Change Mask	RSVD Attach Ma	AV Change Mask	Read	Write
x07	ADC	0x00	Reserved	Reserved	Reserved	ADC[4]	ADC[3]	ADC[2]	ADC[1]	ADC[0]	Read	
0x08	Timing Set 1	0x00	Key Press[3]	Key Press[2]	Key Press[1]	Key Press[0]	Dev Sleep[3]	Dev Sleep[2]	Dev Sleep[1]	Dev Sleep[0]	Read	Write
0x09	Timing Set 2	0x00	SW Wait[3]	SW Wait[2]	SW Wait[1]	SW Wait[0]	LKP[3]	LKP[2]	LKP[1]	LKP[0]	Read	Write
Dx0A	Device Type 1	0x00	USB OTG	DCP	CDP	Type 1/2 Chg	UART	SDP	Audio Type 2	Audio Type 1	Read	
0x0B	Device Type 2	0x00	Audio Type 3	A/V	TTY	PPD	Jig UART OFF	JIG UART ON	JIG USB OFF	JIG USB ON	Read	
Dx0C	Button 1	0x00	7	6	5	4	3	2	1	Send End	Read	
Dx0D	Button 2	0x00	Reserved	Unknown	Error	12	11	10	9	8	Read	
0x13	Manual SW 1	0x00	DM SW[2]	DM SW[1]	DM SW[0]	DP SW[2]	DP SW[1]	DP SW[0]	VBUS SW[1]	VBUS SW[0]	Read	Write
Dx14	Manual SW 2	0x00	Reserved	Reserved	VBUS_CAP	ISET ON	BOOT ON	JIG ON	ID SW[1]	ID SW[0]	Read	Write
0x15	Device Type 3	0x00	Video	U200 Chg	Apple Chg	A/V VBUS	Reserved	VBUS Non-Std	VBUS_Dbnc	MHL	Read	
0x1B	Reset	0x00	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reset	Read	Write
x20	Timer Setting	0x00	ISET EN Time	Load SW EN Time	BCv1.2[2]	BCv1.2[1]	BCv1.2[0]	ADC Start[2]	ADC Start[1]	ADC Start[0]	Read	Write
0x21	OCP/OCL Settin	0x00	OCL Level[2]	OCL Level[1]	OCL Level[0]	OCP Timeout[2]	OCP Timeout[1]	OCP Timeout[0]	Reserved	BCv1.2 EN	Read	Write
x22	OCP/OCL Settin	0x00	Reserved	Reserved	Reserved	OC EN[1]	OC EN[0]	OCP Level[2]	OCP Level[1]	OCP Level[0]	Read	Write
x 23	Device Type 4	0x00	Reserved	Reserved	Reserved	Reserved	Reserved	MCPC ID[2]	MCPC ID[1]	MCPC ID[0]	Read	Write

Figure 4. TSU6721EVM GUI Without LaunchPad

3.4 Getting Started Using the TSU6721 Micro-USB Switch EVM

3.4.1 Evaluating the TSU6721EVM without the GUI

- 1. The TSU6721EVM can be powered with or without the LaunchPad. If you have a LaunchPad available and have completed steps 1–3 in Section 3.2, continue to step 2. If you do not have a LaunchPad, attach the jumper on J2 from VBAT to EXT, and attach jumper on J4 to VDDIO to EXT. Next, apply 3 V to 4.4 V on J1 and apply 1.65 V to 3.6 V on J3.
- Connect a 150-kΩ resistor between ID (J17) and GND (TP1, TP2, or TP3). By default, the TSU6721 closes the appropriate switches as specified in Table 2 of the TSU6721 (SCDS338) datasheet.
- 3. While referencing the on-resistance values for each signal path in the TSU6721 datasheet, measure the following resistance values to verify that the switches have been closed:
 - (a) DM (J14) to TxD (J19)
 - (b) DP (J13) to RxD (J19)
- 4. Remove the 150-k Ω resistor.
- 5. Attach a micro-USB cable from the PC to J15 on the TSU6721EVM. As most PCs are considered USB Standard Downstream Port (SDP) or Charging Downstream Port (CDP) chargers, the TSU6721 closes the appropriate switches as specified in Table 4 on the TSU6721 datasheet.
- 6. While referencing the on-resistance values for each signal path in the TSU6721 datasheet, measure the following resistance values to verify that the switches have been closed:
 - (a) DM (J14) to DM_HT (J11)
 - (b) DP (J13) to DP_HT (J10)
- 7. Remove the micro-USB cable from the PC.
- 8. Choose any desired charger type or ID resistor specified in either **Table 2** or **Table 4** of the TSU6721 datasheet to observe the behavior of the TSU6721 switch. The datasheet describes the switch behavior for each condition.

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9. The user may develop software that uses I²C to communicate with the internal registers of the TSU6721. See *Standard I²C Interface Details* on page 18 of the TSU6721 datasheet.

3.4.2 Evaluating the TSU6721EVM with the GUI

1. After completing the steps in Section 3.2 and Section 3.3, launch the TSU6721EVM software. The screen looks like Figure 5:

					Register Map							
Address	Register	Reg Value	Bt7	B#6	Bt5	Bit4	Bt3	Bit2	Bit 1	Bk0	Rea	d Al
601	Device ID	0x12	Version[4]	Version[3]	Version[2]	Version[1]	Version[0]	Vendor[2]	Vendor[1]	Vendor[0]	Read	
H02	Control	0x1E	Reserved	Reserved	MCPC Mode	SW Open	Raw Data	Manual SW	Wat	INT Mask	Read	Wite
M03	Interrupt 1	0x00	OVP_OCP_OTP	OCP_EN	OVP_EN	LKR	LKP	KP	Detach	Attach	Read	
x04	Interrupt 2	0x00	VBUS	OTP_EN	CONNECT	Stuck_Key RCV	Stuck Key	ADC Change	RSVD Attach	AV Change	Read	
×05	Int Mask 1	0x00	OVP_OCP_OTP	OCP_EN Mask	OVP_EN Mask	LKR Mask	LKP Mask	KP Mask	Detach Mask	Attach Mask	Read	Wite
x06	Int Mask 2	0x20	VBUS Mask	OTP_EN Mask	CONNECT Mask	Stuck_Key RCK	Stuck Key Mask	ADC Change Mask	RSVD Attach Ma	AV Change Mask	Read	Write
x07	ADC	0x1F	Reserved	Reserved	Reserved	ADC(4)	ADC[3]	ADC[2]	ADC[1]	ADC[0]	Read	
M08	Timing Set 1	0x00	Key Press[3]	Key Press[2]	Key Press[1]	Key Press[0]	Dev Sleep[3]	Dev Sleep[2]	Dev Sleep[1]	Dev Sleep[0]	Read	Write
M09	Timing Set 2	0x00	SW Wat[3]	SW Wat[2]	SW Wat[1]	SW Wat[0]	LKP[3]	LKP[2]	LKP[1]	LKP[0]	Read	Write
ыda	Device Type 1	0x00	USB OTG	DCP	CDP	Type 1/2 Chg	UART	SDP	Audio Type 2	Audio Type 1	Read	
MOB	Device Type 2	0x00	Audio Type 3	AV	TTY	PPD	Jg UART OFF	JIG UART ON	JIG USB OFF	JIG USB ON	Read	
MOC .	Button 1	0x00	7	6	5	4	3	2	1	Send End	Read	
MOD	Button 2	0x00	Reserved	Unknown	Error	12	11	10	9	8	Read	
x13	Manual SW 1	0x00	DM SW[2]	DM SW[1]	DM SW[0]	DP SW[2]	DP SW[1]	DP SW[0]	VBUS SW[1]	VBUS SW[0]	Read	Wite
k14	Manual SW 2	0x00	Reserved	Reserved	VBUS_CAP	ISET ON	BOOT ON	JIG ON	ID SW[1]	ID SW[0]	Read	Wite
x15	Device Type 3	0x00	Video	U200 Chg	Apple Chg	A/V VBUS	Reserved	VBUS Non-Std	VBUS_Dbnc	MHL	Read	
x18	Reset	0x00	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reset	Read	Write
x20	Timer Setting	0x15	ISET EN Time	Load SW EN Time	6 BCv1.2[2]	8Cv1.2[1]	BCv1.2[0]	ADC Start[2]	ADC Start[1]	ADC Start[0]	Read	Wrte
k21	OCP/OCL Settin	0x29	OCL Level[2]	OCL Level[1]	OCL Level[0]	OCP Timeout[2]	OCP Timeout[1]	OCP Timeout[0]	Reserved	BCv1.2 EN	Read	Wrte
x22	OCP/OCL Settin	0x19	Reserved	Reserved	Reserved	OC EN(I)	OC EN(0)	OCP Level[2]	OCP Level[1]	OCP Level(0)	Read	Wite
x23	Device Type 4	0x07	Reserved	Reserved	Reserved	Reserved	Reserved	MCPC ID(2)	MCPC ID(1)	MCPC ID(0)	Read	Witte
CL Level Se	tting		Long Key Press	Timer S	witching Wait Tim	er ISET	Enable Time				Auto	Read on /I
2.0A			300 ms	i i i i i i i i i i i i i i i i i i i	10 ms		40 ms			JIG Out	V Auto	Write on C
CP Level Se	tting		Normal Key Pre	ss Timer B	C1.2 Timeout Le	noth Load	Switch Enable Tim	e				
1.5A			100 ms		1.85	-	150 ms			BOOT Out		squest Pin
CP Timeout	Delay		Device Sleep T	imer B	C1.2 Enabled?		Start Timer			ISET Out		Status
4 ms			50 ms		ENABLED		16 ms			/INT Indicator		

Figure 5. TSU6721EVM GUI After Connecting the LaunchPad to the Computer

 Connect a 150-kΩ resistor between ID (J17) and GND (TP1, TP2, or TP3). The TSU6721 closes the appropriate switches as specified in Table 2 of the TSU6721 datasheet. The ATTACH interrupt will go high until its register is read.



					Register Map							
Address	Register	Reg Value	Bit7	Bit6	Bit5	B84	BR3	Bit2	Bit 1	BitD	Rea	d Al
0x01	Device ID	0x12	Version[4]	Version[3]	Version[2]	Version[1]	Version[0]	Vendor[2]	Vendor[1]	Vendor[0]	Read	
Dx02	Control	0x1E	Reserved	Reserved	MCPC Mode	SW Open	Rev Data	Manual SW	Wat	INT Mask	Read	Wite
bx03	Interrupt 1	0x00	OVP_OCP_OTP	OCP_EN	OVP_EN	LKR	LKP	KP	Detach	Attach	Read	
0x04	Interrupt 2	0x00	VBUS	OTP_EN	CONNECT	Stuck_Key RCV	Stuck Key	ADC Change	RSVD Attach	AV Change	Read	
0x05	Int Mask 1	0x00	OVP_OCP_OTP	OCP_EN Mask	OVP_EN Mask	LKR Mask	LKP Mask	KP Mask	Detach Mask	Attach Mask	Read	Wite
0x06	Int Mask 2	0x20	VBUS Mask	OTP_EN Mask	CONNECT Mask	Stuck_Key RCK	Stuck Key Mask	ADC Change Mask	RSVD Attach Ma	AV Change Mask	Read	Wite
b:07	ADC	0x16	Reserved	Reserved	Reserved	ADC[4]	ADC[3]	ADC[2]	ADC[1]	ADC[0]	Read	
80%	Timing Set 1	0x00	Key Press[3]	Key Press[2]	Key Press[1]	Key Press(0)	Dev Sleep[3]	Dev Sleep[2]	Dev Sleep[1]	Dev Sleep[0]	Read	Write
0x09	Timing Set 2	0x00	SW Wat[3]	SW Wat[2]	SW Wat[1]	SW Wait[0]	LKP[3]	LKP[2]	LKP[1]	LKP[0]	Read	Wrte
0x0A	Device Type 1	0x08	USBOTG	DCP	CDP	Type 1/2 Chg	UART	SDP	Audio Type 2	Audio Type 1	Read	
0x08	Device Type 2	0x00	Audio Type 3	AV	TTY	PPD	Jg UART OFF	JIG UART ON	JIG USB OFF	JIG USB ON	Read	
DAUC COM	Button 1	0x00	7	6	5	4	3	2	1	Send End	Read	
0x0D	Button 2	0x00	Reserved	Unknown	Error	12	11	10	9	8	Read	
0x13	Manual SW 1	0x00	DM SW[2]	DM SW[1]	DM SW[0]	DP SW[2]	DP SW[1]	DP SW[0]	VBUS SW[1]	VBUS SW[0]	Read	Write
0x14	Manual SW 2	0x00	Reserved	Reserved	VBUS_CAP	ISET ON	BOOT ON	JIG ON	ID SW[1]	ID SW[0]	Read	Wite
Dx15	Device Type 3	0x00	Video	U200 Chg	Apple Chg	A/V VBUS	Reserved	VBUS Non-Std	VBUS_Dbnc	MHL	Read	
Dx18	Reset	0x00	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reset	Read	Write
0x20	Timer Setting	0x15	ISET EN Time	Load SW EN Time	BCv1.2[2]	BCv1.2[1]	BCv1.2[0]	ADC Stat[2]	ADC Stat[1]	ADC Stat(0)	Read	Write
0x21	OCP/OCL Settin	0x29	OCL Level[2]	OCL Level[1]	OCL Level[0]	OCP Timeout[2]	OCP Timeout[1]	OCP Timeout[0]	Reserved	BCv1.2 EN	Read	Write
3x22	OCP/OCL Settin	0x19	Reserved	Reserved	Reserved	OC EN[1]	OC EN[0]	OCP Level[2]	OCP Level[1]	OCP Level[0]	Read	Wite
b23	Device Type 4	0x01	Reserved	Reserved	Reserved	Reserved	Reserved	MCPC ID[2]	MCPC ID[1]	MCPC ID[0]	Read	Wite
2.0A 2.0A DCP Level Se 1.5A DCP Timeout 4 ms	etting		Long Key Pres 300 ms Normal Key Pr 100 ms Device Sleep 50 ms	ess Timer B	witching Wait Tim 10 ms C1.2 Timeout Le 1.8s C1.2 Enabled? ENABLED	ngth Load S ADC S	Enable Time 0 ms Switch Enable Ti 10 ms Start Timer 8 ms	me		JIG Out BOOT Out ISET Out /INT Indicator		

Figure 6. TSU6721EVM GUI Showing ID Detection of a UART Cable

- 4. Remove the 150-k Ω resistor.
- 5. Attach a micro-USB cable from the PC to J15 on the TSU6721EVM. As most PCs are considered USB Standard Downstream Port (SDP) or Charging Downstream Port (CDP) chargers, the TSU6721 closes the appropriate switches as specified in Table 4 on the TSU6721 datasheet.

Setup



Setup

6. Click *Read All*. When the micro-USB cable is attached to the PC, the GUI looks like Figure 7. Notice the change in register 0x0A, where the SDP bit has gone high after detection.

					Register Map							
Address	Register	Reg Value	Bk7	Bit6	Bt5	Bit4	Bk3	Bit2	Bit 1	Bk0	Read	d Al
x01	Device ID	0x12	Version[4]	Version[3]	Version[2]	Version[1]	Version(0)	Vendor[2]	Vendor[1]	Vendor[0]	Read	
w02	Control	0x1E	Reserved	Reserved	MCPC Mode	SW Open	Raw Data	Manual SW	Wat	INT Mask	Read	Wite
x03	Interrupt 1	0x00	OVP_OCP_OTP	OCP_EN	OVP_EN	LKR	LKP	KP	Detach	Attach	Read	
k04	Interrupt 2	0x00	VBUS	OTP_EN	CONNECT	Stuck_Key RCV	Stuck Key	ADC Change	RSVD Attach	AV Change	Read	
x05	Int Mask 1	0x00	OVP_OCP_OTP	OCP_EN Mask	OVP_EN Mask	LKR Mask	LKP Mask	KP Mask	Detach Mask	Attach Mask	Read	Wite
x06	Int Mask 2	0x20	VBUS Mask	OTP_EN Mask	CONNECT Mask	Stuck_Key RCK	Stuck Key Mask	ADC Change Mask	RSVD Attach Ma	AV Change Mask	Read	Write
x07	ADC	Ox1F	Reserved	Reserved	Reserved	ADC[4]	ADC[3]	ADC[2]	ADC[1]	ADC[0]	Read	
x08	Timing Set 1	0x00	Key Press[3]	Key Press[2]	Key Press[1]	Key Press[0]	Dev Sleep[3]	Dev Sleep[2]	Dev Sleep[1]	Dev Sleep[0]	Read	Wite
x09	Timing Set 2	0x00	SW Wait[3]	SW Wat[2]	SW Wat[1]	SW Wait[0]	LKP[3]	LKP[2]	LKP[1]	LKP[0]	Read	Wite
b0A	Device Type 1	0x04	USB OTG	DCP	CDP	Type 1/2 Chg	UART	SDP	Audio Type 2	Audio Type 1	Read	
×08	Device Type 2	0x00	Audio Type 3	A/V	TTY	PPD	Jig UART OFF	JIG UART ON	JIG USB OFF	JIG USB ON	Read	
MOC .	Button 1	0x00	7	6	5	4	3	2	1	Send End	Read	
x00	Button 2	0x00	Reserved	Unknown	Error	12	11	10	9	8	Read	
k13	Manual SW 1	0x00	DM SW[2]	DM SW[1]	DM SW[0]	DP SW[2]	DP SW[1]	DP SW[0]	VBUS SW[1]	VBUS SW(0)	Read	Wite
k14	Manual SW 2	0x00	Reserved	Reserved	VBUS_CAP	ISET ON	BOOT ON	JIG ON	ID SW[1]	ID SW[0]	Read	Write
0x15	Device Type 3	0x02	Video	U200 Chg	Apple Chg	A/V VBUS	Reserved	VBUS Non-Std	VBUS_Dbnc	MHL	Read	
0x18	Reset	0x00	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reset	Read	Wite
¥20	Timer Setting	0x15	ISET EN Time	Load SW EN Time	BCv1.2[2]	BCv1.2[1]	BCv1.2[0]	ADC Start[2]	ADC Start[1]	ADC Start[0]	Read	Wite
621	OCP/OCL Settin	0:29	OCL Level[2]	OCL Level[1]	OCL Level[0]	OCP Timeout[2]	OCP Timeout[1]	OCP Timeout[0]	Reserved	BCv1.2 EN	Read	Wite
3x22	OCP/OCL Settin	0x19	Reserved	Reserved	Reserved	OC EN[1]	OC EN(0)	OCP Level[2]	OCP Level[1]	OCP Level(0)	Read	Wite
x23	Device Type 4	0x07	Reserved	Reserved	Reserved	Reserved	Reserved	MCPC ID[2]	MCPC ID[1]	MCPC ID(0)	Read	Wite
CL Level Se	tting		Long Key Pres	s Timer S	witching Wait Tim	or ISET E	nable Time				🗸 Auto	Read on J
2.0A			300 ms		10 ms		0 ms			JIG Out	Auto	Write on (
CP Level Se	tting		Normal Key Pr	ess Timer B	C1.2 Timeout Le	toat load	Switch Enable Tim	e				
1.5A			100 ms		1.85		0 ms	~		BOOT Out	0.	and Ba
CP Timeout	Delay		Device Sleep 1	limer B	C1.2 Enabled?		start Timer			ISET Out		quest Pin Status
4 ms			50 ms	D D	ENABLED		6 ms			/INT Indicator		

Figure 7. TSU6721EVM GUI Showing SDP Charger Detection

- 7. Disconnect the micro-USB cable from the PC.
- The TSU6721EVM GUI can write to each register specified as *Read/Write* in the TSU6721 datasheet. Click on register 0x02, bit 2 (Manual SW). The box turns grey, which means that 0x02 bit 2 has been set to 0.

					Register Map							
Address	Register	Reg Value	Bit 7	Bk6	Bit5	Bit4	Bit3	Bit2	Bit 1	BitD	Rea	d Al
0x01	Device ID	0x12	Version[4]	Version[3]	Version[2]	Version[1]	Version[0]	Vendor[2]	Vendor[1]	Vendor[0]	Read	
0×02	Control	Oc1A	Reserved	Reserved	MCPC Mode	SW Open	Rev Data	Manual SW	Wat	INT Mask	Read	Write
0x03	Interrupt 1	0x00	OVP_OCP_OTP	OCP_EN	OVP_EN	LKR	LKP	KP	Detach	Attach	Read	
0x04	Interrupt 2	0x00	VBUS	OTP_EN	CONNECT	Stuck_Key RC	/ Stuck Key	ADC Change	RSVD Attach	AV Change	Read	
0x05	Int Mask 1	0x00	OVP_OCP_OTP	OCP_EN Mask	OVP_EN Mask	LKR Mask	LKP Mask	KP Mask	Detach Mask	Attach Mask	Read	Wite
0x06	Int Mask 2	0x20	VBUS Mask	OTP_EN Mask	CONNECT Mask	Stuck_Key RC	C Stuck Key Mask	ADC Change Mask	RSVD Attach Ma	AV Change Mask	Read	Wite
0x07	ADC	Ox1F	Reserved	Reserved	Reserved	ADC[4]	ADC[3]	ADC[2]	ADC[1]	ADC[0]	Read	
80x08	Timing Set 1	0x00	Key Press[3]	Key Press[2]	Key Press[1]	Key Press[0]	Dev Sleep[3]	Dev Sleep[2]	Dev Sleep[1]	Dev Sleep[0]	Read	Wite
Dx09	Timing Set 2	0x00	SW Wat(3)	SW Wat(2)	SW Wat[1]	SW Wat(0)	LKP[3]	LKP[2]	LKP[1]	LKP[0]	Read	Wite
DxDA	Device Type 1	0x00	USBOTG	DCP	CDP	Type 1/2 Chg	UART	SDP	Audio Type 2	Audio Type 1	Read	
0x08	Device Type 2	0x00	Audio Type 3	AV	TTY	PPD	Jig UART OFF	JIG UART ON	JIG USB OFF	JIG USB ON	Read	
0x0C	Button 1	0x00	7	6	5	4	3	2	1	Send End	Read	
0+00	Button 2	0x00	Reserved	Unknown	Error	12	11	10	9	8	Read	
0x13	Manual SW 1	0x00	DM SW[2]	DM SW[1]	DM SW[0]	DP SW[2]	DP SW[1]	DP SW(0)	VBUS SW[1]	VBUS SW[0]	Read	Wite
0x14	Manual SW 2	0x00	Reserved	Reserved	VBUS_CAP	ISET ON	BOOT ON	JIG ON	ID SW[1]	ID SW[0]	Read	Wite
0x15	Device Type 3	0x00	Video	U200 Chg	Apple Chg	A/V VBUS	Reserved	VBUS Non-Std	VBUS_Dbnc	MHL	Read	
0x18	Reset	0x00	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reset	Read	Write
0x20	Timer Setting	0x15	ISET EN Time	Load SW EN Time	BCv1.2[2]	BOv1.2[1]	BCv1.2[0]	ADC Stat[2]	ADC Stat[1]	ADC Stat[0]	Read	Wite
Dx21	OCP/OCL Settin	0x29	OCL Level[2]	OCL Level[1]	OCL Leve[0]	OCP Timeout[2	OCP Tineout[1]	OCP Timeout[0]	Reserved	BOV1.2 EN	Read	Wite
Dx22	OCP/OCL Settin	0x19	Reserved	Reserved	Reserved	OC EN[1]	OC EN[0]	OCP Level[2]	OCP Level[1]	OCP Level[0]	Read	Wite
Dx23	Device Type 4	0x07	Reserved	Reserved	Reserved	Reserved	Reserved	MCPC ID[2]	MCPC ID[1]	MCPC ID[0]	Read	Wite
OCL Level Se	ting		Long Key Pres	a Tamar a G	witching Wait Tim	ISF	Enable Time				2 Arto	Read on /
2.0A	any		300 ms	sinner s	10 ms	Ket IOL	40 ms		_			Write on C
DCP Level Se	etting		Normal Key Pr	and Times - D	C1.2 Timeout Le	nath Lan	d Switch Enable Tim			JIG Out	(C) 7000	THUS GIVE
1.5A			100 ms	ess rimer D	1.8s	ngin Loa	150 ms	HC .		BOOT Out		
OCP Timeout Delay				Denor B	C1.2 Enabled?	404	Start Timer			ISET Out	Re	quest Pin. Status
4 ms			Device Sleep 1 50 ms	B B	ENABLED	AD	16 ms			/INT Indicator		

Figure 8. TSU6721EVM GUI Showing Manual Switching Mode

According to page 23 of the TSU6721 datasheet, the TSU6721 is now in manual switching mode. Attach VBUS or a valid ID resistance to the TSU6721EVM. The attachment will not determine the switch status, but it will ensure that the TSU6721 does not enter sleep mode, allowing manual switching to work properly.

9. Connect an ohmmeter between DM (J14) and DM_HT (J11), and connect another ohmmeter between DP (J13) and DP_HT (J10).



Setup

10. On register 0x13, click *DM SW[0]* and *DP SW[0]* (bits 5 and 2). Figure 9 shows that they turn yellow, indicating they have been set to 1.

TSU6721-EVM	GOL		-		of the later is the							
					Register Map							
Address	Register	Reg Value	Bt7	Bit6	Bit5	B84	B83	Bit2	Bit 1	BitO	Rea	d Al
x01	Device ID	0x12	Version[4]	Version[3]	Version[2]	Version[1]	Version[0]	Vendor[2]	Vendor[1]	Vendor[0]	Read	
x02	Control	0x1A	Reserved	Reserved	MCPC Mode	SW Open	Raw Data	Manual SW	Wat	INT Mask	Read	Wite
x03	Interrupt 1	0x00	OVP_OCP_OTP	OCP_EN	OVP_EN	LKR	LKP	KP	Detach	Attach	Read	
x04	Interrupt 2	0x00	VBUS	OTP_EN	CONNECT	Stuck_Key RC	V Stuck Key	ADC Change	RSVD Attach	AV Change	Read	
x05	Int Mask 1	0x00	OVP_OCP_OTP	OCP_EN Mask	OVP_EN Mask	LKR Mask	LKP Mask	KP Mask	Detach Mask	Attach Mask	Read	Wite
x06	Int Mask 2	0x20	VBUS Mask	OTP_EN Mask	CONNECT Mask	Stuck_Key RC	K Stuck Key Mask	ADC Change Mask	RSVD Attach Ma	AV Change Mask	Read	Wite
x07	ADC	0x1F	Reserved	Reserved	Reserved	ADC[4]	ADC[3]	ADC[2]	ADC[1]	ADC[0]	Read	
x08	Timing Set 1	0x00	Key Press[3]	Key Press[2]	Key Press[1]	Key Press[0]	Dev Sleep[3]	Dev Sleep[2]	Dev Sleep[1]	Dev Sleep[0]	Read	Wite
x09	Timing Set 2	0x00	SW Wat[3]	SW Wat[2]	SW Wat[1]	SW Wat[0]	LKP[3]	LKP[2]	LKP[1]	LKP[0]	Read	Wite
x0A	Device Type 1	0x00	USBOTG	DCP	CDP	Type 1/2 Chg	UART	SDP	Audio Type 2	Audio Type 1	Read	
x0B	Device Type 2	0x00	Audio Type 3	A/V	TTY	PPD	Jig UART OFF	JIG UART ON	JIG USB OFF	JIG USB ON	Read	
x0C	Button 1	0x00	7	6	5	4	3	2	1	Send End	Read	
x0D	Button 2	0x00	Reserved	Unknown	Error	12	11	10	9	8	Read	
x13	Manual SW 1	0x24	DM SW[2]	DM SW[1]	DM SW[0]	DP SW[2]	DP SW[1]	DP SW(0)	VBUS SW[1]	VBUS SW[0]	Read	Write
x14	Manual SW 2	0x00	Reserved	Reserved	VBUS_CAP	ISET ON	BOOT ON	JIG ON	ID SW[1]	ID SW[0]	Read	Wite
x15	Device Type 3	0x00	Video	U200 Chg	Apple Chg	A/V VBUS	Reserved	VBUS Non-Std	VBUS_Dbnc	MHL	Read	
x18	Reset	0x00	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reset	Read	Wite
x20	Timer Setting	0x15	ISET EN Time	Load SW EN Tim	e BCv1.2[2]	BCv1.2[1]	BCv1.2[0]	ADC Stat[2]	ADC Stat[1]	ADC Stat[0]	Read	Write
x21	OCP/OCL Settin	0x29	OCL Level[2]	OCL Level[1]	OCL Level[0]	OCP Timeout[2] OCP Timeout[1]	OCP Timeout[0]	Reserved	BOV1.2 EN	Read	Wite
x22	OCP/OCL Settin	0x19	Reserved	Reserved	Reserved	OC EN[1]	OC EN[0]	OCP Level[2]	OCP Level[1]	OCP Level[0]	Read	Wrte
x23	Device Type 4	0x07	Reserved	Reserved	Reserved	Reserved	Reserved	MCPC ID[2]	MCPC ID[1]	MCPC ID[0]	Read	Wite
CL Level Se	tting		Long Key Pres	s Timer S	witching Wait Tin	er ISE	T Enable Time				🔽 Auto	Read on .
2.0A			300 ms		10 ms		40 ms			JIG Out	🔽 Auto	Write on (
CP Level Se	tting		Normal Key Pro	ess Timer E	C1.2 Timeout Le	nath Loa	d Switch Enable Tim	ne		BOOT Out		
1.5A		100 ms		1.85		150 ms				P.	quest Pin	
OCP Timeout Delay			Device Sleep 1	imer E	C1.2 Enabled?	AD	C Start Timer			ISET Out		Status
4 ms C Enabled?			50 ms	i i	ENABLED		16 ms			/INT Indicator		

Figure 9. TSU6721EVM GUI Showing Manually Closed DM and DP Switches

11. According to page 29 of the TSU6721 datasheet, DP has been connected to DP_HT and DM has been connected to DM_HT:

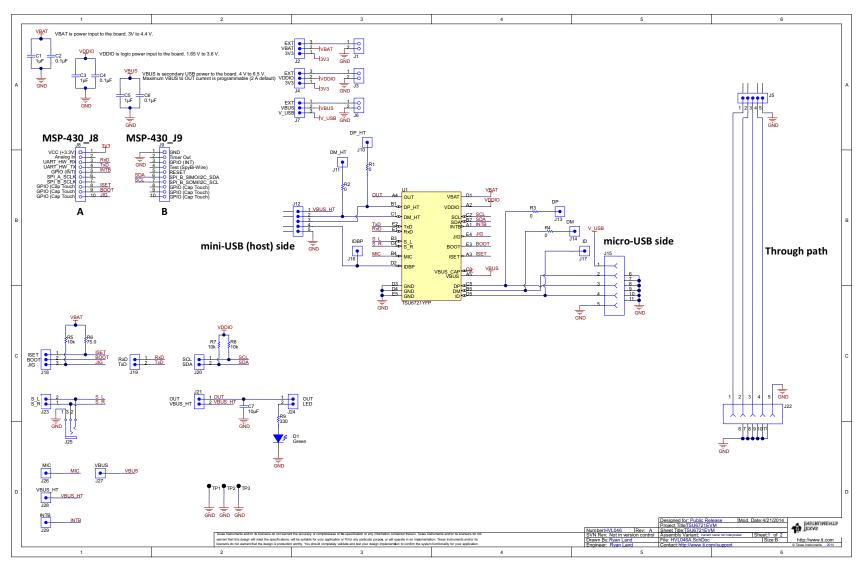
While referencing to the specified on-resistance values for each signal path in the TSU6721 datasheet, measure the following resistance values to verify that the switches have been closed:

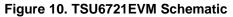
- (a) DM (J14) to DM_HT (J11)
- (b) DP (J13) to DP_HT (J10)



4 Schematic

Figure 10 shows the schematic for the TSU6721EVM.







5 Board Layout

Figure 11 through Figure 14 illustrate the PCB layout drawings for this EVM.

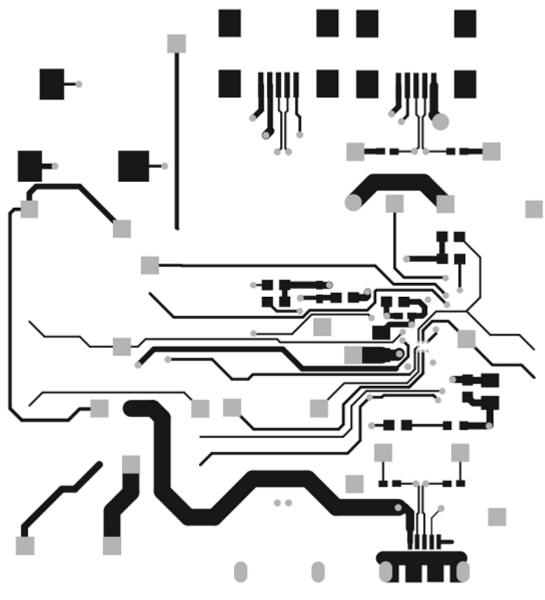


Figure 11. PCB Layer 1 (Top Layer)



Board Layout

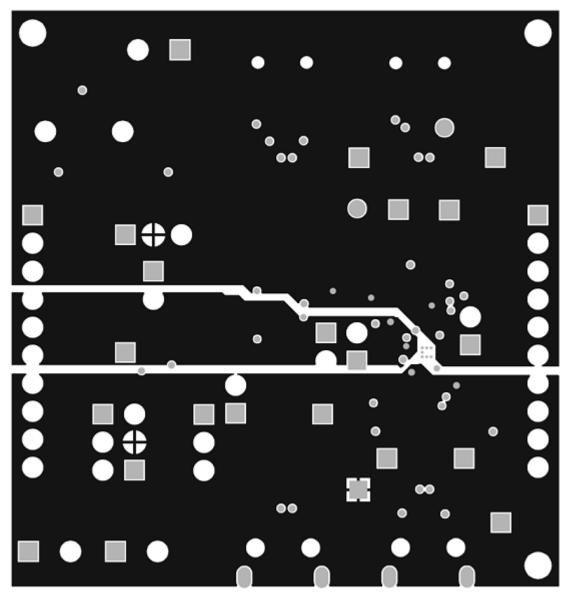


Figure 12. PCB Layer 2 (VBUS)



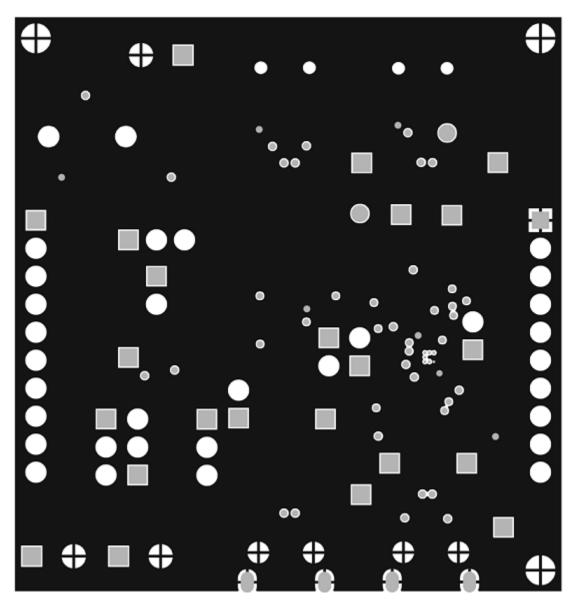


Figure 13. PCB Layer 3 (GND)



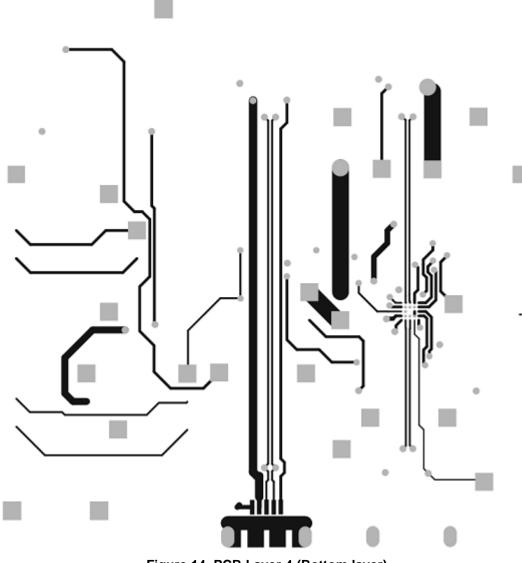


Figure 14. PCB Layer 4 (Bottom layer)



6 Bill of Materials

Table 2 lists the BOM for the TSU6721EVM.

Table 2. TSU6721EVM Bill of Materials

Designator	Qty.	Value	Description	Package Reference	Part Number	Manufacturer	
PCB1 1 Prin			Printed Circuit Board		HVL046	Any	
C1, C3	2	1uF	CAP, CERM, 1µF, 16V, ±10%, X5R, 0603	603	GRM188R61C105KA93D	Murata	
C2, C4	2	0.1uF	CAP, CERM, 0.1µF, 16V, ±10%, X7R, 0402	402	GRM155R71C104KA88D	Murata	
C5	1	1uF	CAP, CERM, 1µF, 50V, ±10%, X7R, 0805	805	GRM21BR71H105KA12L	Murata	
C6	1	0.1uF	CAP, CERM, 0.1µF, 100V, ±10%, X7R, 0603	603	GRM188R72A104KA35D	Murata	
C7	1	10uF	CAP, CERM, 10µF, 16V, ±10%, X5R, 0805	805	GRM21BR61C106KE15L	Murata	
D1	1	Green	LED, Green, SMD	1.6x0.8x0.8mm	LTST-C190GKT	Lite-On	
J1, J3, J6	3	2x1	Conn Term Block, 2POS, 3.81mm, TH	PhoenixConact_1727010	1727010	Phoenix Contact	
J2, J4, J7, J18	4		Header, TH, 100mil, 3x1, Gold plated, 230 mil above insulator	TSW-103-07-G-S	TSW-103-07-G-S	Samtec, Inc.	
J5, J12	2		Conn Rcpt Mini USB2.0 Type B 5POS SMD	USB Mini Type B	1734035-2	TE Connectivity	
J8, J9	2		Receptacle 100mil 10x1, Tin, TH	Receptacle, 10x1, 100mil, Tin	PPTC101LFBN-RC	Sullins Connector Solutions	
J10, J11, J13, J14, J16, J17, J26–J29	10		Header, TH, 100mil, 1pos, Gold plated, 230 mil above insulator	Testpoint	TSW-101-07-G-S	Samtec, Inc.	
J15, J22	2		Receptacle, Micro-USB-B, Right Angle, SMD		105017-0001	Molex	
J19–J21, J23, J24	5		Header, TH, 100mil, 2x1, Gold plated, 230 mil above insulator	TSW-102-07-G-S	TSW-102-07-G-S	Samtec, Inc.	
J25	1		Connector, Audio Jack, 3.5mm, Stereo, SMD	Audio Jack SMD	SJ-3523-SMT	CUI Inc.	
R1–R4	4	0	RES, 0 Ω, 5%, 0.063W, 0402	402	CRCW04020000Z0ED	Vishay-Dale	
R5, R7, R8	3	10k	RES, 10 kΩ, 5%, 0.1W, 0603	603	CRCW060310K0JNEA	Vishay-Dale	
R6	1	75	RES, 75.0 Ω, 1%, 0.1W, 0603	603	CRCW060375R0FKEA	Vishay-Dale	
R9	1	330	RES, 330 Ω, 5%, 0.1W, 0603	603	CRCW0603330RJNEA	Vishay-Dale	
SH-J1–SH-J4	4	1x2	Shunt, 100 mil, Gold plated, Black	Shunt	969102-0000-DA	3M	
TP1–TP3	3	Black	Test Point, TH, Multipurpose, Black	Keystone5011	5011	Keystone	
U1	1		MCPC Compatible USB Port Multimedia Switch Supports USB, UART, Audio, ID, MIC, and Load Switch, custom YFP0025	YFP0025_TSU2721	TSU6721YFP	Texas Instruments	
FID1–FID3	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A	

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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.

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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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