# USB2GPIO# Adapter Board

# Evaluates: USB2GPIO

## General Description

The USB2GPIO# adapter board is designed to work with Maxim's Munich GUI and to connect to various EV kit or Pmod boards with Pmod™ compatible connectors for I²C/SPI/GPIO communication to test and evaluate different Maxim ICs. This document explains how the USB2GPIO# adapter board receives commands from a laptop through the USB to create an I²C/SPI/GPIO interface. The Maxim USB2GPIO# board requires the Munich GUI which can be downloaded from Maxim's website free of charge.

The USB2GPIO# design is powered directly from the USB bus power (5V) and integrates two low-power, 1.2A, PWM step-down DC-DC converters (MAX1556) to provide programmable $V_{CC}$ voltages of 1.8V, 2.5V, 3.3V, or 5.0V. A dual, high-speed, USB-to-multipurpose UART/FIFO IC (FT2232HQ), high-speed USB switches (MAX4983), and a 4K MICROWIRE-compatible serial EEPROM are the other ICs on this adapter board.

USB2GPIO# is designed to supersede USB2PMB1# and USB2PMB2# adapters and includes two connectors; connector X3 is a 12-pin connector which supports either I²C with 6 GPIO pins, or SPI with 4 GPIO pins, and is fully compatible with previous adapters and low-pin count EV kit or Pmod boards. This connector is controlled from the Munich GUI. The addition of another connector, X2, which is a 20-pin connector allows either 16 extra GPIO connections or a second SPI port and 12 extra GPIO connections. This 20-pin connector is NOT controlled by Munich GUI but is for use with future EV kits and will be controlled by the relevant EV kit GUIs.

This USB2GPIO# adapter board can be used to enable USB-to-I²C/SPI interface for any Pmod-compatible plug-in peripheral modules such as the Maxim MAX14001PMB#, and MAXREFDES12 – Corona reference designs. In addition, it can be ordered together as an evaluation system (EV system) with different EV kits, such as MAX14001EVKIT#. Note that an "EV system" is an EV kit combined with an interface board, such as a USB2GPIO# and EV kit GUI software. Ordering information for EV systems is included in the EV kits' corresponding data sheet. Refer to the appropriate EV kit data sheet for quick start and detailed operating instructions.

The USB2GPIO# has been tested on Windows® 7, Windows 8, and Windows 10 system using Munich GUI, Version 2.17 or later.

## Features

- USB-to-I²C/SPI/GPIO Interface
- Small PCB area
- Pmod-Compatible Form Factor

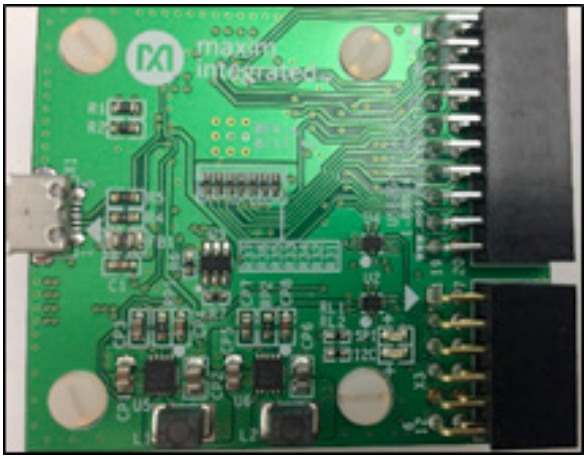


*Figure 1. USB2GPIO# Board*

***Ordering Information*** ***appears at end of data sheet.***



*319-100131; Rev 0; 1/18*

maxim integrated™

## Quick Start

### Required Equipment

- PC with Windows OS (Windows 7, Windows 8, or Windows 10) with a USB port
- USB2GPIO# board
- A-to-Micro-B USB cable (not supplied)
- Munich software V2.17 or later
- Supported I²C or SPI interface device for communication like MAX14001PMB# board

### Procedure

The USB2GPIO# is fully assembled and tested. Follow the steps below to verify board operation:

1) Go to **www.maximintegrated.com/evkitsoftware** to download the most recent version of the Munich GUI software, **MUNICH GUI**. Save the software to a temporary folder and decompress the **Munich_GUI-SetupV2.17.zip** file.
2) Connect the USB cable between the USB2GPIO# board and the PC; the USB driver is installed automatically.
3) Ensure that the companion SPI interface device's jumper settings are correct. Refer to your companion device's documentation.
4) Connect the USB2GPIO# board's 2 x 6-pin, right-angle connector to the companion device's 2 x 6-pin, right-angle header, as shown in Figure 2.
5) Once the USB2GPIO# board is connected to the companion device, open the **MUNICH GUI.exe** (double-click) software.
6) Start the Munich GUI software and select the tab sheet that corresponds to the companion device. Follow instructions in the companion device data sheet to test it in conjunction with USB2GPIO#.

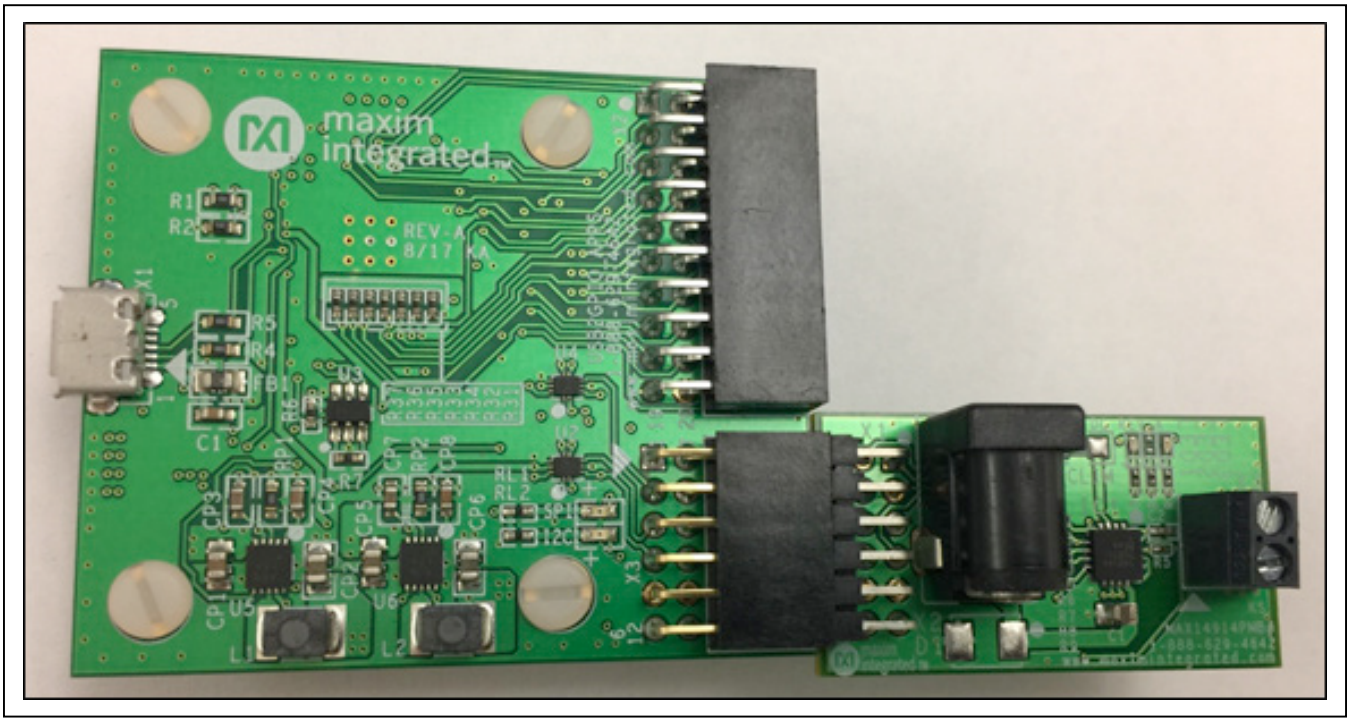



*Figure 2. USB2GPIO# Board Connected with MAX14914PMB#*

## Detailed Description of Hardware

The USB2GPIO# board uses the FT2232HQ (U1), a USB 2.0 high-speed (480Mbps)-to-UART/FIFO IC, to process commands sent by a program running on the PC. Each particular EV kit has its own custom software specific to that kit. The operation of this board is USB-to-dual-channel I2C and SPI engine with additional GPIO channels. The subsystem block diagram and simplified power tree are shown in Figure 3.

The VCCIO and +3.3V voltage supplies are generated by two MAX1556ETBs (U5 and U6), 1.2A, highly efficient PWM step-down DC-DC converters. The 5V supply voltage input for these ICs is provided by the Micro-USB supply terminal available from the laptop. The 3V3 supply provides power to the FDTI chip's VREGIN pin and its internal oscillator through an LC filter, and the 4K MICROWIRE EEPROM (93LC66BT). The USB-to-I2C/SPI engine is powered by 3.3V at the VREGIN pin and the core voltage of 1.8V for the IC is generated at VREGOUT. This VCORE is used within the FTDI IC itself for its internal logic processes and there is an external 12MHz crystal across OSCI and OSCO pins of the FTDI IC. See *USB2GPIO# Adapter Board Schematic* for details.

### Pmod and Connector Supply Voltages

The USB2GPIO# is designed to supply power (V_OUT) to external boards through the connectors X2 and X3. This voltage is defined by the type of board connected to X3, and when the user selects that tab in the Munich GUI, V_OUT is automatically set to the correct level, either 1.8V, 2.5V, 3.3V, or 5.0V.

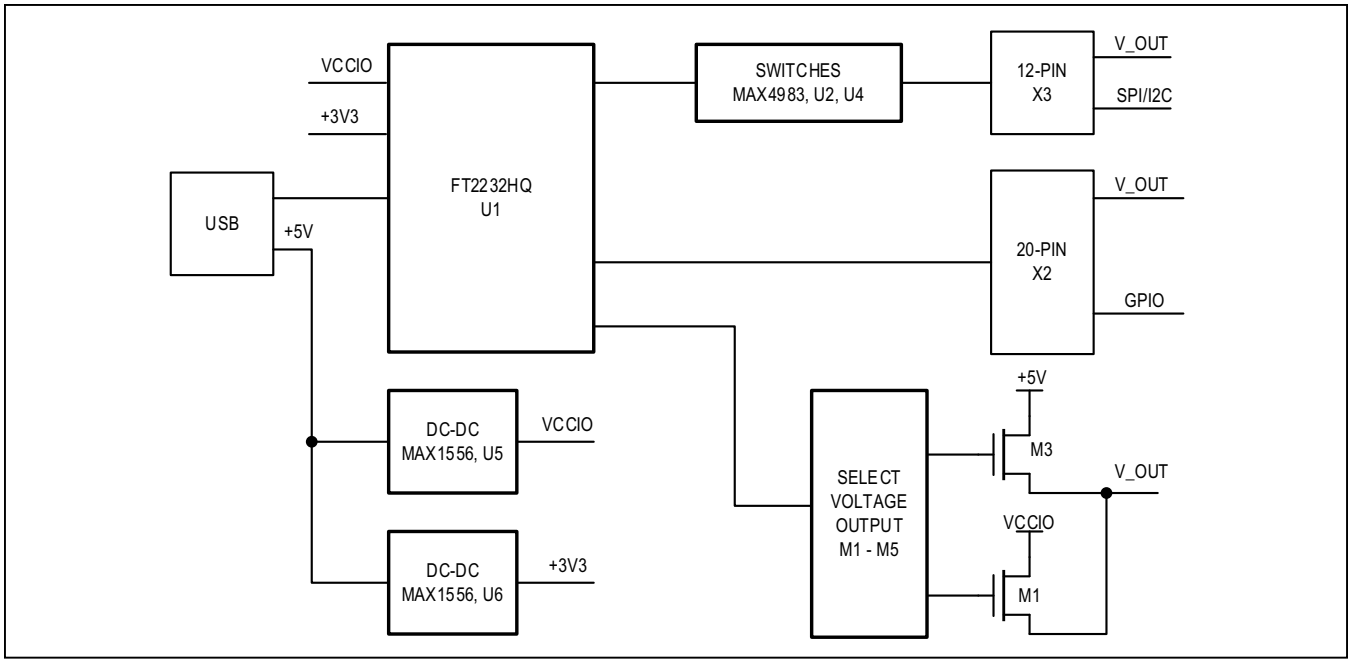



*Figure 3. USB2GPIO# Subsystem Block Diagram*

Figure 4 shows the pin configuration for the 12-pin SPI/I2C-compatible Pmod connector on the USB2GPIO# board which aligns to the pin configuration for the connector found on companion Pmod boards such as MAX14001PMB#. The connector type is female on the USB2GPIO# board and male type on the companion Pmod boards.

Figure 5 shows the pin configuration for the 20-pin GPIO-compatible connector on the USB2GPIO# board which aligns to the pin configuration for the connector found on companion EV kit boards. The connector type is female on the USB2GPIO# board and male type on the companion EV kit boards. Note that this connector is NOT used by the Munich GUI, but by the appropriate EV kit GUI. The pinout for this connector includes allowing for an extra SPI port should the EV kit require this functionality.

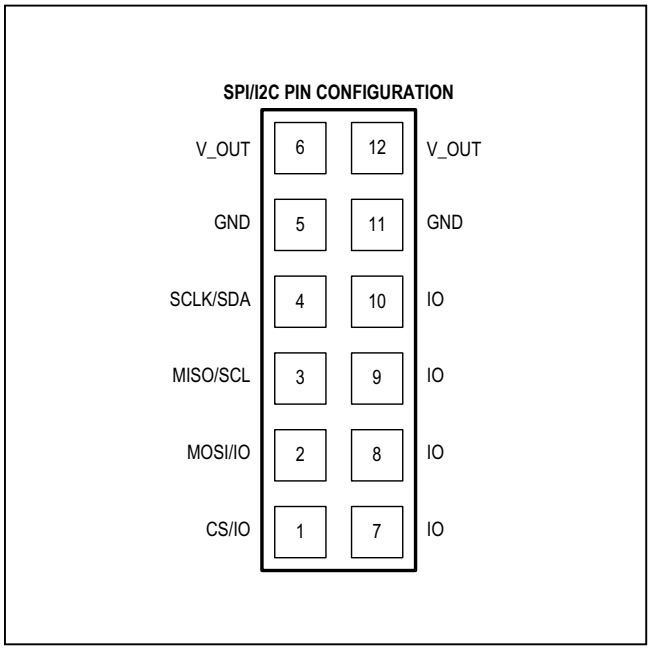



*Figure 4. X3: Pmod SPI/I2C Connector Pin Configuration*

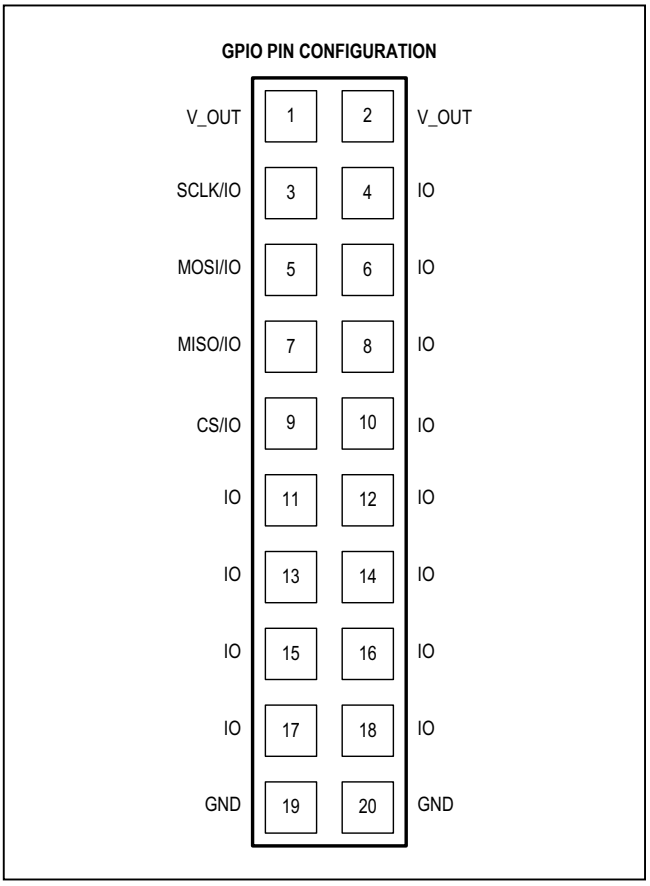



*Figure 5. X2: GPIO Connector Pin Configuration*

Figure 6 shows the top view of the USB2GPIO# board, with the different connectors and the pin 1 identifiers. Note that there are no jumpers or shunts on this board, all configuration is done under software control. Care should be taken to only insert the boards in the correct way as the connectors are not keyed to avoid false insertions—reversing the connections (by turning the Pmod board upside down, for example) may result in damage to the USB2GPIO# or the companion board. Two LEDs are included to indicate if the X3 Pmod connector is configured as SPI or $I^2C$.

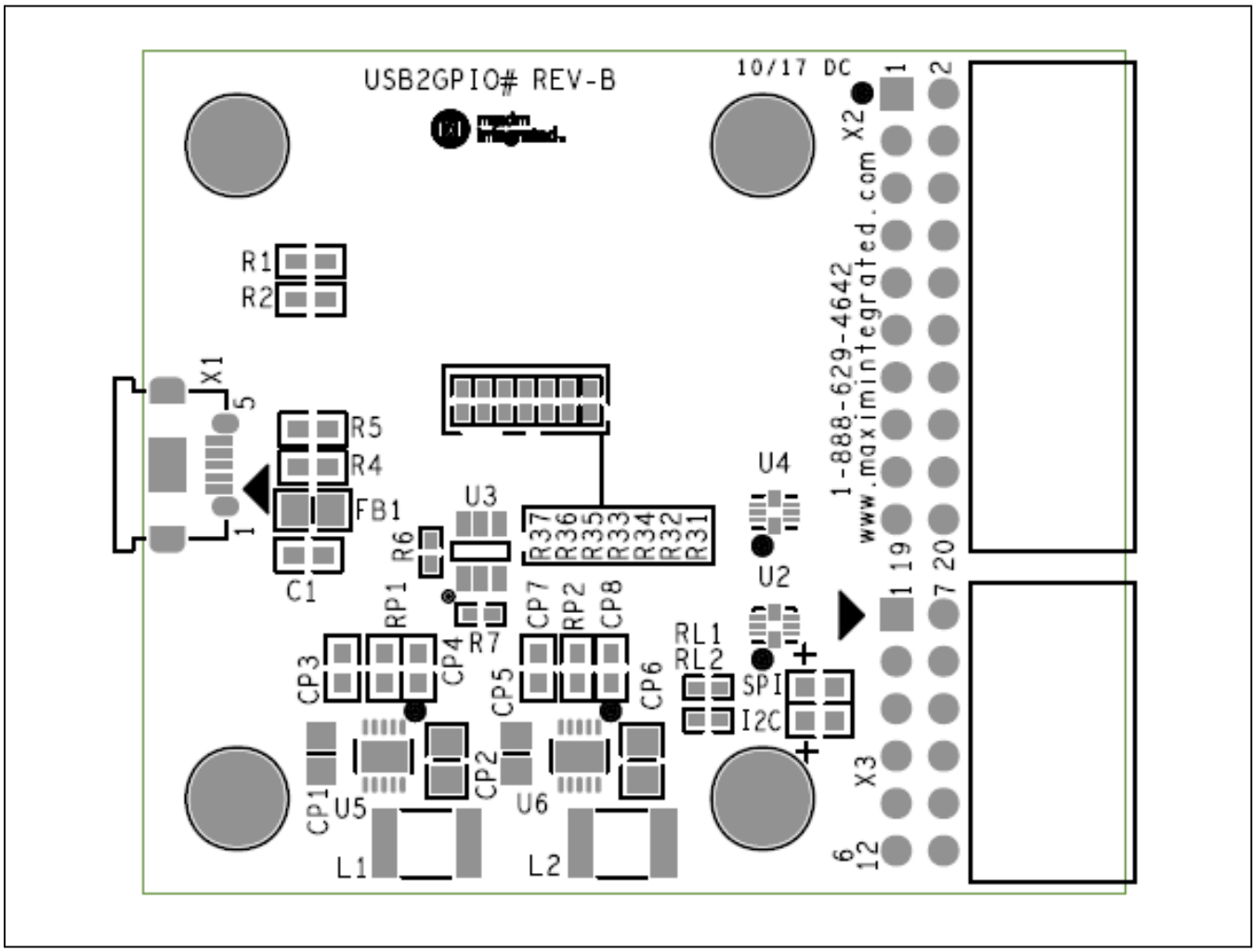



*Figure 6. USB2GPIO# Orientation and Pinouts*

## Ordering Information

| PART | TYPE |
|---|---|
| USB2GPIO# | Adapter Board |

*#Denotes RoHS compliant.*

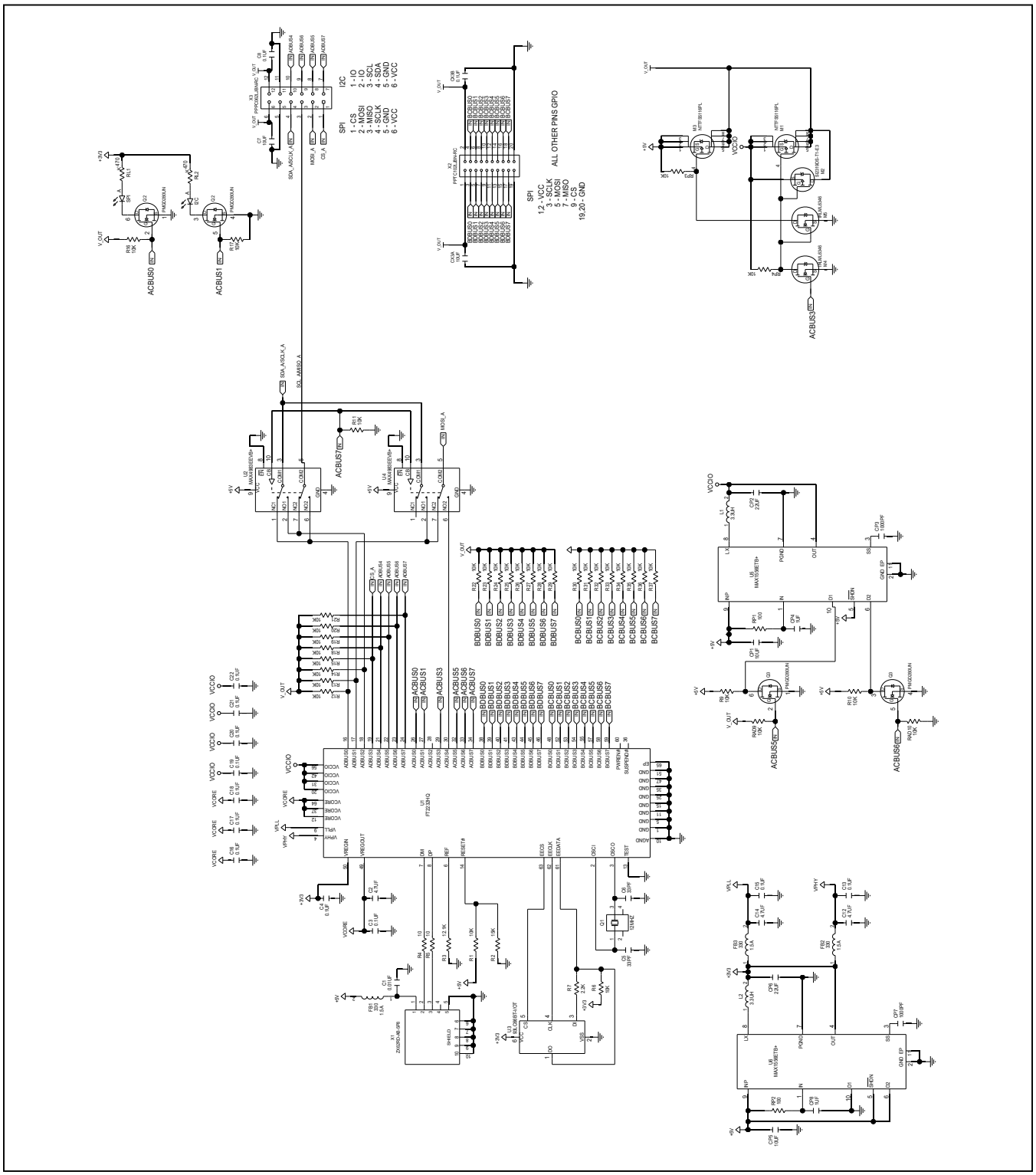
## USB2GPIO# Adapter Board Bill of Materials

| ITEM | REF_DES | DNI/DNP | QTY | MFG PART # | MANUFACTURER | VALUE | DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1 | C1 | - | 1 | C0603C103K5RAC; GRM188R71H103K;C0603X7R500-103KNE | KEMET/MURATA/VENKEL LTD. | 0.01UF | CAPACITOR; SMT; 0603; CERAMIC; 0.01uF; 50V; 10%; X7R; -55degC to + 125degC | |
| 2 | C2, C12, C14 | - | 3 | GRM21BR71C475KA73 | MURATA | 4.7UF | CAPACITOR; SMT (0805); CERAMIC CHIP; 4.7UF; 16V; TOL=10%; MODEL=GRM SERIES; TG=-55 DEGC TO +125 DEGC; TC=X7R | |
| 3 | C3, C4, C8, C13, C15-C22, CX3B | - | 13 | C0603C104K5RAC; C1608X7R1H104K | KEMET; TDK | 0.1UF | CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 50V; TOL=10%; TG=-55 DEGC TO +125 DEGC; TC=X7R; | |
| 4 | C5, C6 | - | 2 | C0603C330J5GAC; GRM1885C1H330JA01; ECU-V1H330JCV | KEMET/MURATA/PANASONIC | 33PF | CAPACITOR; SMT; 0603; CERAMIC; 33pF; 50V; 5%; C0G; -55degC to + 125degC; 0 +/-30PPM/degC | |
| 5 | C7, CP1, CP5, CX3A | - | 4 | CL21A106KOQNNN; GRM21BR61C106KE15; EMK212ABJ106KD | SAMSUNG ELECTRONICS; MURATA; TAIYO YUDEN | 10UF | CAPACITOR; SMT (0805); CERAMIC CHIP; 10UF; 16V; TOL=10%; TG=-55 DEGC TO +85 DEGC; TC=X5R | |
| 6 | CP2, CP6 | - | 2 | C0805C226M9PAC; GRM21BR60J226ME39; JMK212BJ226MG; CL21A226MQCLQN | GENERIC PART | 22UF | CAPACITOR; SMT (0805); CERAMIC CHIP; 22UF; 6.3V; TOL=20%; TG=-55 DEGC TO +125 DEGC; TC=X5R | |
| 7 | CP3, CP7 | - | 2 | C0603C102K5RAC; GRM188R71H102KA01; C0603X7R500-102KNE | KEMET/MURATA/VENKEL | 1000PF | CAPACITOR; SMT; 0603; CERAMIC; 1000pF; 50V; 10%; X7R; -55degC to + 125degC; +/-15% from -55degC to +125degC | |
| 8 | CP4, CP8 | - | 2 | C0603C105K3PAC; GRM188R61E105KA12; 06033D105KAT2A | KEMET; MURATA; AVX | 1UF | CAPACITOR; SMT (0603); CERAMIC CHIP; 1UF; 25V; TOL=10%; TG=-55 DEGC TO +85 DEGC; | |
| 9 | FB1-FB3 | - | 3 | BLM21PG331SN1 | MURATA | 330 | INDUCTOR; SMT (0805); FERRITE-BEAD; 330; TOL=+/-25%; 1.5A | |
| 10 | I2C, SPI | - | 2 | 150060VS75000 | WURTH ELECTRONICS INC | 150060VS75000 | DIODE; LED; WL-SMCW SMD CHIP LED TOP VIEW MONO-COLOR WATER CLEAR; GREEN; SMT (0603); VF=2V; IF=0.02A | |
| 11 | L1, L2 | - | 2 | B82432T1332K | TDK | 3.3UH | INDUCTOR; SMT (1812); FERRITE CORE; 3.3UH; TOL=+/-10%; 0.9A | |
| 12 | M1, M3 | - | 2 | NTTFS5116PL | ON SEMICONDUCTOR | NTTFS5116PL | TRAN; POWER MOSFET; PCH; WDFN8; PD-(40W); I-(-20A); V-(-60V) | |
| 13 | M2 | - | 1 | SI2319DS-T1-E3 | VISHAY SILICONIX | SI2319DS-T1-E3 | TRAN; P-CHANNEL D-S MOSFET; PCH; SOT-23; PD-(0.75W); I-(-2.3A); V-(-40V) | |
| 14 | M4, M5 | - | 2 | IRLML6346 | INTERNATIONAL RECTIFIER | IRLML6346 | TRAN; HEXFET POWER MOSFET; NCH; SOT-23; PD-(1.3W); I-(0.00025A); V-(30V) | |
| 15 | MT1-MT4 | - | 4 | P440.375 | GENERIC PART | N/A | MACHINE SCREW; SLOTTED; PAN; 4-40IN; 3/8IN; NYLON | |
| 16 | MT1-MT4 | - | 4 | 1902B | GENERIC PART | N/A | STANDOFF; FEMALE-THREADED; HEX; 4-40IN; 3/8IN; NYLON | |
| 17 | Q1 | - | 1 | ECS-120-20-33 | ECS INC | 12MHZ | CRYSTAL; SMT; 20PF; 12MHZ; +/-50PPM; +/-50PPM | |

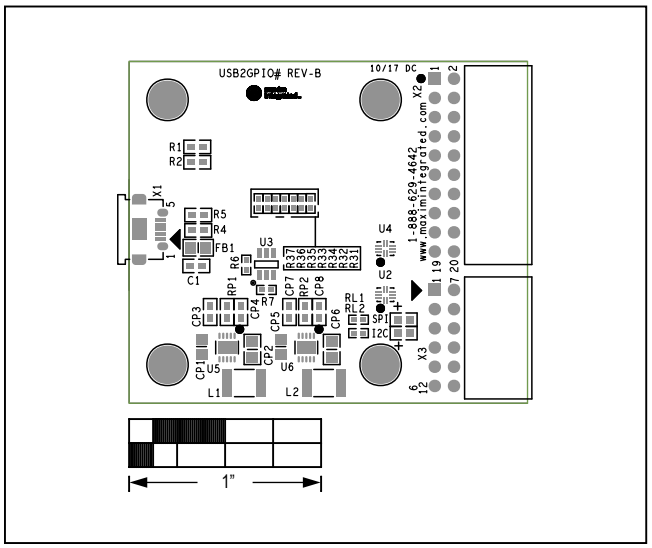
## USB2GPIO# Adapter Board Bill of Materials (continued)

| ITEM | REF_DES | DNI/DNP | QTY | MFG PART # | MANUFACTURER | VALUE | DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 18 | Q2, Q3 | - | 2 | PMGD280UN | NXP | PMGD280UN | TRAN; DUAL N-CHANNEL UTRENCHMOS ULTRA LOW LEVEL FET; NCH; SOT-363; PD-(0.4W); I-(0.87A); V-(20V) | |
| 19 | R1, R9-R11, R16, R17, RP3, RP4 | - | 8 | CRCW060310K0FK; ERJ-3EKF1002 | VISHAY DALE; PANASONIC | 10K | RESISTOR; 0603; 10K; 1%; 100PPM; 0.10W; THICK FILM | |
| 20 | R2 | - | 1 | CRCW060315K0FK | VISHAY DALE | 15K | RESISTOR, 0603, 15K OHM,1%, 100PPM, 0.10W, THICK FILM | |
| 21 | R3 | - | 1 | CRCW060312K1FK | VISHAY DALE | 12.1K | RESISTOR; 0603; 12.1K OHM; 1%; 100PPM; 0.1W; THICK FILM | |
| 22 | R4, R5 | - | 2 | CRCW060310R0FK; MCR03EZPFX10R0 | VISHAY DALE/ROHM | 10 | RESISTOR; 0603; 10 OHM; 1%; 100PPM; 0.10W; THICK FILM | |
| 23 | R6, R12-R15, R18-R37, RAD9, RAD10 | - | 27 | CRCW040210K0FK; RC0402FR-0710K | VISHAY DALE; YAGEO PHICOMP | 10K | RESISTOR; 0402; 10K; 1%; 100PPM; 0.0625W; THICK FILM | |
| 24 | R7 | - | 1 | CRCW04022K20FK; RC0402FR-072K2L | VISHAY DALE/YAGEO PHICOMP | 2.2K | RESISTOR, 0402, 2.2K OHM, 1%, 100PPM, 0.0625W, THICK FILM | |
| 25 | RL1, RL2 | - | 2 | ERJ-2GEJ471X | PANASONIC | 470 | RESISTOR; 0402; 470 OHM; 5%; 200PPM; 0.10W; THICK FILM | |
| 26 | RP1, RP2 | - | 2 | CRCW0603100RFK; ERJ-3EKF1000 | VISHAY DALE/PANASONIC | 100 | RESISTOR; 0603; 100 OHM; 1%; 100PPM; 0.10W; THICK FILM | |
| 27 | U1 | - | 1 | FT2232HQ | FUTURE TECHNOLOGY DEVICES INTL LTD. | FT2232HQ | IC; MMRY; DUAL HIGH SPEED USB TO MULTIPURPOSE UART/FIFO; QFN64-EP | |
| 28 | U2, U4 | - | 2 | MAX4983EEVB+ | MAXIM | MAX4983EEVB+ | IC; ASW; HI-SPEED USB 2.0 SWITCH WITH +/- 15KV ESD; UTQFN10 | |
| 29 | U3 | - | 1 | 93LC66BT-I/OT | MICROCHIP | 93LC66BT-I/OT | IC; EPROM; 4K MICROWIRE SERIAL EEPROM; SOT23-6 | |
| 30 | U5, U6 | - | 2 | MAX1556ETB+ | MAXIM | MAX1556ETB+ | IC; CONV; PWM STEP-DOWN DC-DC CONVERTER; TDFN10-EP 3X3 | |
| 31 | X1 | - | 1 | ZX62RD-AB-5P8 | HIROSE ELECTRIC CO LTD. | ZX62RD-AB-5P8 | CONNECTOR; MALE; SMT; MICRO-USB CONNECTOR MEETING REQUIREMENTS OF USB 2.0 STANDARD; RIGHT ANGLE; 5PINS | |
| 32 | X2 | - | 1 | PPTC102LJBN-RC | SULLINS ELECTRONICS CORP | PPTC102LJBN-RC | CONNECTOR; FEMALE; THROUGH HOLE; BREAKAWAY HEADER; RIGHT ANGLE; 20PINS | |
| 33 | X3 | - | 1 | PPPC062LJBN-RC | SULLINS ELECTRONICS CORP. | PPPC062LJBN-RC | CONNECTOR; FEMALE; THROUGH HOLE; 0.1IN CC; HEADER; 2 ROW; RIGHT ANGLE; 12PINS | |
| 34 | PCB | - | 1 | USB2GPIO_APPS_B | MAXIM | PCB | PCB:USB2GPIO_APPS_B | - |
| TOTAL | | | 106 | | | | | |

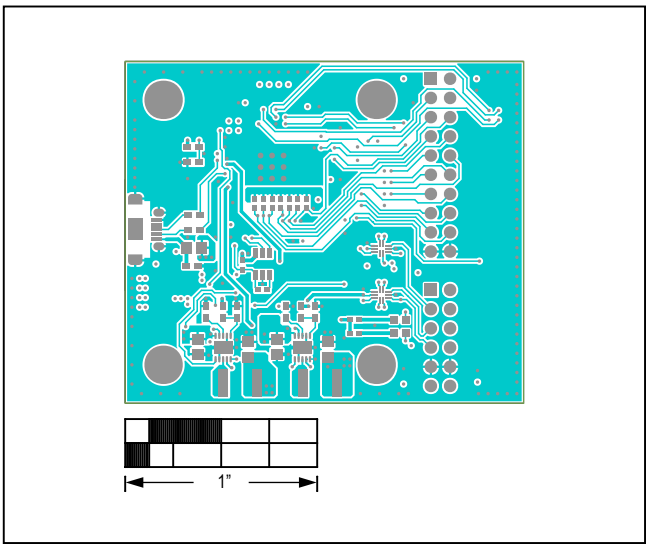
## USB2GPIO# Adapter Board Schematic



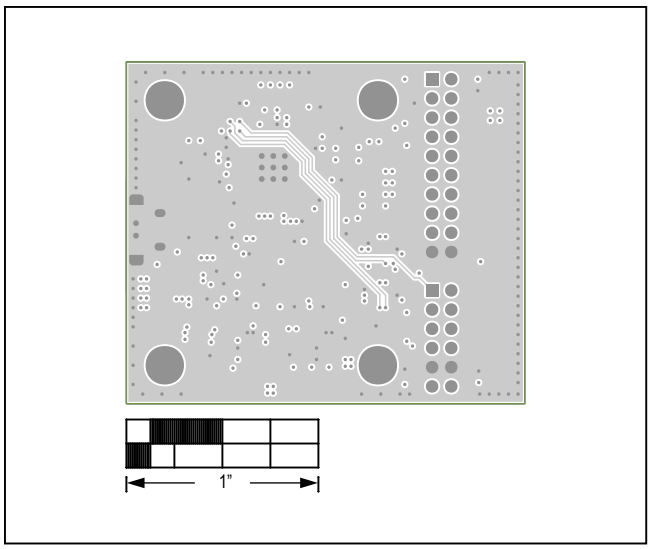
## USB2GPIO# Adapter Board PCB Layout Diagrams



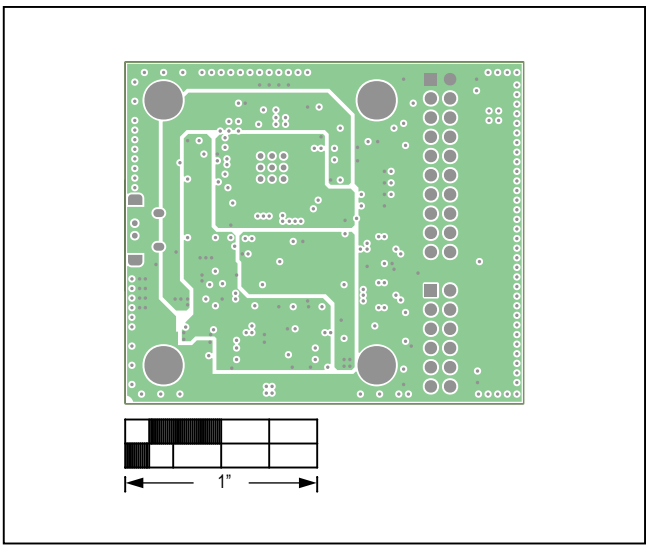

*USB2GPIO# Adapter Board—Top Silkscreen*




*USB2GPIO# Adapter Board—Top*

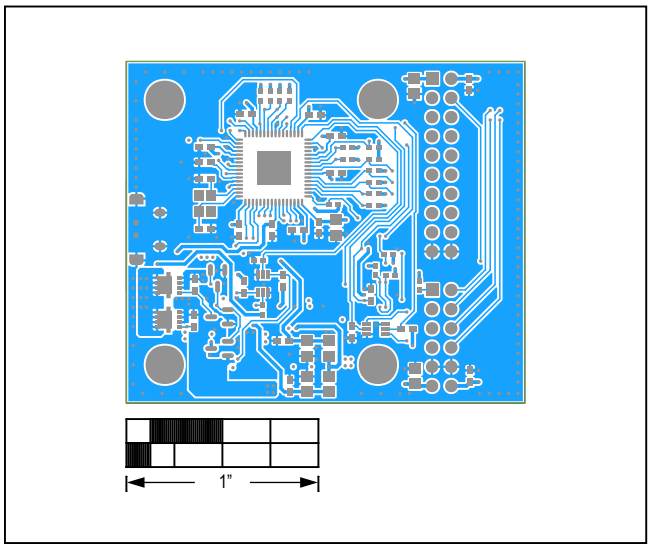



*USB2GPIO# Adapter Board—Internal 2*

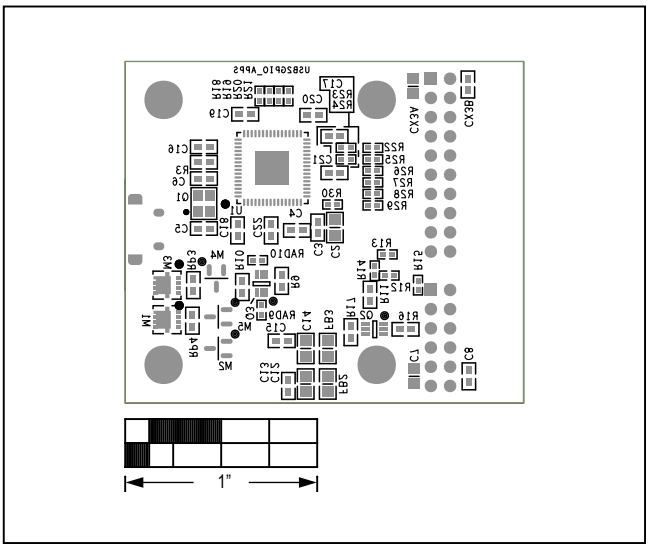



*USB2GPIO# Adapter Board—Internal 3*

## USB2GPIO# Adapter Board PCB Layout Diagrams (continued)




*USB2GPIO# Adapter Board—Bottom*




*USB2GPIO# Adapter Board—Bottom Silkscreen*

## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|---|---|---|---|
| 0 | 12/17 | Initial release | — |

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at www.maximintegrated.com.

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