# TP6616/TP6617

# RF 2.4G
# Wireless Keyboard

# Application Note

# AMENDMENT HISTORY

| Version | Date | Description |
|---|---|---|
| V1.0 | April, 2011 | New release. |

# CONTENTS

# PRODUCT NAME

TP6616/TP6617

# TITLE

RF 2.4 GHz Wireless Keyboard With uTouch Widget

# APPLICATION NOTE

## 1. Introduction

This product is a 8x16 key keyboard device which also supports two touch keys, using RF 2.4G module to do data transfer. Using with tenx TP6617 2.4G Dongle, it can send device function to PC port; can immediately enjoy the wireless convenience and freedom. User can also use CD to install tenx developed Widget software application program to join Google and PC software application to Widget application software, the Widget application software can be edited or accessed, designed as exclusively personalized tool, convenient and fast to be accessed. WebKey function button is also located in TP6617 Dongle, single button auto-complete website, and link to preset website for browsing.

## 2. Software, Hardware Function Introduction

USB uTouch Widget application software function is displayed with hidden pop-up mode. There are several default functions, i.e. Windows Media Player, Email, Paint, Volume control, Recorder, tenx inc website, System Information, Data and Timer, Calendar, Calculator, etc… User can set and configure the related contents through uTouch Widget application software function, and use touch key to slide to the toolkit needed and execute the program.

Toolbar is hidden


Toolbar is opened

### 2.1 Software Edit Function Introduction

Right-click on the uTouch Widget icon in bottom right of the toolbar in PC OS, the related editing selection will be shown provided for user to set the function, as shown in below figure:


(1) uTouch Widget application software function for user to conveniently add new Widget toolkit.

(2) uTouch Widget Management function for user to conveniently manage and edit Widget toolkit.

(3) uTouch Widget Dockside function for user to conveniently decide the toolbar location, which consists of top, bottom, left, right direction of selections.

(4) uTouch Widget Settings function for user to conveniently set USB capacitance sensor device sensitivity, toolbar icon size, toolbar rotate direction, toolbar rotate speed.

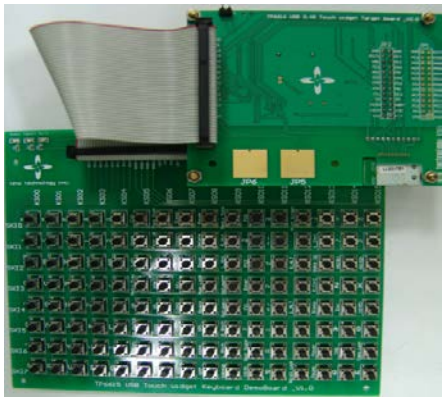
### 2.2 TP6616 Demoboard Function Introduction

(1) Support 8x16 keyboard scan

(2) Support 2 capacitance touch keys, can be used with uTouch Widget AP

(3) Use with 2.4GHz RF Module

(4) DemoBoard hardware figure:



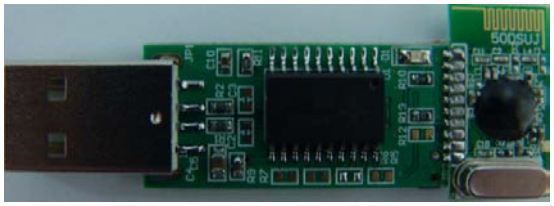
### 2.3 TP6617 Demoboard Function Introduction

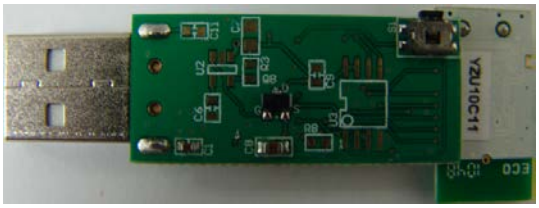
(1) Support Webkey function, when button is pressed, the website will be completed automatically, and link to predefined website for browsing.

(2) Support RF Wireless 2.4G data transfer, can be used with tenx TP6616 wireless keyboard, touch key, and also tenx TP6701 wireless mouse product.

(3) Use with 2.4GHz RF Module

(4) DemoBoard hardware figure:





## 3. Circuit Design

(1). Please use the circuit design as suggested in Application Circuit.

(2). Additional passive component is layout closer to IC.

(3). It is suggested that the circuit is designed using 10 mil circuit line (not included power supply, GND, and CLK circuit line).

(4). It is suggested to design the power supply, GND, and CLK circuit line is more than 20 mil in circuit design.

(5). PAD (touch copper foil) dimension is suggested to be larger than 12 mm X 12 mm.

(6). The conducting wire among PADs (touch copper foil) is located in the middle of PCB board (but not beneath the touch copper foil), or located further from the PCB side edge, to avoid misoperation.

(7). TouchPad(PB0, PB1) circuit line distance is better to be the same. The number of Via maybe not more than one, let Touchpad parasitic effect closer. The conducting wire is the further the better, the best is separated more than 3 times of the line width, it also needs to be far away from high frequency line signal, cannot be parallel with high frequency signal, at most is vertical circuit line.

(8). The conducting wire connected PAD (touch copper foil) must be in different layout level of the PAD (touch copper foil), can use a Via to connect, component must be in different layout level of the PAD (touch copper foil).

(9). DP, DM must be set parallel, same length, avoid hitting Via.

(10). It is suggested to use PCB board with thickness FR 4 1.6 mm.

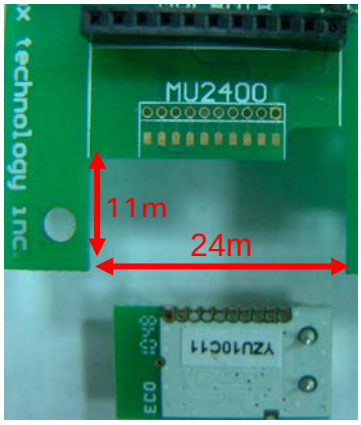
(11). This product is not suggested to use large area of copper spread of PCB board, which will decrease the touch key variation.

(12). It is suggested to use medium with thickness not more than 4 mm.

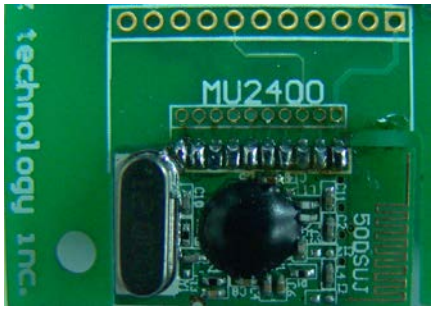
(13). The medium must be pasted closely to top of the touch copper foil (using adhesive glue), the best condition is airless.

(14). It is suggested the distance between PAD (touch copper foil) and PAD (touch copper foil) is reserved to more than 5 mm.

(15). An open slot must be designed beneath the PCB board of RF MU2400 2.4G module, as shown in below figure:




2.4G before plug in, the open slot location

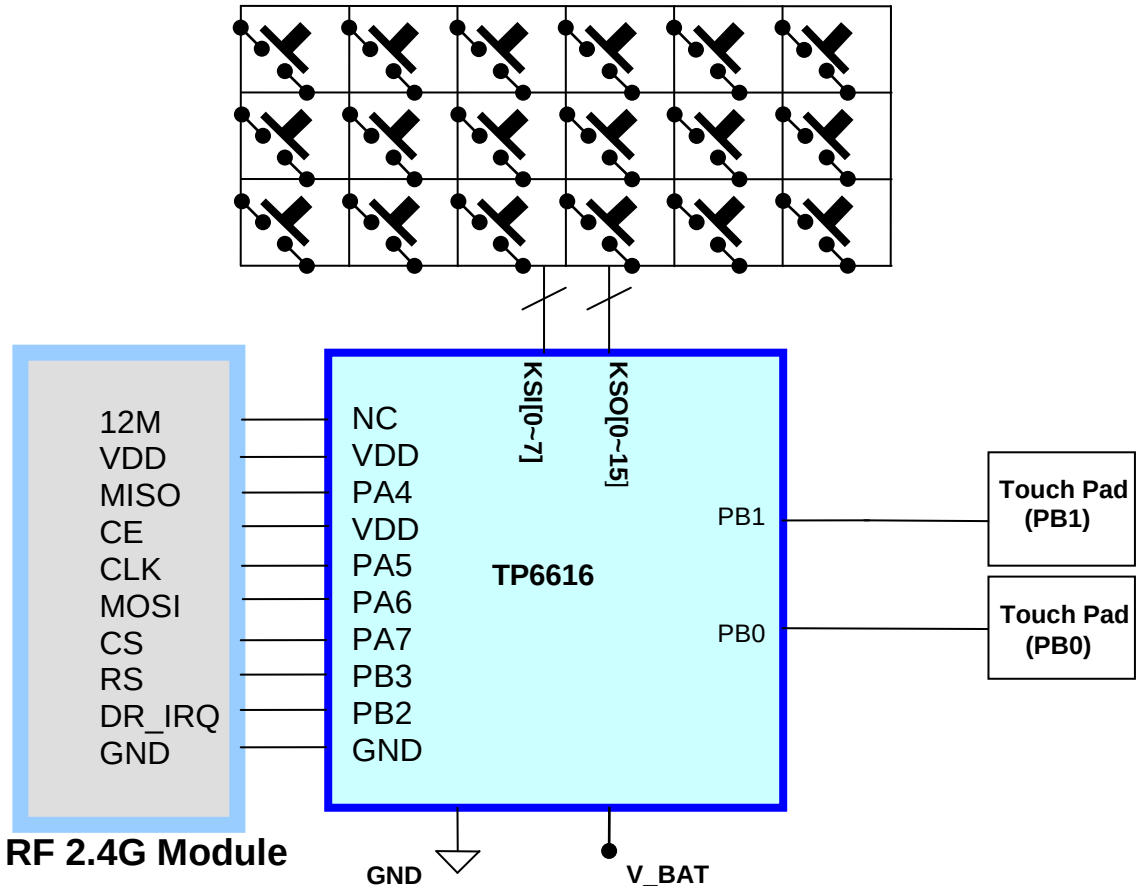



2.4G after the key is plugged

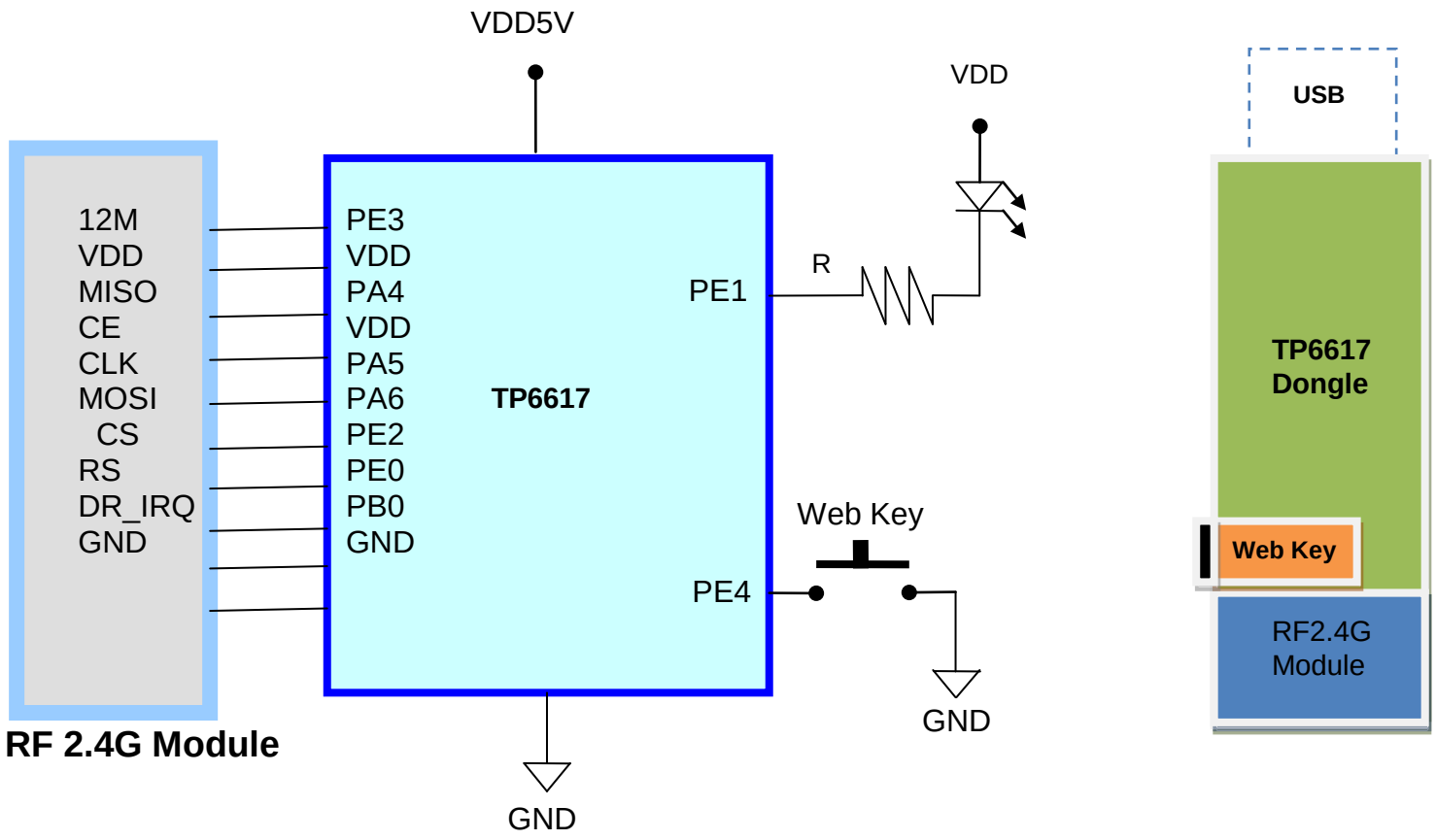
## 4. Keyboard Mapping Matrix Definition Table

| | | PC7 | PC6 | PC5 | PC4 | PC3 | PC2 | PC1 | PC0 |
|---|---|---|---|---|---|---|---|---|---|
| | | *KSI7* | *KSI6* | *KSI5* | *KSI4* | *KSI3* | *KSI2* | *KSI1* | *KSI0* |
| PD0 | *KSO0* | E | F3 | D | F4 | C | (K133) | F2 | # 3 |
| PD1 | *KSO1* | R | T | F | G | V | B | % 5 | $ 4 |
| PD2 | *KSO2* | U | Y | J | H | M | N | ^ 6 | & 7 |
| PD3 | *KSO3* | I | } ] | K | F6 | < , | (K56) | + = | * 8 |
| PD4 | *KSO4* | O | F7 | L | | > . | App | F8 | ( 9 |
| PD5 | *KSO5* | KP + | (K107) | KP ENTER | Up | Media Play | Left | Home | End |
| PD6 | *KSO6* | KB 9 | KP 6 | KP 3 | KP . | KP * | KP - | Page Up | Page Down |
| PD7 | *KSO7* | KP 8 | KP 5 | KP 2 | KP 0 | KP / | Right | Insert | Sleep |
| PE0 | *KSO8* | KP 7 | KP 4 | KP 1 | Space | Num Lock | Down | Delete | Power |
| PE1 | *KSO9* | WakeUp | L_Shift | R_Shift | Volume-- | Volume + | L_Win | R_Win | Media Mute |
| PE2 | *KSO10* | (K14) | Back Space | \| \ | F11 | Enter | F12 | F9 | F10 |
| PE3 | *KSO11* | P | { [ | : ; | " ' | \| \ | ? / | - - | ) 0 |
| PE4 | *KSO12* | Scroll Lock | | | L_ALT | | R_ALT | | Print Screen |
| PE5 | *KSO13* | Pause | Power | | Sleep | R_Ctrl | Wake Up | L_Ctrl | F5 |
| PE6 | *Kso14/PA1* | Q | TAB | A | Esc | Z | (K131) | ~ ` | ! 1 |
| PE7 | *Kso15/PA0* | W | Caps Lock | S | (K45) | X | (K132) | F1 | @ 2 |

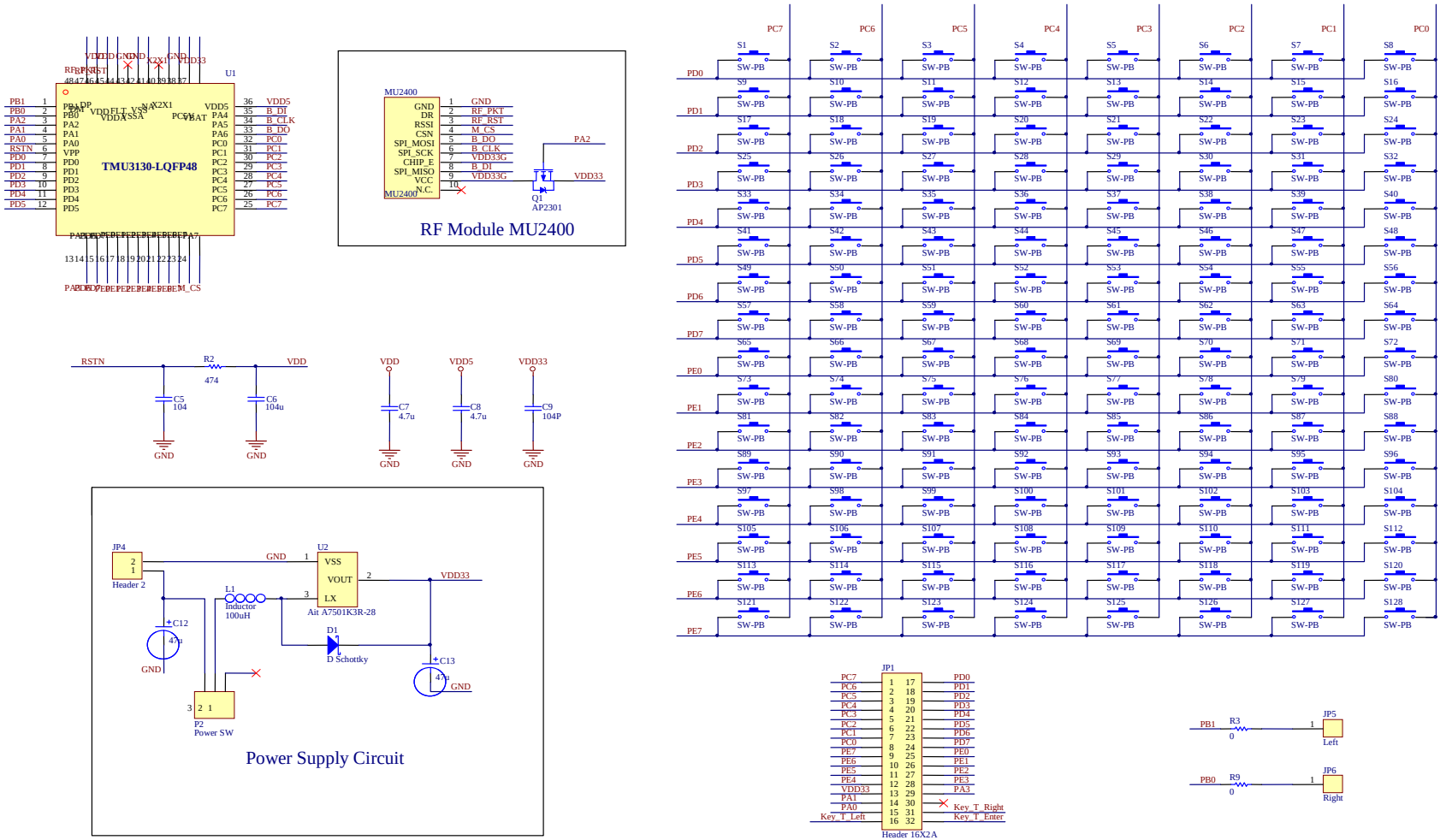
## 5. TP6616 Application Diagram



## 6. TP6617 Application Diagram

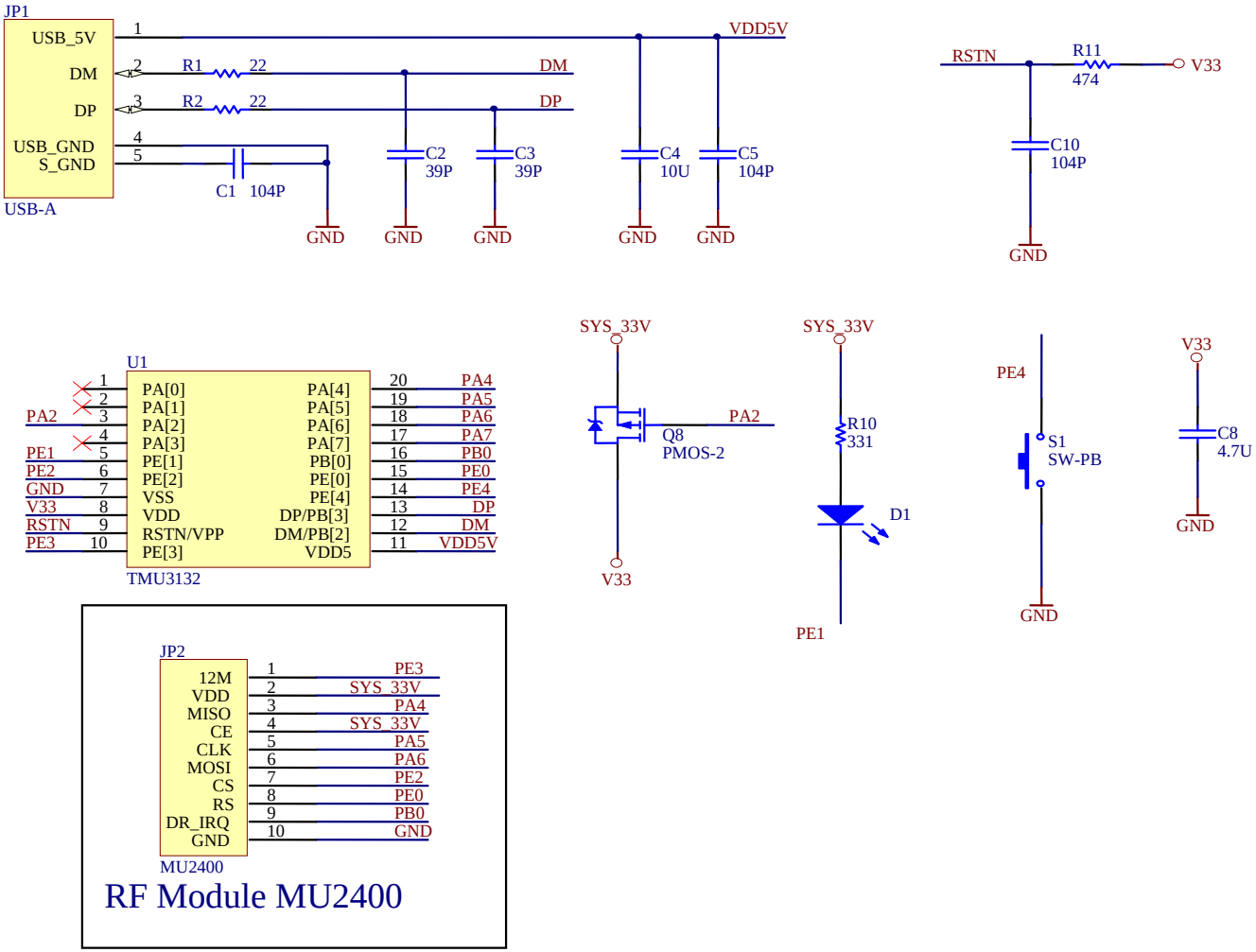


## 7. TP6616 Application Circuit Diagram




# TP6616_2.4G Demoboard Circuit

## 8. TP6617 Application Circuit Diagram



# 9. Appendix

## 9.1 TMU3130 Characteristics

### ABSOLUTE MAXIMUM RATINGS

GND= 0V

| Name | Symbol | Range | Unit |
|---|---|---|---|
| Maximum Supply Voltage | VDD5 | -0.3 to 5.5 | V |
| Chip Operating Voltage | VDD | 2.0 to 3.6 | V |
| Maximum Input Voltage | Vin | -0.3 to VDD+0.3 | V |
| Maximum output Voltage | Vout | -0.3 to VDD+0.3 | V |
| Maximum Operating Temperature | Topg | -40 to +85 | ℃ |
| Maximum Storage Temperature | Tstg | -65 to +150 | ℃ |

### RECOMMENDED OPERATING CONDITION

At Ta=-20℃ to 70℃, GND= 0V

| Name | Symb. | Min. | Typical | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Supply Voltage | VDD5 | 2.3 | | 5.5 | V | |
| Battery Voltage, if apply | Vbat | 2.2 | | 3.6 | V | |
| VDD output voltage | VDD | | 3.3 | | V | VDD5=5V Vbat=0V |
| | | | | 2.96 | V | VDD5=3V Vbat=0V |
| | | | | 3.2 | V | Vbat=3.6V, VDD5=0V |
| | | | | 2.93 | V | Vbat=3V, VDD5=0V |
| Input “H” Voltage | Vih | 0.8VDD | | | V | |
| Input “L” Voltage | Vil1 | | | 0.3VDD | V | |

## DC CHARACTERISTICS

At Ta=-25 ℃, VDD5=5.0V, VSS= 0V

| Name | Symb. | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Internal Clock | Firc | | 48 | | MHz | Enable IRC, VDD5=5V |
| External clock | Fpll | | 48 | | MHz | Crystal 6 MHz, PLL enable VDDA=3.2V |
| Operating current | Icc | | 6.5 | | mA | CPU clock=12 MHz |
| Power Down current | Ipd | | | 1 | uA | No load |
| Suspend Current | Isus | | 350 | 500 | uA | USB Mode, No load |
| Output High Current (Push Pull Mode) | Ioh1 | | 11 | | mA | VDD5=5V, Voh1=2.8V |
| | Ioh2 | | 10 | | mA | VDD5=3V, Voh2=2.3V |
| Output High Current (Pseudo Open Drain Mode) | Ioh3 | | 11 | | uA | VDD5=5V, Voh3=2.8V |
| | Ioh4 | | 13 | | uA | VDD5=3V, Voh4=2.3V |
| Output Low Current (Push Pull Mode) | Iol1 | | 17 | | mA | VDD5=5V, Vol1=0.3V |
| | Iol2 | | 15 | | mA | VDD5=3V, Vol2=0.3V |
| Output Low Current (Pseudo Open Drain Mode) | Iol3 | | 16 | | mA | VDD5=5V, Vol3=0.3V |
| | Iol4 | | 15 | | mA | VDD5=3V, Vol4=0.3V |
| Input Leakage Current (pin high) | Iilh | | | 1 | uA | Vin=VDD |
| Input Leakage Current (pin low) | Iill | | | -1 | uA | Vin=0V |
| Pull-Up Resistor | $R_{pull-up}$ | | 118 | | KΩ | VDD5=5V |
| | | | 140 | | KΩ | VDD5=3V |
| System Clock Frequency (CPU clock Frequency) | Fcpu | | 12 | | MHz | R07[1:0]=2'b00 |
| | | | 6 | | MHz | R07[1:0]=2'b01 |
| | | | 3 | | MHz | R07[1:0]=2'b10 |
| | | | 1.5 | | MHz | R07[1:0]=2'b11 |
| LVR reference Voltage | Vlvr | | 2.1 | | V | Fcpu=1.5 MHz |
| WDT time | Twdt | | 15 | | ms | VDD5=5V, WRC enable R06[6:5]=2'b00 |
| | | | 30 | | ms | VDD5=5V, WRC enable R06[6:5]=2'b01 |
| | | | 60 | | ms | VDD5=5V, WRC enable R06[6:5]=2'b10 |
| | | | 120 | | ms | VDD5=5V, WRC enable R06[6:5]=2'b11 |
| WKT Time | | | 120 | | ms | VDD5=5V, WRC enable R06[4:3]=2'b00 |
| | | | 240 | | ms | VDD5=5V, WRC enable R06[4:3]=2'b01 |
| | | | 480 | | ms | VDD5=5V, WRC enable R06[4:3]=2'b10 |
| | | | 960 | | ms | VDD5=5V, WRC enable R06[4:3]=2'b11 |

## 9.2 TMU3132 Characteristics

### ABSOLUTE MAXIMUM RATINGS

GND= 0V

| Name | Symbol | Range | Unit |
|---|---|---|---|
| Maximum Supply Voltage | VDD5 | -0.3 to 5.5 | V |
| Maximum Input Voltage | Vin | -0.3 to VDD+0.3 | V |
| Maximum output Voltage | Vout | -0.3 to VDD+0.3 | V |
| Maximum Operating Temperature | Topg | -40 to +85 | ℃ |
| Maximum Storage Temperature | Tstg | -65 to +150 | ℃ |

### RECOMMENDED OPERATING CONDITION

At Ta=-20℃ to 70℃,GND= 0V

| Name | Symb. | Min. | Typical | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Supply Voltage | VDD5 | 4.5 | 5 | 5.5 | V | |
| VDD output voltage | VDD | | 3.3 | | V | VDD5=5V |
| Input “H” Voltage | Vih | 0.6VDD | | | V | |
| Input “L” Voltage | Vil | | | 0.3VDD | V | |
| Operating Voltage for I/O Ports | Vddio | | 3.3 | | | |
| 3.3V Regulator driving capacity | Ireg | | 50 | | mA | |

## DC CHARACTERISTICS

At Ta=-25℃VDD5=5.0V, VSS= 0V, Fcpu=12 MHz

| Name | Symb. | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| Internal Clock | $F_{48m}$ | | 48 | | MHz | Enable IRC, VDD5=5V |
| Operating current | Icc | | 5 | | mA | CPU clock=12 MHz |
| Suspend current | Ipd | | 360 | 500 | uA | USB Mode, No load |
| Output High Current (Push Pull Mode) | Ioh1 | | 12 | | mA | VDD5=5V, Voh1=2.8V |
| Output High Current (Pseudo Open Drain Mode) | Ioh2 | | 11 | | uA | VDD5=5V, Voh2=2.8V |
| Output Low Current (Push Pull Mode) | Vol | | 16 | | mA | VDD5=5V, Vol1=0.3V |
| Output Low Current (Pseudo Open Drain Mode) | | | 16 | | mA | VDD5=5V, Vol2=0.3V |
| Pull-Up Resistor | Rpull-up | | 110 | | KΩ | VDD5=5V |
| Input Leakage Current (pin high) | Iilh | | | 1 | uA | Vin=VDD |
| Input Leakage Current (pin low) | Iill | | | -1 | uA | Vin=0V |
| System Clock Frequency (CPU clock Frequency) | Fcpu | | 12 | | MHz | R07[1:0]=2'b00 |
| | | | 6 | | MHz | R07[1:0]=2'b01 |
| | | | 3 | | MHz | R07[1:0]=2'b10 |
| | | | 1.5 | | MHz | R07[1:0]=2'b11 |
| LVR reference Voltage | Vlvr | | 2.0 | | V | Fcpu=1.5MHz |
| WDT time | Twdt | | 17.5 | | ms | VDD5=5V, WRC enable R06[6:5]=2'b00 |
| | | | 35 | | ms | VDD5=5V, WRC enable R06[6:5]=2'b01 |
| | | | 70 | | ms | VDD5=5V, WRC enable R06[6:5]=2'b10 |
| | | | 140 | | ms | VDD5=5V, WRC enable R06[6:5]=2'b11 |
| WKT Time | | | 140 | | ms | VDD5=5V, WRC enable R06[4:3]=2'b00 |
| | | | 280 | | ms | VDD5=5V, WRC enable R06[4:3]=2'b01 |
| | | | 560 | | ms | VDD5=5V, WRC enable R06[4:3]=2'b10 |
| | | | 1120 | | ms | VDD5=5V, WRC enable R06[4:3]=2'b11 |

### 9.3 MuChip 2.4 GHz RF Module Characteristics

| Parameter | Symbol | Specification | | | Unit | Test Condtion |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Supply Voltage | | 2.1 | 3 | 3.6 | V | With internal LDO |
| Threshold Voltage to bypass internal LDO | | 1.8 | | 2.1 | V | Internal circuit will sense VDD and bypass the internal LDO |
| Data Rate | | | 1M | 1.6M | Bps | |
| Current Consumption Tx | | | 20 | | mA | 0 dBm output power |
| Current Consumption Rx | | | 23 | | mA | |
| Current Consumption Standby II | | | 3.5 | | mA | |
| Current Consumption Standby I | | | 1.5 | | mA | |
| Current Consumption Idle | | | 10 | | uA | |
| Current Consumption Power Down | | | <1 | | uA | |
| Operating Freqency | | 2400 | | 2483 | MHZ | |
| Receiver Sensitivity | FD=400K | | -90 | | dBm | Data Rate 1M@0.1%BER |
| | FD=500K | | -85 | | dBm | Data Rate 1.6M@0.1%BER |
| RF Output Power | | | +0 | | dBm | |