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

Evaluates: MAX22202

MAX22202 Evaluation Kit

General Description

The MAX22202 evaluation kit (EV kit) provides a proven design to evaluate the MAX22202 brushed DC motor driver. The MAX22202 IC integrates very low impedance FETs in a full bridge configuration for use in 36V, 3.5A motor driver applications. The typical R_{ON} (high-side + low-side) of this configuration is 0.3Ω. The EV kit features headers, test points, and terminal blocks to provide an interface to the MAX22202 motor driver PWM inputs, current sense outputs, and power supply inputs and motor driver outputs. An on-board ICM7556 provides an on-board PWM generator with a fixed frequency of 16.5kHz and an adjustable duty cycle from 4% to 95%. The EV kit also allows the user to adjust the integrated current limiting using an on-board potentiometer.

Features

- Easy Evaluation of the MAX22202
- Configurable for External PWM or Adjustable On-Board PWM Input
- Configurable R_{ILIM} Resistor to Adjust Integrated Current Limit Threshold
- Configurable Decay Mode Using MODE Pin
- Fully Assembled and Tested
- Proven PCB Layout

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

MAX22202 EV Kit Board

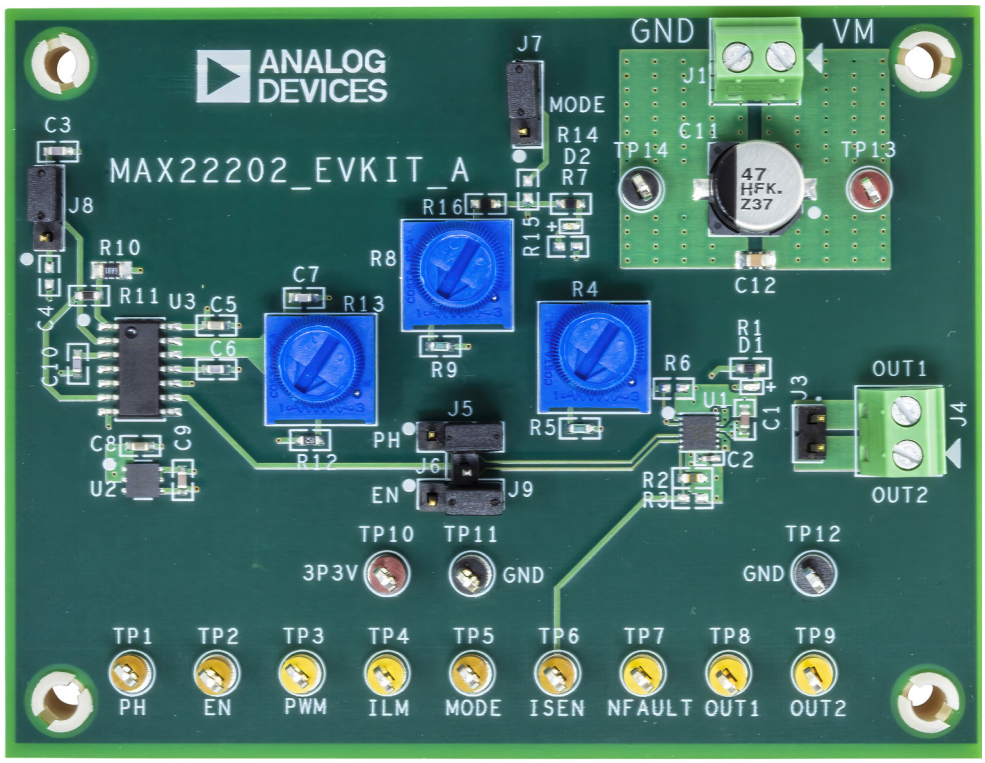


Figure 1. MAX22202 EV Kit Board

319-100994; Rev 0; 5/23

Quick Start

Required Equipment

- MAX22202 EV kit
- +36V DC, 5A power supply
- Optional up to 100kHz square wave signal generator
- Brushed DC motor or load

Procedure

It is recommended that the engineer read the MAX22202 IC data sheet prior to using the EV kit. Refer to the Typical Application Circuits and Detailed Description in the MAX22202 IC data sheet for more information. The EV kit is fully assembled and tested. Use the following steps to verify board operation:

1) As with all motor drive applications, stopping or braking the motor can cause a back EMF (BEMF) current and voltage spike. At high supply voltages (+36V), this can cause the supply to rise above the absolute maximum allowable voltage to the supply pins of a motor drive IC. It is highly recommended that the power supply be clamped appropriately to avoid damage to the motor driver IC.
2) Verify that all shunts are installed in their default position as described in Table 2.
3) Adjust the current limit threshold using potentiometer R4 and reading the resistance using test point TP4 and a GND test point.
4) If a load or DC motor is being used, connect the load or motor to terminal block J4.
5) Connect a +4V to +36V DC power supply to the terminal block J1 or TP13 and TP14 and turn on the supply.
6) The default header positions result in the MAX22202 in low-power sleep mode (MODE = GND). To wake the part up from the low-power sleep state at power-up, move the shunt on header J7 from 2-3 to 1-2 to drive the MODE pin high. This action will wake up the part after the power-on time (t_{ON} = 400µs max). OUT1 and OUT2 are actively driven low (brake). To drive current from OUT1 to OUT2 (OUT1 = V_M and OUT2 = GND) when the part is in low-power sleep mode, install shunts across pins 1-2 of header J5 (PH = +3.3V) and header J9 (EN = +3.3V), then install a shunt across pins 1-2 of J7 (MODE = +3.3V). To drive current from OUT2 to OUT1 (OUT2 = V_M and OUT1 = GND), install shunts across pins 2-3 of header J5 (PH = GND) and across pins 1-2 of header J9 (EN = +3.3V).
7) Pin 2 of headers J5 (PH) and J9 (EN) or TP1 (PH) and TP2 (EN) can also be used to drive the MAX22202 inputs with an on-board PWM signal. To use the on-board PWM signal to drive these pins, install a shunt across pin 2 of either header J5 or J9 and pin 1 of J6. See the *Example Startup Procedure* section for an example of a startup sequence and Table 2 for more information.

Example Startup Procedure

The steps below describe the startup procedure using the on-board PWM signal to drive the MAX22202 inputs with slow decay.

1) Verify that all shunts are installed in their default positions. This brings up the part in low-power sleep mode.
2) Move the shunt on header J7 from 2-3 to 1-2 to drive the MODE pin high. This action will wake up the part after the power-on time (t_{ON} = 400µs max). OUT1 and OUT2 are actively driven low (brake).
3) Select which direction the motor will be driven in and adjust the shunts on the J5 (PH), J9 (EN), J7 (MODE), and J6 (on-board PWM signal) headers according to Table 1 and Table 2. For example, to drive the load in the forward direction with a PWM input and slow decay, move the shunt on header J5 to the 1-2 position (PH = +3.3V) and move the shunt on header J9 to bridge the single J6 pin and pin 2 of J9 (EN = on-board PWM input).

Detailed Description of Hardware (or Software)

The MAX22202 EV kit provides a proven layout and evaluation circuit for the MAX22202 (U1) IC. The EV kit features a MAX15006 (U2) ultra-low quiescent current LDO to provide +3.3V from an input voltage of +4V to +36V from the V_M supply to power the on-board PWM switching circuitry. On-board PWM switching is achieved using an ICM7556 (U3) dual timer IC and can be routed to either PH or EN input of the MAX22202.

Power Supplies

The MAX22202 IC can be powered by either applying a +4V to +36V power supply to terminal block J1 or test points TP13 and TP14. The on-board +3.3V MAX15006 LDO (U3) and ICM7556 (U3) dual timer circuit is sourced from this supply.

MAX22202 Input Configuration

The MAX22202's inputs (PH and EN) can be driven either using an external signal applied to PH using TP1 and EN using TP2, or the user can choose to drive the MAX22202 inputs using the on-board generated PWM signal.

Headers J5, J6, and J9 can be configured to either drive one or both MAX22202 inputs with a continuous voltage of +3.3V or GND, or can be configured to drive one MAX22202 input to +3.3V and apply a PWM signal to the other MAX22202 input. The on-board PWM signal is routed to a single pin header J6. Pin 2 of headers J5 and J9 are routed to the MAX22202 inputs PH and EN. Pin 1 on J5 and J9 are connected to +3.3V and pin 3 on J5 and J9 are connected to GND. Table 1 describes the operation of the MAX22202 outputs based on the MAX22202 input pin states.

Table 1. Full Bridge PHASE, ENBL, and MODE Truth Table

PHASE	ENBL	MODE	OUT1	OUT2	DESCRIPTION
1	1	X	H	L	Forward (current from OUT1 to OUT2)
0	1	X	L	H	Reverse (current from OUT2 to OUT1)
X	0	1	L	L	Brake (slow decay)
1	0	0	L	H	Fast-decay synchronous rectification (*) Sleep mode if following a longer than t_{SLEEP} brake status
0	0	0	H	L	Fast-decay synchronous rectification (*) Sleep mode if following a longer than t_{SLEEP} brake status

(*) To prevent reversal of current during fast decay synchronous rectification, outputs go to the high-impedance state as the current approaches 0A.

Table 2. On-Board PWM Configuration Table (Default Configuration)

HEADER	OUT2	DESCRIPTION
J5	1-2	MAX22202 input PH connected to +3.3V
	2-3*	MAX22202 input PH connected to GND
J6	J6 pin 1 to J5 pin 2	On-board PWM signal connected to the MAX22202 input PH
	J6 pin 1 to J5 pin 2	On-board PWM signal connected to the MAX22202 input EN
J9	1-2	MAX22202 input EN connected to +3.3V
	2-3*	MAX22202 input EN connected to GND
J8	1-2	User customizable PWM frequency with the population of C4
	2-3*	Selects the default PWM frequency of 16.5kHz
J7	1-2	MAX22202 input MODE connected to +3.3V
	2-3*	MAX22202 input MODE connected to GND

**Default shunt position.*

Figure 2 and Table 2 describe the configuration of headers J5, J6, and J9 to drive the MAX22202 inputs using the either the on-board PWM signal or continuously with +3.3V or GND. Potentiometer R13 can be used to adjust the duty cycle of the on-board PWM signal from 4% to 95%. Figure 3 and Figure 4 show the duty cycle range of the on-board PWM generated signal.

Current Drive Regulation and Current Limiter

The integrated current limit can be adjusted using potentiometer R4. The resistance connected from the MAX22202 ILIM pin to GND can be adjusted from 18kΩ to 115kΩ for a corresponding current limit of 2.7A to 0.43A. If the current limit threshold is reached, the device enters a slow decay cycle by enabling both low-side FETs for a specified off time (t_{OFF}). The current limit threshold equation is given below where K_{ILIM} = 50KV:

$$I_{TRIP}(A) = \frac{K_{ILIM}(KV)}{R_{ILIM}(k\Omega)}$$

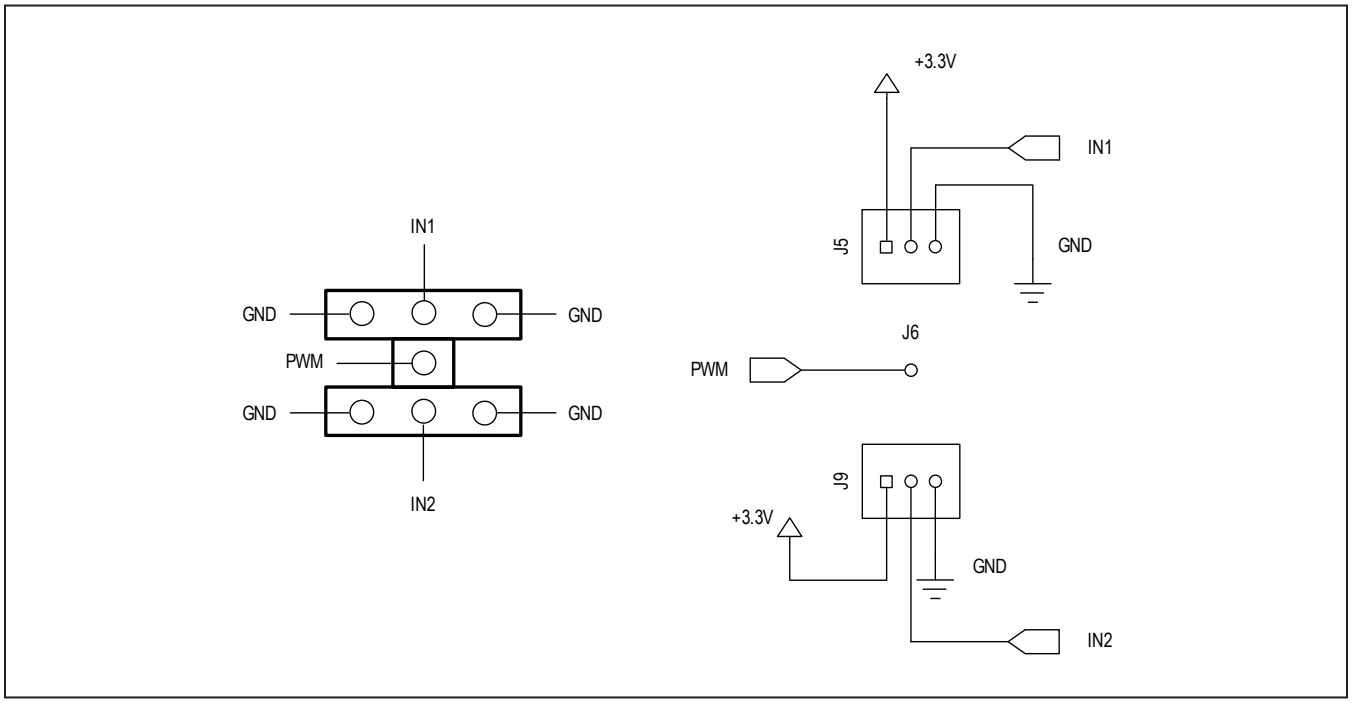


Figure 2. Configuration of the MAX22202 Input Headers J5, J6, and J9

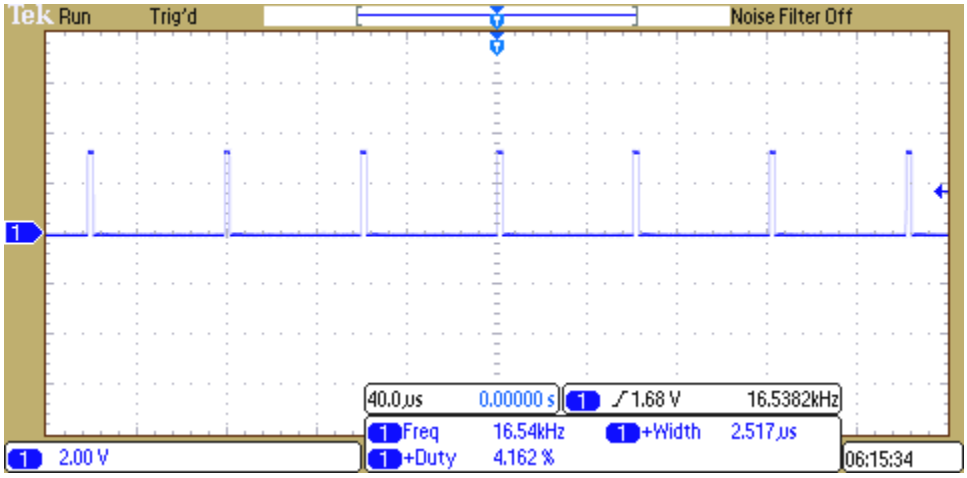


Figure 3. PWM Signal Measured at Test Point TP3 With a 4% Duty Cycle

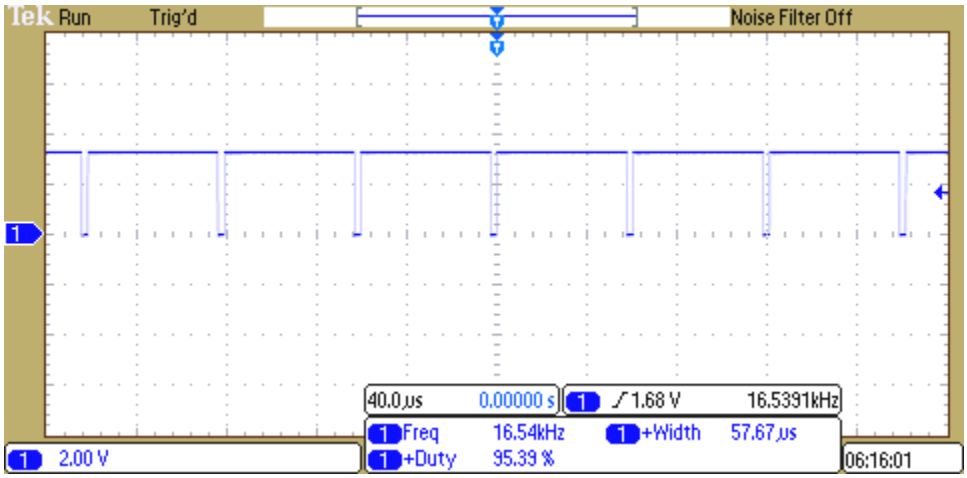


Figure 4. PWM Signal Measured at Test Point TP3 with a 95% Duty Cycle

Ordering Information

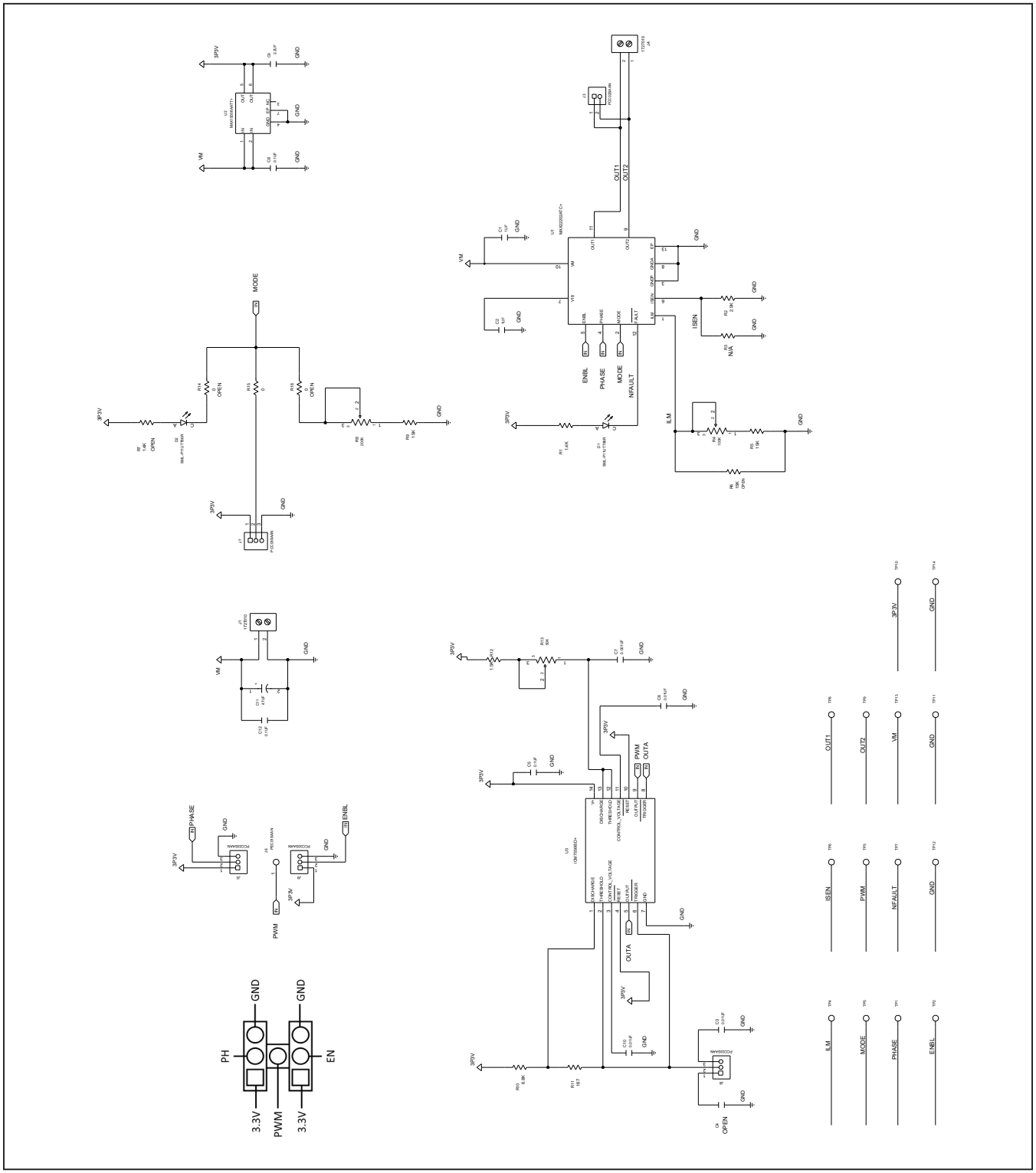
PART	TYPE
MAX22202EVKIT#	EV Kit

#Denotes RoHS compliance.

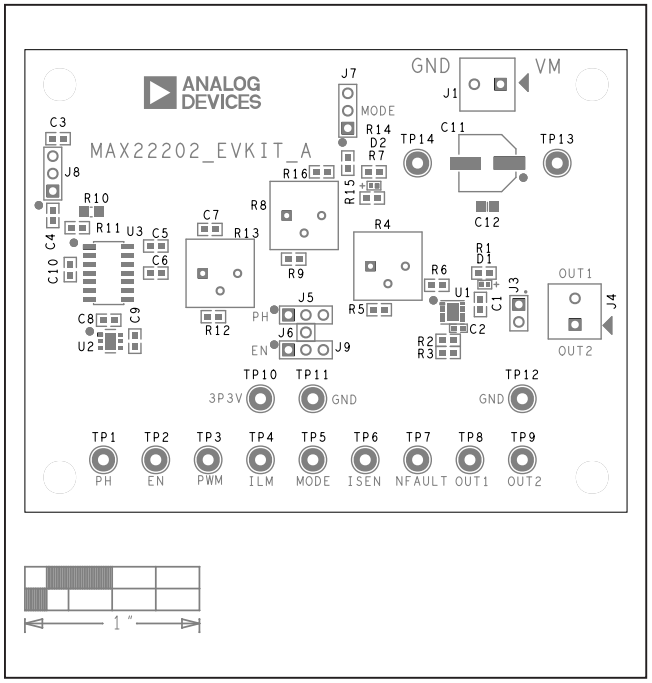
MAX22202 EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
1	C1	-	1	UMK107BJ105KA;C1608X5R1H105K080AB; CL10A105KB8NNN;GRM188R61H105KAAL; UMK107ABJ105KAH	TAIYO YUDEN;TDK;SAMSUNG; MURATA;TAIYO YUDEN	1UF	CAP; SMT (0603); 1UF; 10%; 50V; X5R; CERAMIC
2	C2	-	1	C0402C105K8PAC;CC0402KRX5R6BB105	KEMET;YAGEO	1UF	CAP; SMT (0402); 1UF; 10%; 10V; X5R; CERAMIC
3	C3, C6, C10	-	3	C1608C0G1H103J080AA; CGA3E2C0G1H103J080AD; GRM1885C1H103JA01	TDK;TDK;MURATA	0.01UF	CAP; SMT (0603); 0.01UF; 5%; 50V; C0G; CERAMIC
4	C5	-	1	C0603C104J4RAC;X7R0603CTTD104J; GRM188R71C104JA01;0603YC104JAT2A	KEMET; KOA SPEER ELECTRONICS INC; MURATA;AVX	0.1UF	CAP; SMT (0603); 0.1UF; 5%; 16V; X7R; CERAMIC;
5	C7	-	1	GRM1885C1E102JA01	MURATA	0.001UF	CAP; SMT (0603); 0.001UF; 5%; 25V; C0G; CERAMIC
6	C8	-	1	C1608X5R1H104K080AA	TDK	0.1UF	CAP; SMT (0603); 0.1UF; 10%; 50V; X5R; CERAMIC
7	C9	-	1	C1608X5R1E225K;TMK107ABJ225KA; TMK107BJ225KA;GRM188R61E225KA12	TDK;TAIYO YUDEN; TAIYO YUDEN;MURATA	2.2UF	CAP; SMT (0603); 2.2UF; 10%; 25V; X5R; CERAMIC
8	C11	-	1	EEE-FK1H470P	PANASONIC	47UF	CAP; SMT (CASE_E); 47UF; 20%; 50V; ALUMINUM-ELECTROLYTIC
9	C12	-	1	C0805C104J1RAC;08051C104JAT2A; GCM21BR72A104JA37	KEMET;AVX;MURATA	0.1UF	CAP; SMT (0805); 0.1UF; 5%; 100V; X7R; CERAMIC
10	D1, D2	-	2	SML-P11UTT86R	ROHM SEMICONDUCTOR	SML-P11UTT86R	DIODE; LED; RED CLEAR; PICOLED; SMT; VF=1.8V; IF=0.001A
11	J1, J4	-	2	1727010	PHOENIX CONTACT	1727010	CONNECTOR; FEMALE; THROUGH HOLE; GREEN TERMINAL BLOCK; RIGHT ANGLE; 2PINS
12	J3	-	1	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC
13	J5, J7-J9	-	4	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC
14	J6	-	1	PEC01SAAN	SULLINS ELECTRONICS CORP	PEC01SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 1PIN
15	R1	-	1	CRCW06031K40FK	VISHAY DALE	1.4K	RES; SMT (0603); 1.4K; 1%; +/-100PPM/DEGC; 0.1000W
16	R2	-	1	MCT06030E2501B	VISHAY DALE	2.5K	RES; SMT (0603); 2.5K; 0.10%; +/-15PPM/DEGC; 0.1000W
17	R4	-	1	3386P-1-104TLF	BOURNS	100K	RES; THROUGH HOLE-RADIAL LEAD; 100K; 10%; +/-100PPM/DEGC; 0.5W
18	R5, R9	-	2	TNPW060315K0BE;ERA-3AEB153	VISHAY DALE;PANASONIC	15K	RES; SMT (0603); 15K; 0.10%; +/-25PPM/DEGK; 0.1000W
19	R8	-	1	3386P-1-204TLF	BOURNS	200K	RES; THROUGH HOLE-RADIAL LEAD; 200K; 10%; +/-100PPM/DEGC; 0.5W
20	R10	-	1	CRCW08056K80FK	VISHAY DALE	6.8K	RES; SMT (0805); 6.8K; 1%; +/-100PPM/DEGC; 0.1250W
21	R11	-	1	CRCW0603187RFK;ERJ-3EKF1870	VISHAY DALE;PANASONIC	187	RES; SMT (0603); 187; 1%; +/-100PPM/DEGC; 0.1000W
22	R12	-	1	TNPW06031K50BE;ERA-3YEB152V	VISHAY DALE;PANASONIC	1.5K	RES; SMT (0603); 1.5K; 0.10%; +/-25PPM/DEGK; 0.1000W
23	R13	-	1	3386P-1-503TLF	BOURNS	50K	RES; THROUGH HOLE-RADIAL LEAD; 50K; 10%; +/-100PPM/DEGC; 0.5W
24	R15	-	1	CRCW0603000Z0	VISHAY DALE	0	RES; SMT (0603); 0; JUMPER; JUMPER; 0.1000W
25	TP1-TP9	-	9	5014	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; YELLOW; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
26	TP10, TP13	-	2	5010	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;
27	TP11, TP12, TP14	-	3	5011	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
28	U1	-	1	MAX22202ATC+	MAXIM	MAX22202ATC+	IC; DRV; 36V BRUSHED MOTOR DRIVER WITH INTEGRATED CURRENT SENSE; TDFN12-EP
29	U2	-	1	MAX15006AATT+	MAXIM	MAX15006AATT+	IC; VREG; ULTRA-LOW QUIESCENT-CURRENT LINEAR REGULATOR; TDFN6-EP 3X3
30	U3	-	1	ICM7556ISD+	MAXIM	ICM7556ISD+	IC; TIMR; GENERAL PURPOSE TIMER; NSOIC14 150MIL
31	PCB	-	1	MAX22202	MAXIM	PCB	PCB:MAX22202
32	C4	DNP	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0603 NON-POLAR CAPACITOR
33	R3	DNP	0	N/A	N/A	N/A	RESISTOR; 0603 PACKAGE; GENERIC
34	R6	DNP	0	TNPW060315K0BE;ERA-3AEB153	VISHAY DALE;PANASONIC	15K	RES; SMT (0603); 15K; 0.10%; +/-25PPM/DEGK; 0.1000W
35	R7	DNP	0	CRCW06031K40FK	VISHAY DALE	1.4K	RES; SMT (0603); 1.4K; 1%; +/-100PPM/DEGC; 0.1000W
36	R14, R16	DNP	0	CRCW0603000Z0	VISHAY DALE	0	RES; SMT (0603); 0; JUMPER; JUMPER; 0.1000W
TOTAL			50				

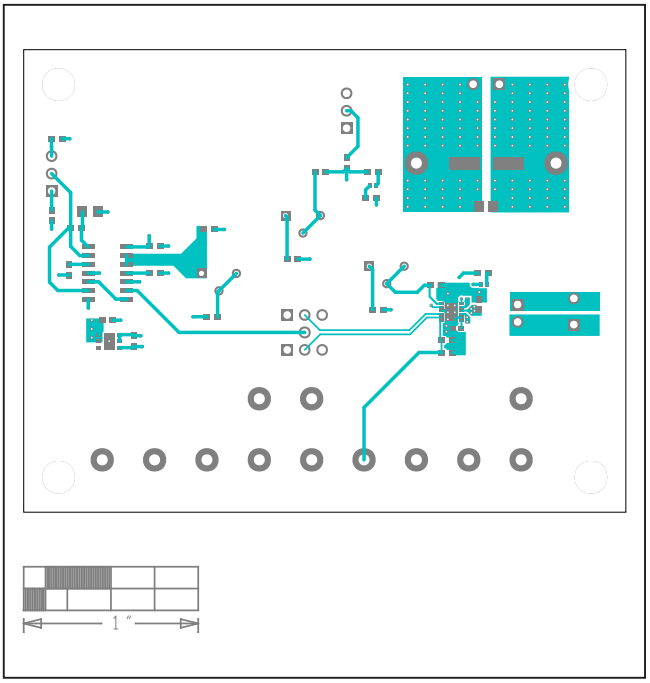
MAX22202 EV Kit Schematic



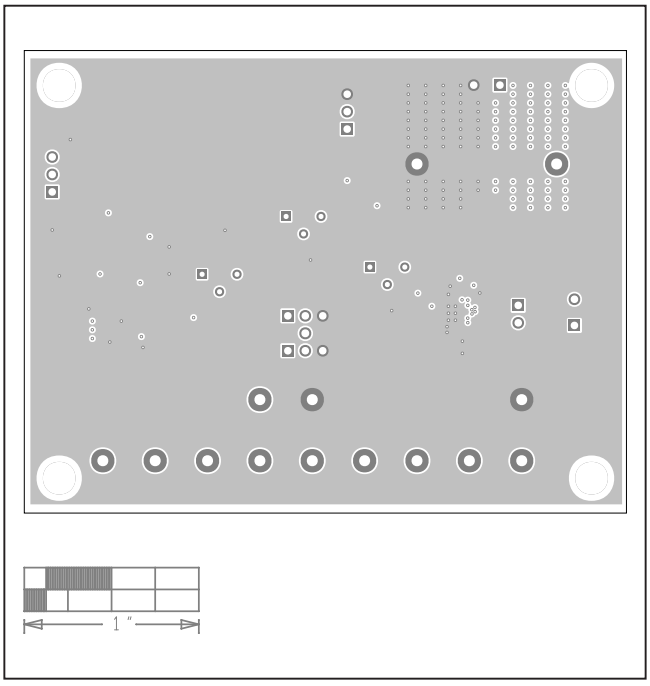
MAX22202 EV Kit PCB Layouts



MAX22202 EV Kit Component Placement Guide—Top Silkscreen

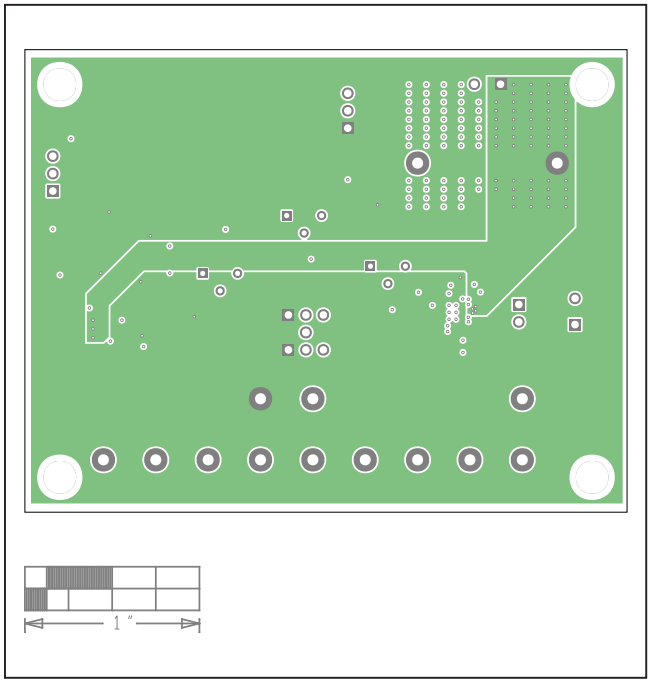


MAX22202 EV Kit PCB Layout—Top

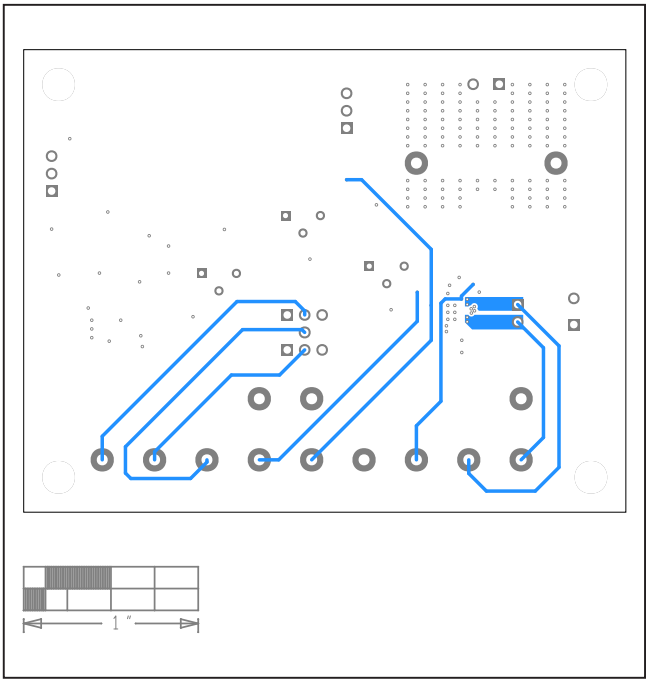


MAX22202 EV Kit PCB Layout—Internal2

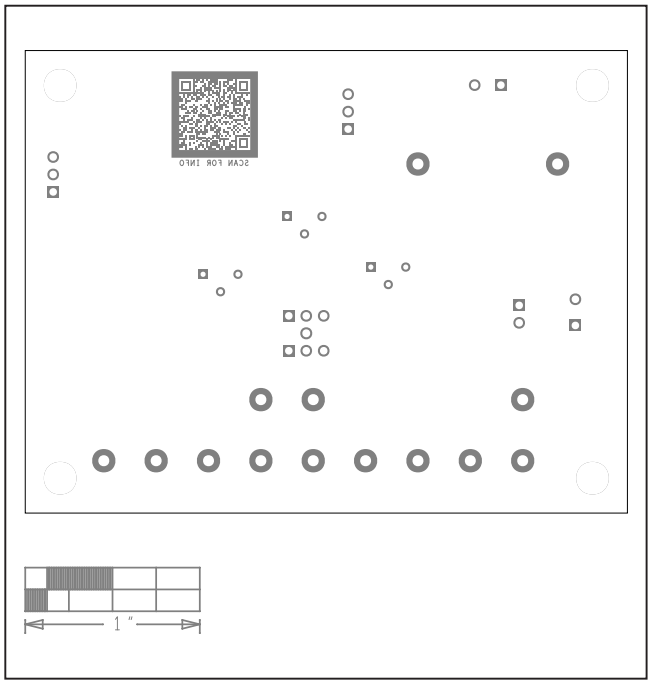
MAX22202 EV Kit PCB Layouts (continued)



MAX22202 EV Kit PCB Layout—Internal3



MAX22202 EV Kit PCB Layout—Bottom



MAX22202 EV Kit Component Placement Guide—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/23	Initial release	—