Click here to ask an associate for production status of specific part numbers.

Evaluates: MAX22007

MAX22007 Peripheral Module

General Description

The MAX22007 Peripheral Module (MAX22007PMB#) provides the hardware to evaluate the MAX22007 four-channel 12-bit configurable analog output. Refer to the MAX22007 IC data sheet for detailed information regarding operation of the IC.

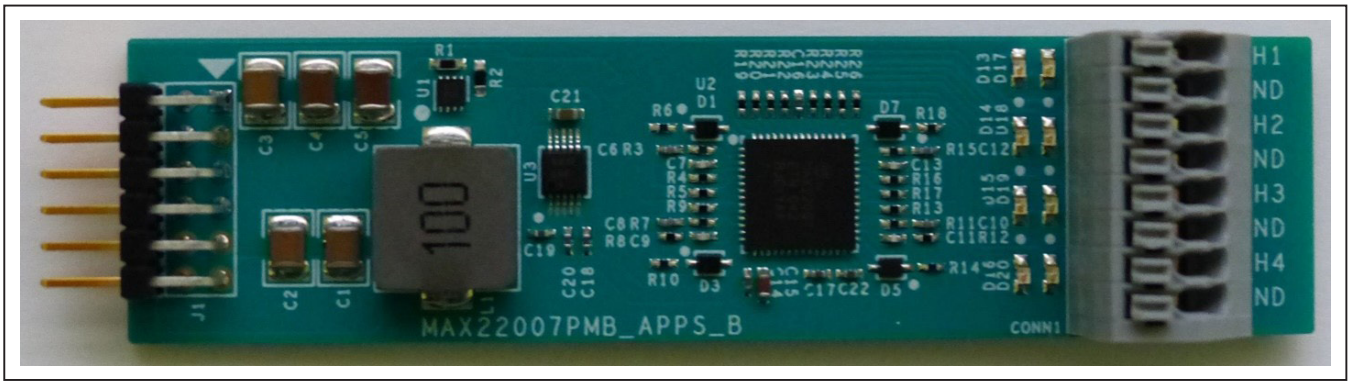
This module can be used in various ways, but it is primarily configured through SPI. Analog Devices sells low-cost USB2PMB2# and USB2GPIO# adapter boards that use the Munich GUI software for communication through a USB cable. The adapter boards are not included with the MAX22007PMB# board. Alternatively, any microcontroller or FPGA with a 12-pin Pmod™-compatible connector can be used with the SPI connection from the Pmod connector J1. Another option for the user is to wire-wrap a temporary connection from their system to the pins on the connector J1. For these later two options, the user needs to write their own control software. The board dimensions are 3.5” x 0.8” (8.69cm x 2.18cm).

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

Features

- Easy Evaluation of the MAX22007 Four-Channel Analog Output
- Two Accessible Modes:
  - Analog Output-Voltage Mode (0 to +10V)
  - Analog Output-Current Mode (0 to +20mA)
- Voltage up to +12.5V Overrange for Loads from 1kΩ to 1MΩ
- Current up to +24mA Overrange for Loads from 0 to 500Ω
- Automatic Load Impedance Detection
- No External Supply Needed
- High-Voltage Supply Rail Generated from USB Supply
- Works with USB2PMB2# and USB2GPIO# Adapters and Munich GUI Software
- Surge Protection up to ±1kV per IEC 61000-4-5
- ESD Protection up to ±6kV (Contact), ±8kV (Air-Gap) per IEC 61000-4-2
- Proven Design and PCB Layout
- RoHS Compliance

MAX22007PMB# Photo



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319-100880; Rev 0; 2/22

Quick Start

Required Equipment

- MAX22007PMB# peripheral module
- USB2PMB2# or USB2GPIO# adapter board
- Windows 10 PC with a spare USB port
- Digital multimeter
- Micro-USB cable
- Munich GUI v2.24 or higher

Note: In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the EV kit software. Text in **bold and underlined** refers to items from the Windows operating system.

Procedure

The MAX22007PMB board is fully assembled and tested. Follow the steps below to verify board operation: If the USB2PMB2# or USB2GPIO# adapter is used, the user can download software by following the steps below to get started. In this description, the USB2PMB2# adapter is used:

1) Visit **www.maximintegrated.com/** to download the latest version of the Munich GUI software, version 2.24 or later, **Munich_GUISetupV2.24.ZIP**.
2) Save the software to a temporary folder. Unzip the .ZIP file and double-click the .EXE file to run the installer. A message box asking, **Do you want to allow the following program to make changes to this computer?** may appear. If so, click **Yes**.
3) The installer includes the drivers for the hardware and software. Follow the instructions on the installer and once complete, click **Finish**. The default location of the software is in the program files directory.
4) Connect the MAX22007PMB# Pmod connector J1 to the connector on USB2PMB2# (see Figure 1).
5) Connect the USB2PMB2# to the PC with the Micro-USB cable. The MAX22007PMB# is powered by the USB cable.
6) Once the hardware is ready to use, launch the Munich software. Go to the **Device** tab and click on **Industrial Analog**. Then select the **MAX22007PMB - 4 Channel Building Automation Analog Out** from the device list.
7) Under the **USB2PMB Adapter** module, select **Scan Adapters** and select the **PMODxxxxxxA** where the **"xxxxxx"** represents a 6-digit serial number. Click **Connect**. The **Status Bar** on the bottom left of the GUI should read **"PMODxxxxxxA Connected (Munich 2)"**. See Figure 3 for an example of the Munich GUI during operation.
8) On any of the four output channels, select **"0-20mA"** for current mode operation, or **"0-10V"** for voltage mode operation. A Blue LED turns on for Voltage Mode, and a green LED turns on for Current Mode.
9) Configure the Channel for the desired output voltage or current or observe the measured load impedance if using the automatic load detection via the **Auto** button.

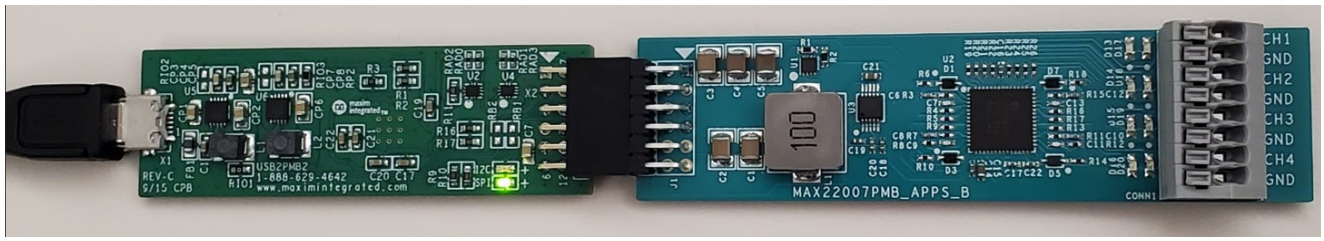


Figure 1. MAX22007PMB# Connected to a USB2PMB2# Adapter

Detailed Description of Hardware

The MAX22007PMB# provides everything needed to evaluate the MAX22007 four-channel analog output. It can be programmed via SPI through the onboard Pmod connector, and it can be set into Voltage Mode (0 to 10V) or Current Mode (0 to 20mA). The Pmod connector can also be plugged into a standard Pmod header on an FPGA or microcontroller board for configuration of the IC over SPI.

Power Supplies

The MAX22007PMB# comes with an onboard Boost Converter circuit based on the MAX17291ATA+ (U1) to generate the high-voltage rail HVDD (14V) for the MAX22007 from the 3.3V supply passed into the Pmod connector, so no external 24V supply is required. It also has an onboard negative charge pump using the MAX881REUB+ (U3). This applies the -2V HVSS rail to allow the MAX22007 to bring its linear range down to zero.

Surge Protection

Suppressor diodes D2, D4, D6, and D8 are connected between the outputs and GND to clamp ±1kV surge transients on the outputs as per IEC 61000-4-5.

Pmod-Style Connector

The MAX22007PMB# can plug directly into a Pmod-compatible port through connector J1. The user can plug the Pmod connector into a compatible USB2PMB2# adapter or utilize the SPI connection from the Pmod to a microcontroller or FPGA. For more information on the interface and control, refer to the MAX22007 IC data sheet. See the Pmod pinout in Figure 2 to assist with wiring an SPI connection.

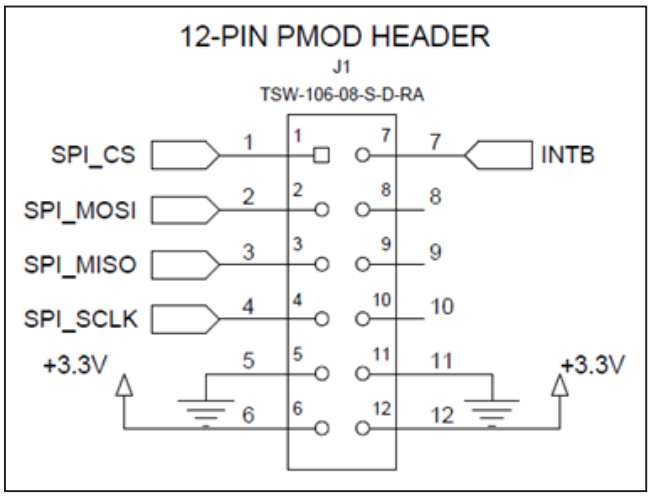


Figure 2. Pmod Pinout for the MAX22007PMB#

SPI Interface

The MAX22007PMB# uses an SPI-compatible interface. Without a USB2PMB2# adapter, the user must configure the microcontroller or FPGA to match the MAX22007PMB# SPI signals. For more information about the SPI features of the MAX22007, refer to the MAX22007 IC data sheet.

Detailed Description of Software

Connect to Hardware

The Munich GUI **Device** menu has options to search for and connect to different peripheral modules. Use the **Scan Adapters** option to search for the USB2PMB2# modules connected to the PC. If modules are found, the serial number of the modules are listed under the **"USB2PMB Adapter"** dropdown box. Select the serial number in the list to connect the software to communicate with that module, and then click the **"Connect"** button. The software can only communicate to one module at a time.

Voltage Output

Each output channel (**CH1-CH4**) is capable of outputting 0 to 10V (20% overrange) in voltage mode, depending on how it is configured by the GUI software. A Blue LED is located next to each channel and turns on when the channel is configured for "**0-10V**" output. The MAX22007 is also capable of up to 12.5V over-ranging for loads from 1kΩ to 1MΩ.

Current Output

Each output channel (**CH1-CH4**) is capable of outputting 0 to 20mA (20% overrange) in current mode, depending on how it is configured by the GUI software. A Green LED is located next to each channel and turns on when the channel is configured for "**0-20mA**" output. The MAX22007 is also capable of up to 24mA overranging for loads up to 500Ω.

Automatic Load Detection

Each channel is capable of automatically detecting and estimating a load impedance and entering voltage mode or current mode accordingly. This feature can be used by clicking the **Auto** button in the GUI for the desired channel. The channel selects current mode for loads < 500Ω, and it selects voltage mode for loads > 500Ω. The green LED next to the channel turns on to indicate current mode, or the blue LED next to the channel turns on to indicate voltage mode.

Munich GUI Software

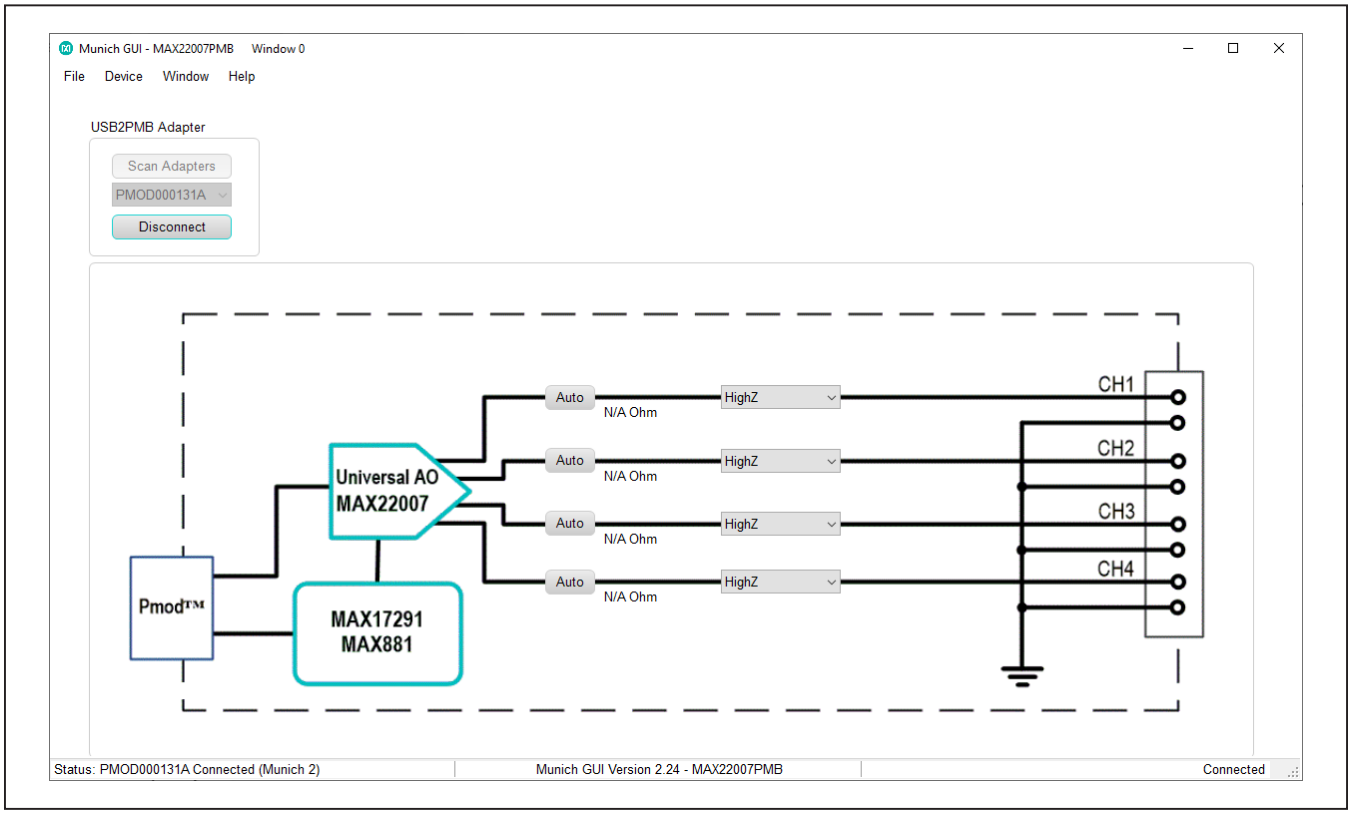


Figure 3. Munich GUI Software

Factory Calibration

The MAX22007 is factory-calibrated to ensure accurate output given valid input data. The measurements shown in Table 1 are some example measurements taken in the MAX22007PMB#'s linear voltage output range, from 0 to 10V. The values were configured by Munich GUI and measured using a 6.5-digit digital multimeter (HP34401A). The data meet the specifications given in the MAX22007 data sheet for Gain and Offset Error within ±0.2% at +25°C.

Ordering Information

PART	TYPE
MAX22007PMB#	Peripheral Module

#Denotes RoHS compliance.

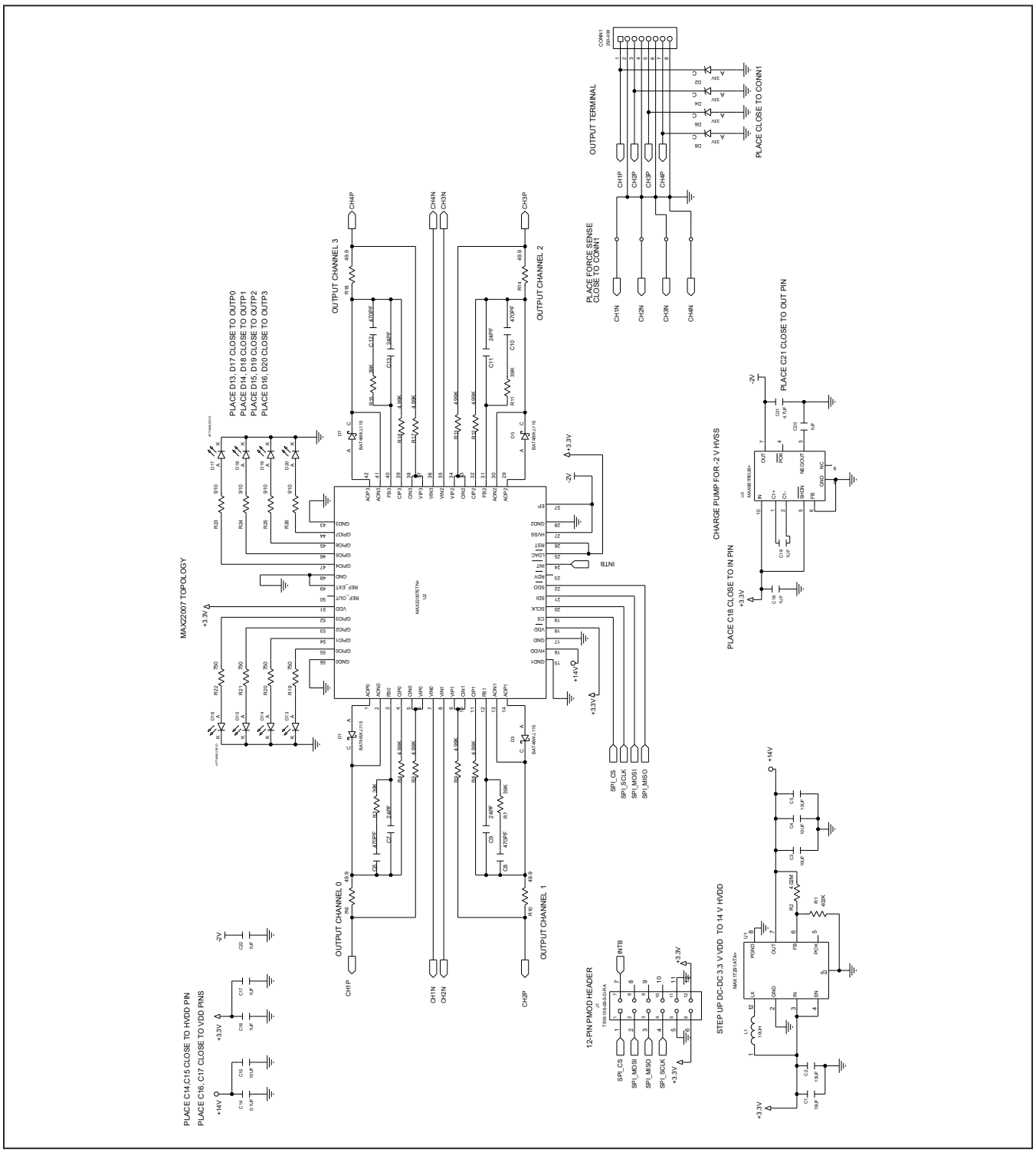
Table 1. Measured Voltages from Munich GUI and Factory-Calibrated MAX22007PMB#

GUI VOLTAGE (V)	MEASURED VOLTAGE (V)
0.000	0.00165
2.000	1.9990
4.000	3.9999
6.000	6.0008
8.000	8.0054
10.000	10.0065
10.500	10.5060

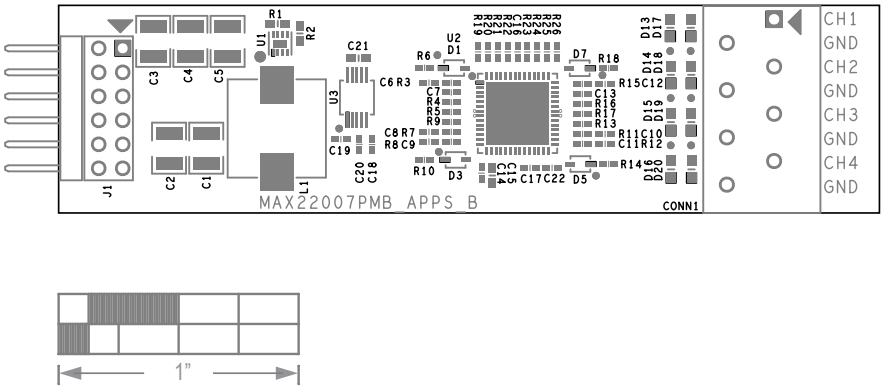
MAX22007PMB# Bill of Materials

ITEM	REF_DES	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1, C2	2	C1210C156K8PAC	KEMET	15UF	CAP; SMT (1210); 15UF; 10%; 10V; X5R; CERAMIC	
2	C3-C5	3	GRM32ER71J106MA12	MURATA	10UF	CAP; SMT (1210); 10UF; 20%; 63V; X7R; NO DATA	
3	C6, C8, C10, C12	4	C1005C0G1H471J050BA	TDK	470PF	CAP; SMT (0402); 470PF; 5%; 50V; C0G; CERAMIC	
4	C7, C9, C11, C13	4	C0402C240J5GAC	KEMET	24PF	CAP; SMT (0402); 24PF; 5%; 50V; C0G; CERAMIC	
5	C14	1	GRM155R71E104KE14; C1005X7R1E104K050BB; TMK105B7104KVH; CGJ2B3X7R1E104K050BB	MURATA;TDK;TAIYO YUDEN;TDK	0.1UF	CAP; SMT (0402); 0.1UF; 10%; 25V; X7R; CERAMIC	
6	C15	1	GRM188R6YA106MA73	MURATA	10UF	CAP; SMT (0603); 10UF; 20%; 35V; X5R; CERAMIC	
7	C16-C20, C22	6	C0402C105K8PAC; CC0402KRX5R6BB105	KEMET;YAGEO	1UF	CAP; SMT (0402); 1UF; 10%; 10V; X5R; CERAMIC	
8	C21	1	C0603C475K8PAC; LMK107BJ475KA; CGB3B1X5R1A475K; C1608X5R1A475K080AC; CL10A475KP8NNN; C1608X5R1A475K080AE	KEMET;TAIYO YUDEN;TDK;TDK;SAMSUNG ELECTRONICS;TDK	4.7UF	CAP; SMT (0603); 4.7UF; 10%; 10V; X5R; CERAMIC	
9	CONN1	1	250-408	WAGO	250-408	CONNECTOR; FEMALE; THROUGH HOLE; COMPACT TERMINAL STRIP WITH PUSH BUTTON; STRAIGHT; 8PINS	
10	D1, D3, D5, D7	4	BAT46WJ	NXP	BAT46WJ,115	DIODE; SCH; SMT (SOD-323F); PIV=100V; IF=0.25A	
11	D2, D4, D6, D8	4	SMM4F33A	ST MICROELECTRONICS	33V	DIODE; TVS; SMT (DO-216AA); VRM=33V; IPP=7A	
12	D13-D16	4	APT1608LVBC/D	KINGBRIGHT	APT1608LVBC/D	DIODE; LED; BLUE WATER CLEAR; BLUE; SMT (0603); VF=2.65V; IF=0.002A	
13	D17-D20	4	APT1608LZGCK	KINGBRIGHT	APT1608LZGCK	DIODE; LED; GREEN WATER CLEAR; GREEN; SMT (0603); VF=2.65V; IF=0.002A	
14	J1	1	TSW-106-08-S-D-RA	SAMTEC	TSW-106-08-S-D-RA	CONNECTOR; THROUGH HOLE; DOUBLE ROW; RIGHT ANGLE; 12PINS;	
15	L1	1	ASPI-1040HI-100M	ABRACON	10UH	INDUCTOR; SMT; WIREWOUND CHIP; 10UH; TOL=+/-20%; 7.5A	
16	R1	1	CRCW06034023FK; ERJ-3EKF4023	VISHAY;PANASONIC	402K	RES; SMT (0603); 402K; 1%; +/-100PPM/DEGC; 0.1000W	
17	R2	1	CRCW06034M02FK	VISHAY	4.02M	RES; SMT (0603); 4.02M; 1%; +/-100PPM/DEGC; 0.1000W	
18	R3, R7, R11, R15	4	ERJ-2RKF3902X; CRCW040239K0FK	PANASONIC;VISHAY DALE	39K	RES; SMT (0402); 39K; 1%; +/-100PPM/DEGC; 0.0630W	
19	R4, R5, R8, R9, R12, R13, R16, R17	8	CRCW04024K99FK	VISHAY DALE	4.99K	RES; SMT (0402); 4.99K; 1%; +/-100PPM/DEGC; 0.0630W	
20	R6, R10, R14, R18	4	ERJ-2RKF49R9	PANASONIC	49.9	RES; SMT (0402); 49.9; 1%; +/-100PPM/DEGC; 0.1000W	
21	R19-R22	4	CRCW0402750RFK	VISHAY DALE	750	RES; SMT (0402); 750; 1%; +/-100PPM/DEGC; 0.0630W	
22	R23-R26	4	CRCW0402910RFK	VISHAY	910	RES; SMT (0402); 910; 1%; +/-100PPM/DEGK; 0.0630W	
23	U1	1	MAX17291ATA+	MAXIM	MAX17291ATA+	EVKIT PART-IC; MAX17291ATA+; HIGH-VOLTAGE MICROPOWER BOOST CONVERTER; PACKAGE OUTLINE: 21-0168; PACKAGE CODE: T822+3C; TDFN8-EP	
24	U2	1	MAX22007ETN+	MAXIM	MAX22007ETN+	IC; DAC; FOUR-CHANNEL 12-BIT CONFIGURABLE ANALOG OUTPUT WITH INTEGRATED VOLTAGE REFERENCE; TQFN56-EP	
25	U3	1	MAX881REUB+	MAXIM	MAX881REUB+	IC; ASW; LOW-NOISE BIAS SUPPLY WITH POWER-OK FOR GAASFET PA; UMAX10	
26	PCB	1	MAX22007PMB_APPS_B	MAXIM	PCB	PCB:MAX22007PMB_APPS_B	-
TOTAL		71					

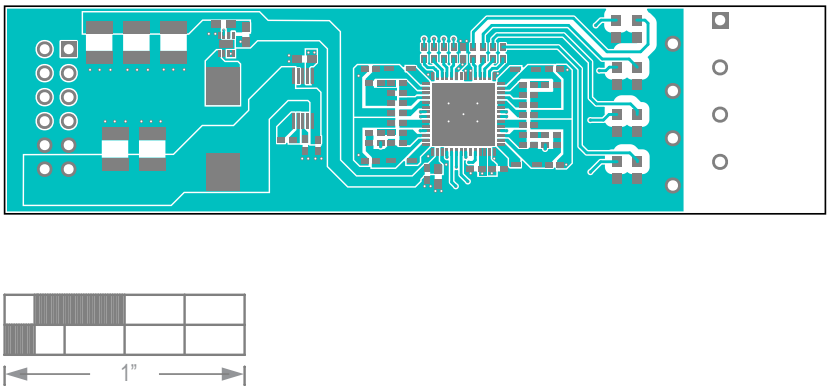
MAX22007PMB# Schematic



MAX22007PMB# PCB Layouts



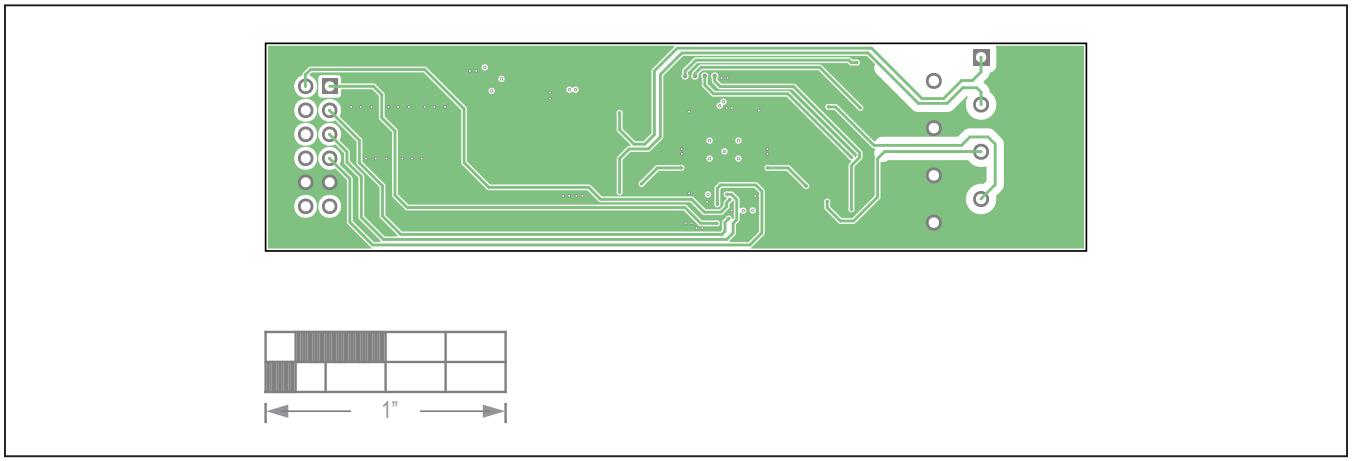
MAX22007PMB# PCB Layout—Top Silkscreen



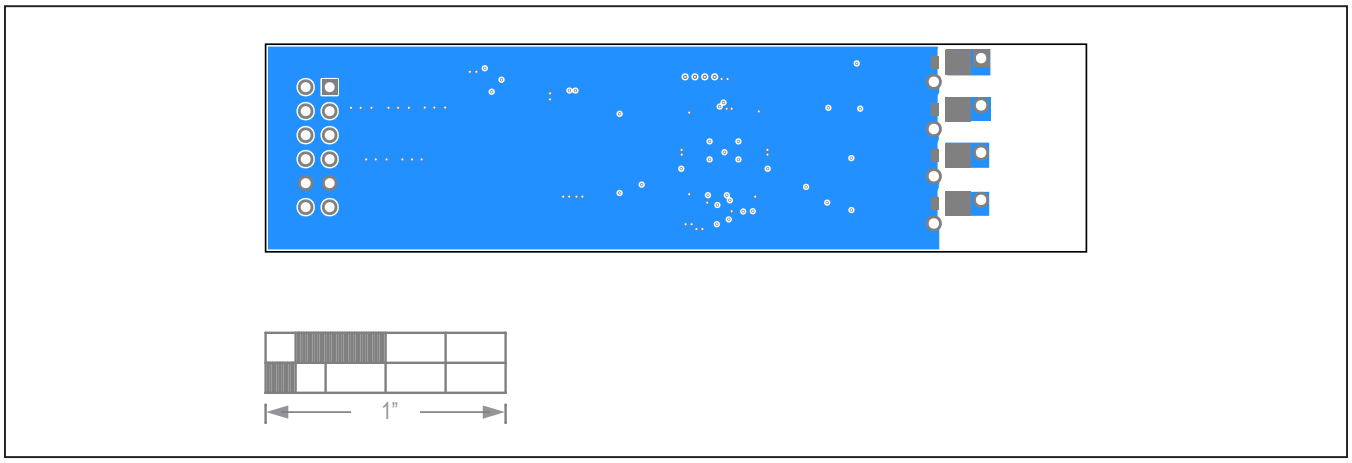
MAX22007PMB# PCB Layout—Top

MAX22007PMB# PCB Layout—Layer 2

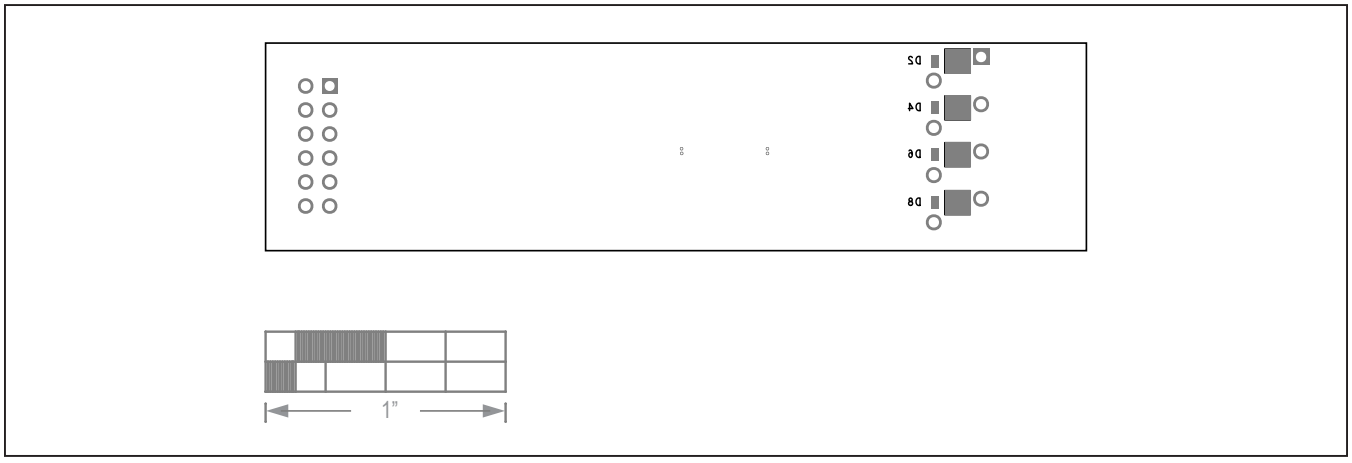
MAX22007PMB# PCB Layouts (continued)



MAX22007PMB# PCB Layout—Layer 3



MAX22007PMB# PCB Layout—Bottom



MAX22007PMB# PCB Layout—Bottom Silkscreen