

MAX25432B Evaluation Kit

Evaluates: MAX25432

General Description

The MAX25432 EV kit and collateral provides a convenient platform to the design engineer for rapid evaluation with reduced test and firmware-development time.

The MAX25432B evaluation kit (EV kit) features MAX25432BATLG/V+ automotive 100W USB-PD PPS buck-boost port controller and protector for head-unit, multi-media hub, rear-seat infotainment, and dedicated charging port (DCP) applications.

The IC combines an automotive-grade buck-boost controller capable of full range PPS 3.3V-21V at up to 6.35A, a USB-PD analog front-end (AFE), legacy USB charging support and USB Type-C® protection switches for automotive USB host or DFP applications.

The integrated USB Type-C protection switches provide automotive system-level ESD and 24V short-circuit protection for D+, D-, CC1, CC2, and VCONN. The device also supports legacy USB 2.0 charging modes including BC1.2, Apple® 2.4A, Apple CarPlay®, Apple MFi and USB On-The-Go (OTG).

The USB-PD source capabilities and I2C registers can be changed using the PC GUI software available for download.

The EV kit also allows evaluation of the intelligent shield short-to-battery detection and protection available on MAX25432. This feature protects against high short-circuit currents flowing from the car battery through the cable shield to module ground during fault events, preventing car module damage.

Automotive USB-PD reference designs are also available. contact Maxim Integrated for more information.

Features

- 100W USB-PD Rev. 3.0 with PPS for CDP and DCP Applications
- Legacy USB 2.0 Charging Support—Meets MFi R3x
- Programmable Fixed and Augmented PDOs Using the Feather Board and GUI
- Test Points Available for Signals and Buck-Boost analysis
- Fully Assembled and Tested, Proven PCB Layout

Apple Inc. registered trademark.

Apple CarPlay is a registered trademark of Apple Inc.

USB Type-C is a registered trademark of the USB Implementers Forum, Inc.

Quick Start

The following procedure demonstrates how to setup the MAX25432B for evaluation.

EV Kit Content

- One MAX25432B main board (p/n MAX25432_EVKIT_P1_01)
- One Feather board and 20-pin ribbon cable (p/n MAXPD_FTHR_APPS_B)
- One Pico board and 10-pin ribbon cable (p/n MAX32625PICO)
- One Maxim USB-C breakout board (p/n MAX25410_PT_LABS_A)
- One 6ft USB Type-C 5A cable
- Two USB Micro-B cables

Required Equipment

- One MAX25432B EV kit main board
- One Feather board
- One USB Type-C cable
- One 14V/8A DC power supply or car battery (VBAT). Not included.
- One USB-PD device with PPS such as a smartphone or a PD trigger. Not included.

Note: Example of PD trigger devices that support PPS are USBCEE CCPROG PAT, Passmark or AVHzY.

Ordering Information appears at end of data sheet.

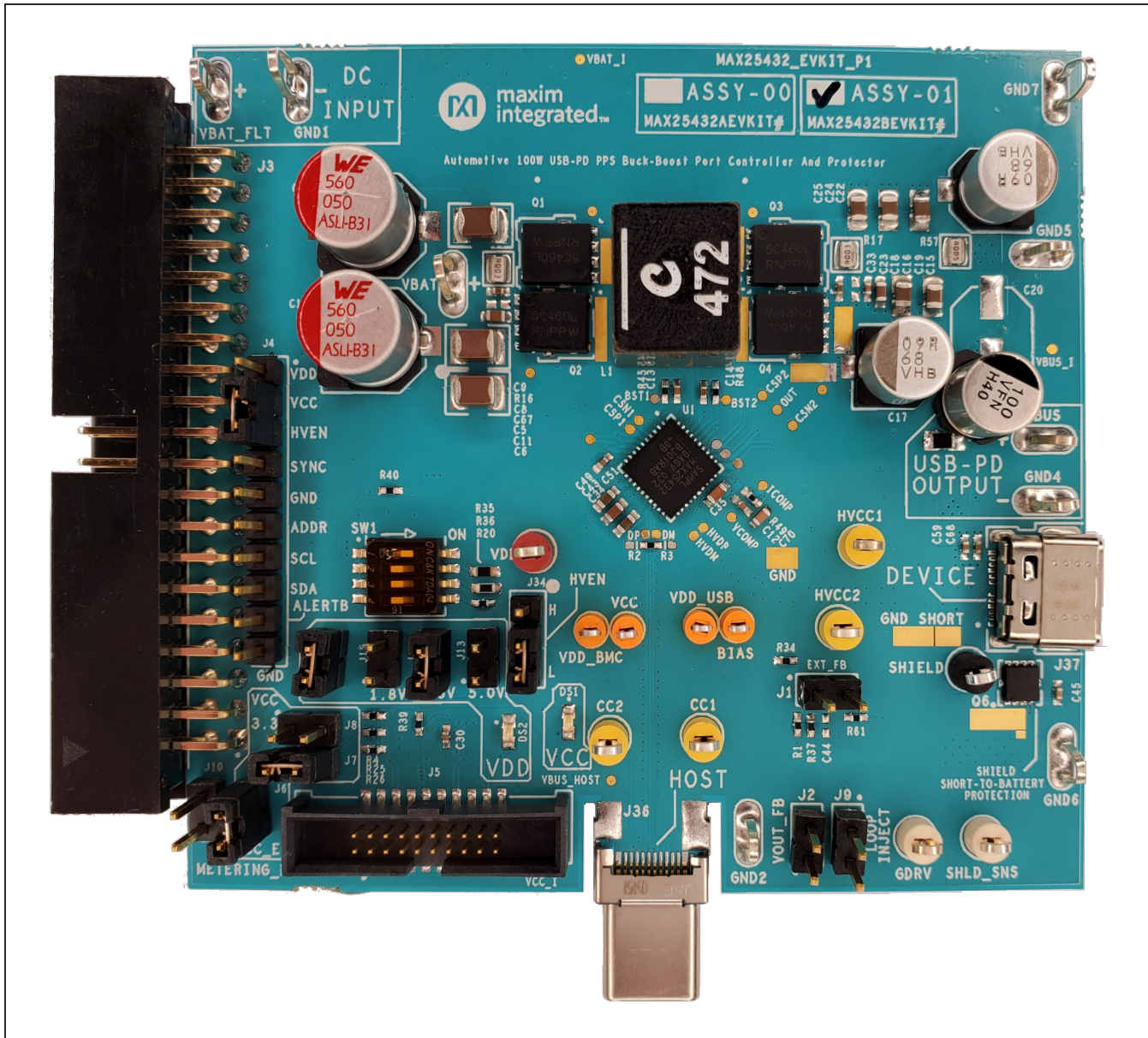


Figure 1. MAX25432B EV Kit (Top View, Main Board)

Initial Setup

The EV kit is fully assembled, tested, and configured. Verify the jumper configuration on the main board as shown in [Figure 2](#).

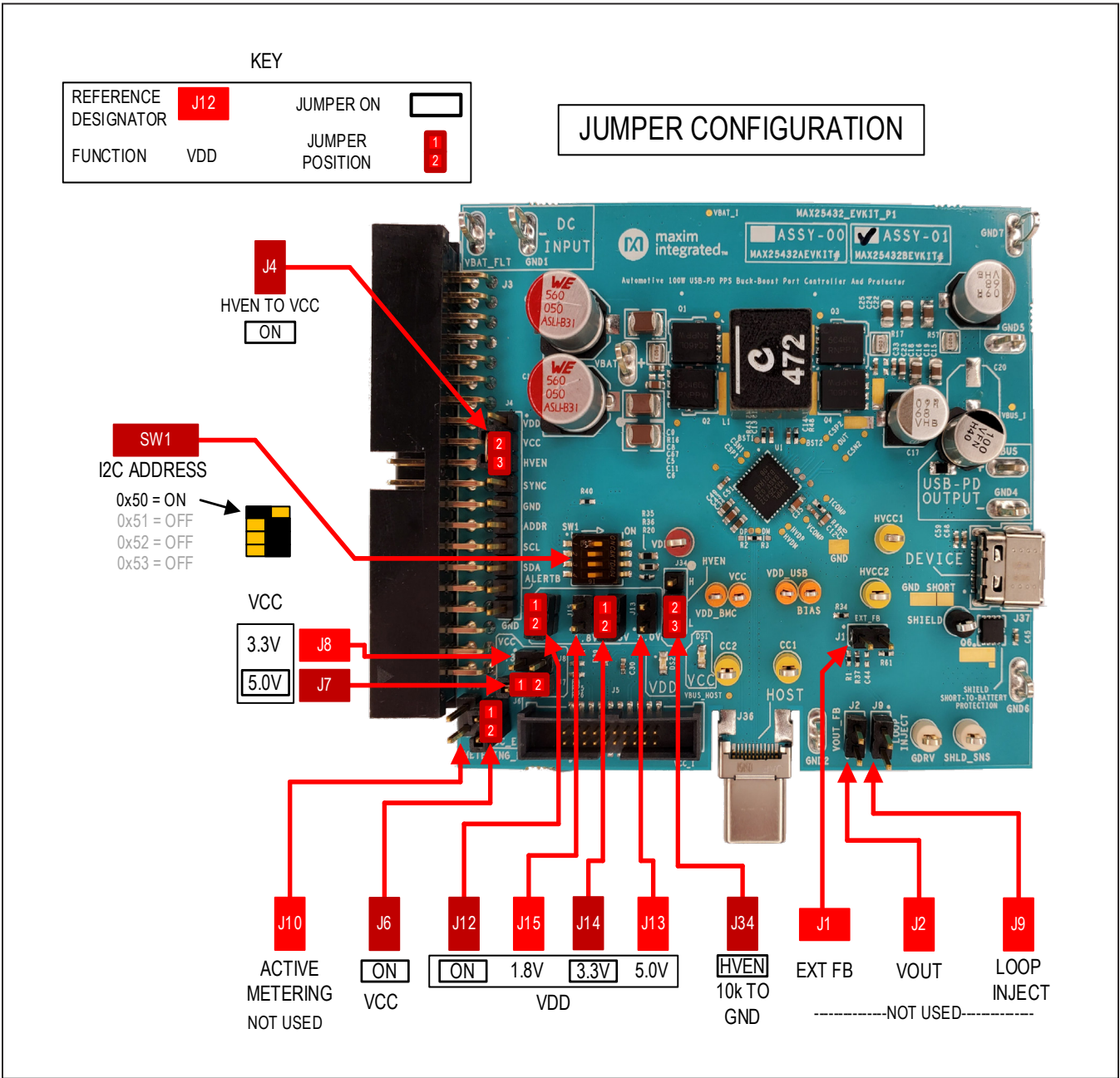


Figure 2. Jumper Configuration

Follow the steps below to set up the board for evaluation when no PC is available.

Once a USB-PD device is connected as shown in [Figure 3](#), the EV kit and the device will agree on a Power Delivery contract, and fast charging will begin.

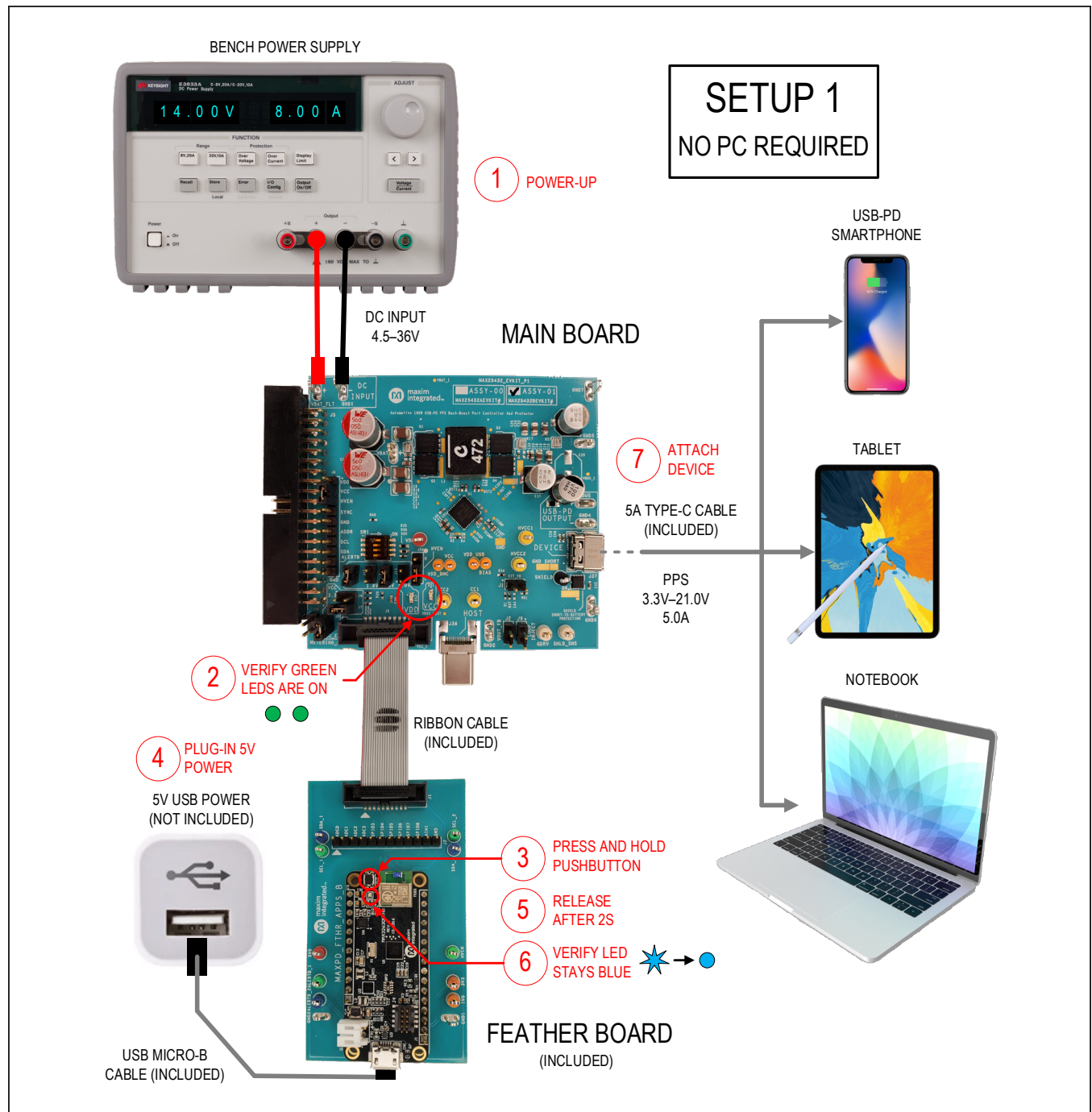


Figure 3. EV Kit Setup 1

MAX25432B Evaluation Kit

Evaluates: MAX25432

Follow the steps below to set up the board for evaluation when a PC is available, see [Figure 4](#). This setup requires the installation of the Maxim automotive USB EV kit PC GUI software available on the MAX25432 EV kit product webpage.

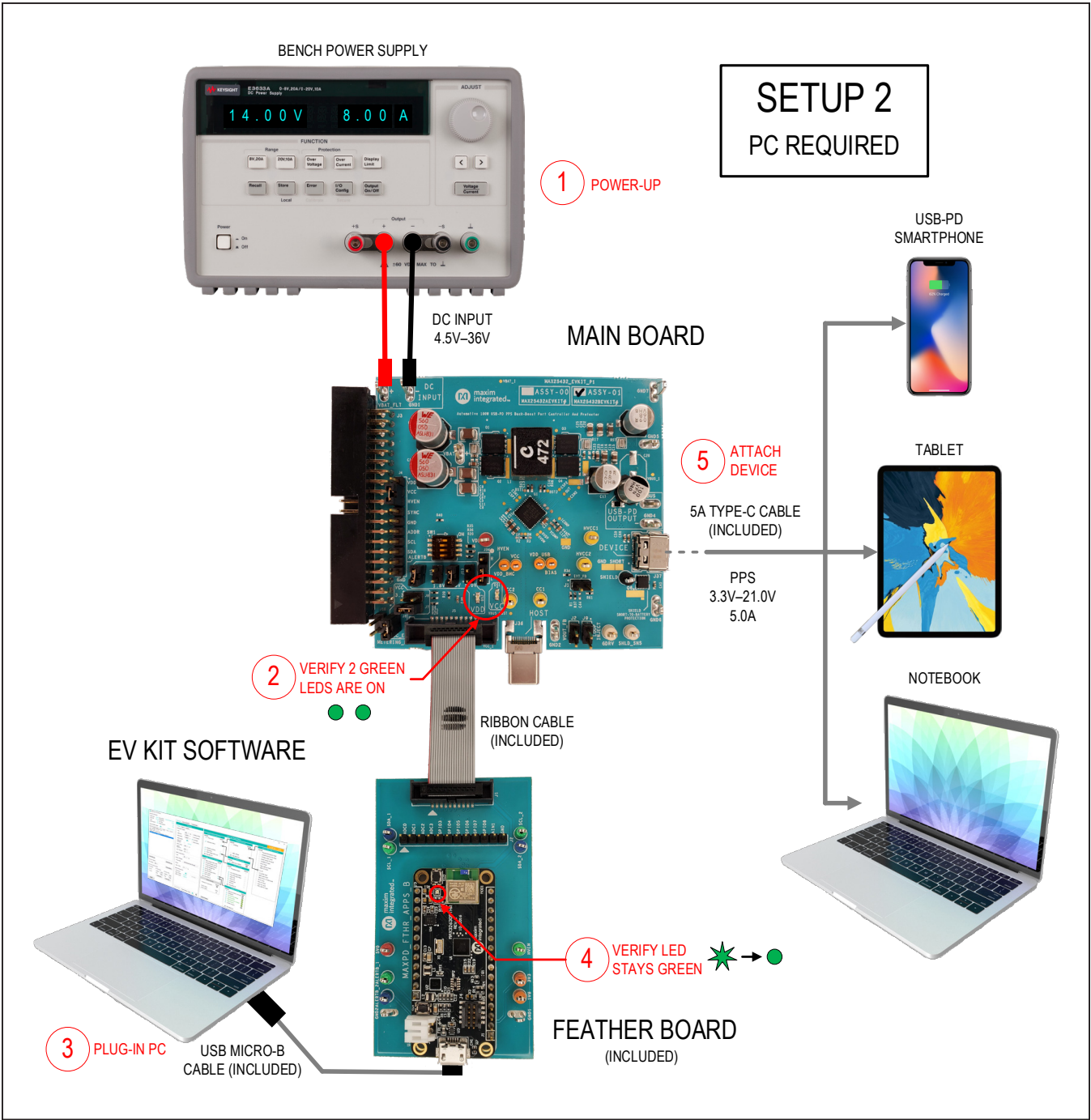


Figure 4. EV Kit Setup 2

PC GUI Software

The MAX25432BEVKIT# features a graphical user interface (GUI) that can be used to configure the TCPM as well as access the internal IC registers. Download the latest software, then connect the Feather board between the computer and the main board using the provided Micro-B and ribbon cable as shown in [Figure 4](#).

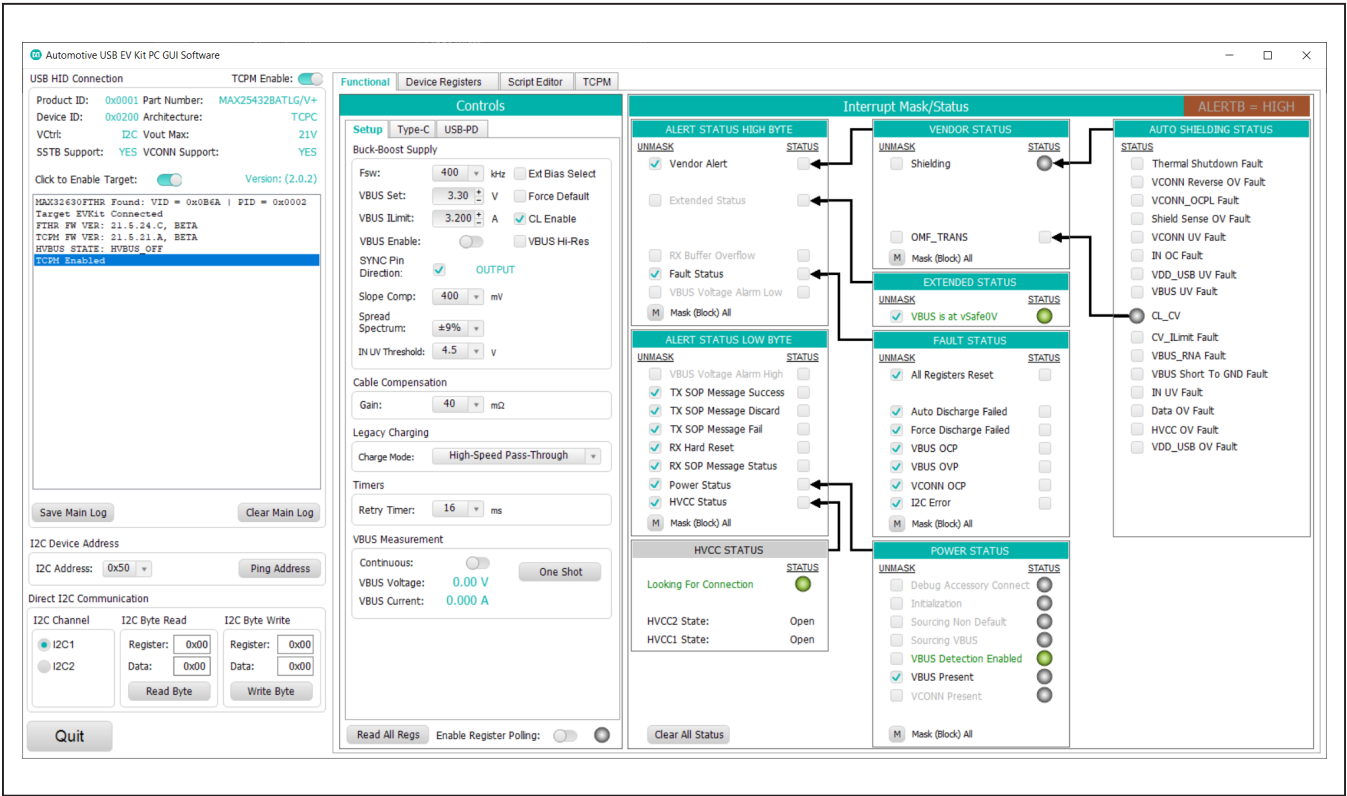


Figure 5. Maxim Automotive USB PC GUI software

Detailed Description

Enabling VBUS

Make sure the jumpers are set correctly and the steps described in either Setup 1 or 2 have been followed.

When the EV kit is in TCPM mode, VBUS powers-up after a valid Type-C device is connected on the Type-C receptacle (J37).

Note: It is recommended to connect HVEN to V_{CC} instead of V_{BAT} when connecting the Feather board to the main board.

The on-board MAX20075 power supplies make VCONN and I²C communication testing convenient for the user. Additionally, their voltage can be changed using jumpers for compatibility with other systems.

Contact the factory for an optimized BOM without external power supplies.

TCPM Mode

The Type-C Port Manager (TCPM), located in the Feather board, is used to control the MAX25432 autonomously over I²C.

TCPM operation is the default power-up mode in both Setup 1 and 2. While the TCPM is running, the user can monitor the VBUS voltage and current as well as override MAX25432 registers.

Reference TCPM open-source code files for the MAX25432B are available for download on the EV kit webpage.

Non-TCPM Mode

The user can change to the non-TCPM mode by turning off the **TCPM Enable** switch in the GUI.

This mode disables the TCPM stack from controlling the MAX25432 and lets the user manually control the registers through the GUI.

Important: Do not connect a USB device to the EV kit, such as a phone or power bank, when the TCPM is disabled. VBUS can be programmed to voltages exceeding 5V and could damage the USB device.

Constant Voltage Operation (CV)

To evaluate CV operation with an e-load, first follow the steps described in either Setup 1 or 2.

In TCPM mode, enable VBUS by connecting a USB-C device such as a PD Trigger.

In non-TCPM mode, enable VBUS manually using the GUI.

Make sure the e-load is programmed as constant current or constant resistance (CR) mode before enabling it. Verify the load current stays below the programmed VBUS_ILIM target in order to stay in CV. In CV, MAX25432 regulates VBUS to the desired VBUS voltage target.

Current Limit Operation (CL)

To evaluate CL operation with an e-load, first follow the steps described in either Setup 1 or 2. Enable VBUS using an external PD Trigger device in TCPM mode. Select the desired PPS APDO voltage and current. Make sure the e-load is programmed as Constant Resistance (CR) mode before enabling it. Finally, dial the load current past the requested PPS current and observe VBUS voltage decrease.

Note: Using an e-load in CC mode and entering CL mode with MAX25432 will cause the VBUS to shut-down and flag the VBUS short to ground fault. This is one of the protection mechanisms built-in the MAX25432 and will not damage the IC or EV kit. To avoid this, make sure the e-load is programmed as constant resistance mode (CR) before enabling it.

In non-TCPM mode, set the desired VBUS voltage target and enable VBUS. Verify the CL_EN bit is set to 1 and the VBUS_ILIM target is set to the desired value. Finally, dial the load current past the VBUS_ILIM target and observe VBUS voltage decreasing.

Changing the USB-PD Source Capabilities

The source capabilities containing the programmable data objects (PDOs) can be changed using the GUI in TCPM mode. Go to the **TCPM** tab on the GUI to change the source capabilities.

Fault Diagnostics

The MAX25432B Maxim Auto-Shield protects the application against many faults related to Type-C, power delivery, and automotive events. Refer to the MAX25432 data sheet for all conditions that can trigger a fault event, action, and recovery. The Feather board is notified using the ALERT pin.

Buck-Boost Controller Operation

To observe the buck-boost controller switching waveforms, copper pads are available at various nodes.

Figure 6 shows recommended probe locations.

VCONN

The MAX25432 has built-in VCONN switches that, when enabled by the TCPM, provide the connection from VCC to HVCC1 or HVCC2 when the correct Ra and Rd are provided on the HVCC lines. This is accomplished with the connection of the e-marked cable provided in this kit, forcing Ra on one of the HVCC pins. Details on interfacing with the register set are covered in the MAX25432 data sheet.

The internal VCONN switches protect the VCC supply against overcurrent, undervoltage, reverse overvoltage, and short-to-ground. Details on the event, reporting, debounce, action, and recovery are described in the MAX25432 data sheet.

The fast protection response to short-to-ground events can be observed by using an oscilloscope to monitor HVCC1, CC1, and VCC.

To evaluate the feature in TCPM mode, connect a 1k Ω resistor from HVCC1 to ground and a 5.1k Ω from HVCC2 to GND. HVCC1 will then be sourcing VCONN, which can range from 3.3V to 5V depending on the selected VCC voltage. Using a short wire, connect HVCC1 to ground and observe a very minimal drop on VCC voltage and fast disconnect of HVCC1 and CC1 from the VCC voltage.

Data Switch Bandwidth

USB Type-C connectors J36 and J37 can be used to test USB 2.0 high-speed bandwidth. Connector J37 is on the device side and connects to the HVD+, HVD- of the

MAX25432. Connector J36 is on the host side and connects to the MAX25432 D+, D- pins.

Before connecting a USB host to the Type-C plug remove the DCP-short resistor populated between R2 and R3.

The switches are also protected against shorting to battery and VBUS with HVD overvoltage fault discussed in the MAX25432 data sheet.

HVD+, HVD- also have integrated $\pm 15\text{kV}$ Air, $\pm 8\text{kV}$ contact ISO 10605 and IEC 61000-4-2 ESD protection.

CC Line Protection

The CC line switches are protected against shorting to battery and VBUS with HCC overvoltage fault discussed in the MAX25432 data sheet.

HVCC1, HVCC2 also have integrated $\pm 15\text{kV}$ Air, $\pm 8\text{kV}$ Contact ISO 10605 and IEC 61000-4-2 ESD protection.

Shield-Short-to-Battery Protection

A shield short-to-car-battery event can occur when a customer's portable device cable is connected to the downstream receptacle, and the far end of this cable falls in to the 12V cigarette lighter receptacle and contacts the 12V center terminal. This condition results in a damaging amount of current flow, with insufficient response time by the cigarette lighter fuse.

The MAX25432 offers advanced integrated protection for cable shield-short-to-battery faults preventing cable, passenger device, and car module damage. The solution uses fast detection of cable shield over-current, fast turn-off of external protection switch, safe dissipation of inrush energy, fault reporting, and auto-retry for fault removal.

The normally open ground logic ensures no damaging current flows on Type-C to Type-C user cables by keeping the downstream connector ground open when no device is attached.

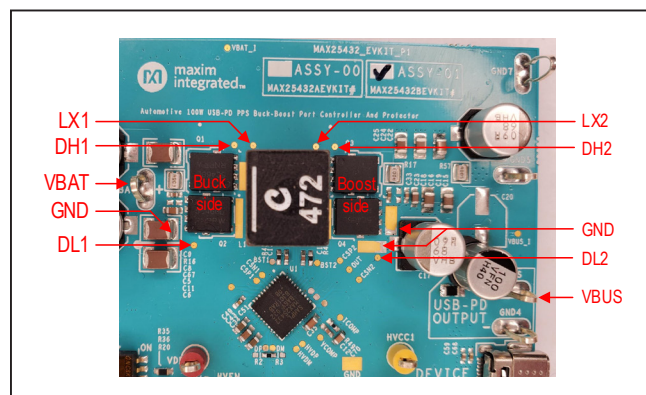


Figure 6. Buck-Boost Signals Location

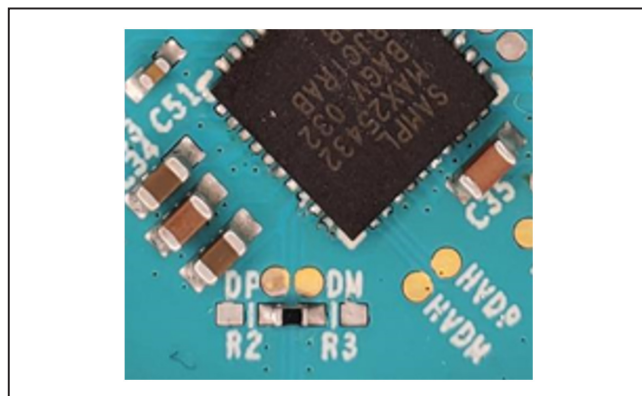


Figure 7. DP/DM 0 Ω Short

Therefore, the main board Type-C connector's ground and shield pins are floating when no R_d is detected. When a valid R_d resistor is detected, MAX25432 enables GDRV to 5V, turning the external shield FET fully ON, which connects the connector ground to EV kit ground. Refer to the MAX25432 data sheet for more information on the normally open ground function.

If the shield-short-to-battery protection feature is not needed, the shield FET can be easily bypassed by shorting the GND SHORT pads next to the J37 connector.

Note: GDRV can also be used as an active-high Type-C attach indicator.

Jumpers and Configuration

The switch SW1 allows the user to set the I²C address. Only one switch must be in the ON position at a single time.

[Table 2](#) shows jumper positions and descriptions.

Table 1. ADDR Switch

SW1 PIN	POSITION	DESCRIPTION
1	0	Switch open
	ON*	ADDR connected to ground, setting the I ² C address to 0x50
2	0*	Switch open
	ON	ADDR connected to an 8.87k Ω to ground, setting the I ² C address to 0x51
3	0*	Switch open
	ON	ADDR connected to a 15.8k Ω to ground, setting the I ² C address to 0x52
4	0*	Switch open
	ON	ADDR connected to a 10k Ω to BIAS, setting the I ² C address to 0x53

*Default position

Table 2. Jumper Descriptions

JUMPER	NAME ON PCB	POSITION	DESCRIPTION
J1	EXT_FB	Open*	Not used. Always leave open.
J2	VOUT_FB	Open*	Not used. Always leave open.
J4	J4	2-3*	Connects HVEN to VCC. Powers-up the MAX25432B.
J6	VCC_EN	1-2*	Provides VBAT power to the VCC regulator.
J7	5.0V	1-2*	Sets VCC = 5V. Leave open if using jumper J8.
J8	3.3V	1-2	Sets VCC = 3.3V. Leave open if using jumper J7.
J9	LOOP_INJECT	Open*	Not used. Always leave open.
J10	METERING_EN	Open*	Not used. Always leave open. Leaving open disables the on-board active metering circuitry.
J12	VDD_EN	1-2*	Provides VBAT power to the VDD regulator.
J13	5.0V	1-2	Sets VCC = 5V. Leave open if using jumper J14 or J15.
J14	3.3V	1-2*	Sets VCC = 3.3V. Leave open if using jumper J13 or J15.
J15	1.8V	1-2	Sets VCC = 1.8V. Leave open if using jumper J13 or J14.
J34	HVEN H	1-2	10k Ω pullup from VBAT to HVEN.
	HVEN L	2-3*	10k Ω pulldown from GND to HVEN.

*Default position

[Table 3](#) shows test points and their descriptions.

Table 3. Test Points

TEST POINT	DESCRIPTION
VBAT_FLT	Main battery input with reverse battery protection and EMI filtering. Connect a 4.5V to 36V supply.
VBAT	Main battery input with no reverse battery and input EMI filter. Direct supply to the MAX25432B's IN pin and on-board VCC and VDD regulators.
VBUS	VBUS output of the MAX25432B's external power stage.
VDD	On-board VDD regulator output and MAX25432B's I2C pullup voltage rail. Connected to pin 9 of the MAX25432B (VDD_IO).
VDD_BMC	Regulated output of the MAX25432B's internal 1.125V regulator, referenced to SHLD_SNS. Pin 13 of the MAX25432B.
VCC	On-board VCC regulator output and MAX25432B's integrated VCONN switch input. Connected to pin 16 of the MAX25432B (VCONN).
VDD_USB	Regulated output of the MAX25432B's internal 3.3V regulator. Pin 17 of the MAX25432B.
BIAS	Regulated output of the MAX25432B's internal 5V regulator. Pin 29 of the MAX25432B.
HVCC1, HVCC2	MAX25432B's high-voltage tolerant CC lines. CC passthrough and VCONN switch outputs. Pin 25 and 24 of the MAX25432B.
CC1, CC2	MAX25432B's integrated Type-C and USB-PD PHY interface. Low voltage side of the CC passthrough switches. Pin 14, 15 of the MAX25432B.
SHLD_SNS	MAX25432B's shield short-to-battery protection sense pin on G-suffix parts and USB-PD PHY ground offset compensation input on all MAX25432B parts. Pin 7 of the MAX25432B.
GDRV	Shield MOSFET gate drive output. Pin 8 of the MAX25432B.

[Table 4](#) shows LEDs and descriptions.

Table 4. LEDs

LED	DESCRIPTION
DS1	Indicates power good for the VCC (VCONN) supply
DS2	Indicates power good for the VDD (I2C) supply.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	SOLUTION
VBUS or VCONN does not come up	VCC supply is off and therefore HVEN is low	Verify VCC supply green LED is on. Verify VCC_EN jumper is on. If VCC does not work, move the HVEN-VCC jumper on J4 to the HVEN-H position on J34 to enable MAX25432.
	Internal BIAS LDO voltage is below its UVLO threshold (3.0V)	Verify VBAT is above 4.5V Verify no extra loads are applied on the BIAS pin.
	The I2C is not working	Verify the SW1 switch is in the correct position. Verify the VDD supply is on Verify the Feather board is connected to the main board and its LED is solid green or blue. Verify all jumper positions are correct. Repeat the steps described in Initial Setup or GUI setup.
	VBUS: A Type-C device is not attached in TCPM mode	Connect a Type-C device to J37. Alternatively, use an Rd pulldown resistor (5.1kΩ) on HVCC1 or HVCC2.
	VCONN: An e-marked cable and Type-C device are not attached in TCPM mode	Connect an e-marked cable and a Type-C device to J37. Alternatively, use an Ra (1kΩ) and an Rd (5.1kΩ) pulldown resistor on HVCC1 and HVCC2 in either orientation.
	A fault has occurred	Read the MAX25432 fault registers using the GUI to determine the cause.
The GUI cannot find a target	See I2C is not working	–
No USB data when connecting an upstream USB Host to the Main Board through the Type-C plug (J36)	The DP/DM pins are shorted with a 0Ω resistor	Remove the 0Ω resistor between DP and DM pins. Then, verify the Charge Mode is selected to Passthrough (SDP) or Auto-CDP using the GUI.
The VCC LED is off	The VCC regulator's output is off	Verify VCC_EN jumper is on. Verify VBAT is above the selected VCC voltage.
The VDD LED is off	The VDD regulator's output is off	Verify VDD_EN jumper is on. Verify VBAT is above the selected VDD voltage.
	The VDD target voltage is 1.8V	None. LED will not light up for 1.8V.

If none of those steps help to resolve the issue, contact Maxim Integrated for assistance.

EV Kit Specifications (Main Board)

The below table lists the EV kit electrical specifications, default BOM and configuration.

Contact Maxim for recommended BOM to target other switching frequencies and/or power levels.

Unused EV Kit Features

The following EV kit features are not used and are provided for reference only.

Main Board:

- Active metering (U2, U3, U4)
- EXT FB, VOUT_FB, and LOOP_INJECT (J1, J2, J9)

Feather Board:

- Active metering (U4, U7, U8)
- FB DRIVE DAC (U9)

References

[Table 6](#) shows the reference specifications, their locations, and the common names they are referred to in this document.

Table 5. EV Kit Specification Table

NAME	VALUE
Ambient temperature range	-40°C to +125°C
Input supply range	4.5V to 36V 16.7A peak (with $R_{CS1} = 3m$)
VBUS output range	3.3V to 21V in CV, down to 2.85V in CL 6.35A Max DC output current
Switching frequency	Default: 400kHz 220k, 300k and 2.2MHz available
Efficiency	96.5% at $V_{IN} = 14V$, $V_{OUT} = 20V$, $I_{OUT} = 5A$, 400kHz - Default EV kit BOM and configuration
Inductor	4.7μH, 25.4A I_{SAT} , 5.7mΩ
Input capacitors	2 x 56μF (Hybrid polymer) + 3 x 10μF (MLCC)
Output capacitors	2 x 68μF (Hybrid polymer) + 5 x 10μF (MLCC) Additional 100μF (Aluminum) on CSN2 for Quadramax compliance
Buck-boost power MOSFETS	40V, 7.2mΩ max (4.5V), 5 x 6mm NVMFS5C460NLAFT1G
Integrated VCONN switch	3.3V-5.0V operation, 50mA to 500mA OCP
Overvoltage and ESD protection on VBUS, HVCC1/2, HVD± and connector GND/Shield	24V DC ±15kV Air/±8kV contact ISO 10605 and IEC 61000-4-2

Table 6. Reference

REFERRED TO IN THIS DOCUMENT	TITLE	LOCATION
USB-PD Rev. 3.0	The Universal serial bus power delivery specification revision 3.0, version 1.2 June 21, 2018	http://www.usb.org
MAX25432 data sheet	Automotive 100W USB-PD Buck-boost port controller and protector 19-100826, Revision 0, August 2020	https://www.maximintegrated.com/en.html

Ordering Information

PART	TYPE
MAX25432BEVKIT#	EV Kit

Denotes RoHS-compliance.

MAX25432B Evaluation Kit

Evaluates: MAX25432

MAX25432B EV Kit Bill of Materials

REF DES	DNI/DNP	QTY	MFG PART #	DESCRIPTION
BIAS, VCC, VDD_BMC, VDD_USB	-	4	5003	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; ORANGE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
BUMP1-BUMP4	-	4	SJ-5003(BLACK)	BUMPER; BLACK-HEMISPHERICAL SHAPE EVKIT EH0231; 0.44D/0.2BH; RESILIENT ELASTOMER POLYURETHANE
C1, C36	-	2	GRM32ER71H106KA12; CL32B106KBJNNN; UMJ325KB7106KMH; 12105C106K4Z2A	CAP; SMT (1210); 10UF; 10%; 50V; X7R; CERAMIC
C2, C16, C27	-	3	C1608X7R1V105K080AC	CAP; SMT (0603); 1UF; 10%; 35V; X7R; CERAMIC
C3, C4, C13, C14, C40	-	5	CGA2B3X7R1H104K050BB; GCM155R71H104KE02; CGA2B3X7R1H104K050BE	CAP; SMT (0402); 0.1UF; 10%; 50V; X7R; CERAMIC
C5	-	1	UMK107B1J05KA; C1608X5R1H105K080AB; CL10A105KB8NNN; GRM188R61H105KAAL	CAP; SMT (0603); 1UF; 10%; 50V; X5R; CERAMIC
C6, C9, C11	-	3	C3225X7S1H106K250AB; CGA6P3X7S1H106K250AB; GCM32EC71H106K; CGA6P3X7S1H106K250AE	CAP; SMT (1210); 10UF; 10%; 50V; X7S; CERAMIC
C7, C10	-	2	8.65E+11	CAP; SMT (CASE HA0); 56UF; 20%; 50V; ALUMINUM-ELECTROLYTIC
C8, C18, C30, C38, C58, C59	-	6	C1005X7R1H104K050BB; GRM155R71H104KE14; C1005X7R1H104K050BE; UMK105B7104KV-FR	CAP; SMT (0402); 0.1UF; 10%; 50V; X7R; CERAMIC
C12	-	1	GRM155R61A333KA01	CAP; SMT (0402); 0.033UF; 10%; 10V; X5R; CERAMIC
C15, C19, C22, C24, C25	-	5	C2012X5R1V106K085AC	CAP; SMT (0805); 10UF; 10%; 35V; X5R; CERAMIC
C17, C20, C21	-	3	EEH-ZA1V680XP	CAP; SMT (CASE D8); 68UF; 20%; 35V; ALUMINUM-ELECTROLYTIC
C26, C42	-	2	C1005C0G1H271J050BA	CAP; SMT (0402); 270PF; 5%; 50V; COG; CERAMIC
C28	-	1	UMK107AB7105KA; CC0603KRX7R9BB105	CAP; SMT (0603); 1UF; 10%; 50V; X7R; CERAMIC
C29, C37	-	2	GRM31CR71H475KA12; GRJ31CR71H475KE11; GXM31CR71H475KA10; UMK316AB7475KL; GRM31CR71H475KA12L	CAP; SMT (1206); 4.7UF; 10%; 50V; X7R; CERAMIC
C31, C39	-	2	GRM32ER71E226KE15; CL32B226KAJNFN; CL32B226KAJNNW; TMK325B7226KM; C1210C226K3RAC7210	CAP; SMT (1210); 22UF; 10%; 25V; X7R; CERAMIC
C32	-	1	C0402C101J3GACAUTO	CAP; SMT (0402); 100PF; 5%; 25V; COG; CERAMIC
C33, C68	-	2	C0402C103K5RAC; GRM155R71H103KA88; C1005X7R1H103K050BE; CL05B103KB5NNN; UMK105B7103KV	CAP; SMT (0402); 0.01UF; 10%; 50V; X7R; CERAMIC
C34, C49	-	2	C0603C105K4RAC; C1608X7R1C105K080AC; EMK107B7105KA; CGA3E1X7R1C105K080AC; 0603YC105KAT2A	CAP; SMT (0603); 1UF; 10%; 16V; X7R; CERAMIC
C35	-	1	GRM188Z71C475KE21	CAP; SMT (0603); 4.7UF; 10%; 16V; X7R; CERAMIC
C41, C50	-	2	GRM31CR71H225KA88; UMK316B7225K	CAP; SMT (1206); 2.2UF; 10%; 50V; X7R; CERAMIC
C43	-	1	GRM188R61C106KAAL	CAP; SMT (0603); 10UF; 10%; 16V; X5R; CERAMIC
C45	-	1	GRM155R71H102JA01; GCM155R71H102JA37	CAP; SMT (0402); 1000PF; 5%; 50V; X7R; CERAMIC
C47	-	1	C0402C123K4RAC; GRM155R71C123KA01; CC0402KRX7R7BB123	CAP; SMT (0402); 0.012UF; 10%; 16V; X7R; CERAMIC
C51	-	1	C0402C103K4RACAUTO	CAP; SMT (0402); 0.01UF; 10%; 16V; X7R; CERAMIC
C53, C55, C64	-	3	C1005X7R1C104K050BC; ATC530L104KT16; 0402YC104KAT2A; C0402X7R160-104KNE; CL05B104K05NNNC; GRM155R71C104KA88; C1005X7R1C104K; CC0402KRX7R7BB104; EMK105B7104KV; CL05B104KO5	CAP; SMT (0402); 0.1UF; 10%; 16V; X7R; CERAMIC
C60, C61	-	2	C1608X7R1H224K080; GRM188R71H224KAC4	CAP; SMT (0603); 0.22UF; 10%; 50V; X7R; CERAMIC
C70	-	1	LMK105B7474KV; GRM155R71A474KE01	CAP; SMT (0402); 0.47UF; 10%; 10V; X7R; CERAMIC
C74	-	1	EEV107M035A9H	CAP; SMT; 100UF; 20%; 35V; ALUMINUM-ELECTROLYTIC ;
CC1, CC2, HVCC1, HVCC2	-	4	5009	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; YELLOW; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
D1	-	1	BAT54AW-7-F	DIODE; SCH; SMT (SOT-323); PIV=30V; IF=0.2A
D2	-	1	BZT52C10S-7-F	DIODE; ZNR; SMT (SOD-323); VZ=10V; IZ=0.005A
DS1, DS2	-	2	APT1608LZGCK	DIODE; LED; GREEN WATER CLEAR; GREEN; SMT (0603); VF=2.65V; IF=0.002A
GDRV, SHLD_SNS	-	2	5007	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; WHITE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;

MAX25432B EV Kit Bill of Materials (continued)

REF_DES	DNI/DNP	QTY	MFG PART #	DESCRIPTION
GND1, GND2, GND4-GND7, VBAT, VBAT_FLT, VBUS	-	9	5020	EVKIT PART - MAXIM PAD; TEST POINT; PIN DIA=0.094IN; TOTAL LENGTH=0.350IN; BOARD HOLE=0.040IN; NONE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
J1, J2, J6-J10, J12-J15	-	11	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC
J3	-	1	SBH11-PBPC-D20-RA-BK	CONNECTOR; MALE; THROUGH HOLE; HEADER CONNECTOR; RIGHT ANGLE; 40PINS
J4	-	1	TSW-110-07-G-S	CONNECTOR; MALE; THROUGH HOLE; 0.025 IN SQ POST HEADER; STRAIGHT; 10PINS
J5	-	1	ESHF-110-01-L-D-SM-K	CONNECTOR; MALE; SMT; SHROUDED AND EJECTOR IDC HEADER; STRAIGHT; 20PINS
J34	-	1	TSW-103-23-G-S	CONNECTOR; THROUGH HOLE; SINGLE ROW; STRAIGHT; 3PINS; -55 DEGC TO +125 DEGC
J36	-	1	DX07P024MJ1	CONNECTOR; FEMALE; SMT; USB 3.1; SUPERSPEED; RIGHT ANGLE; 24PINS
J37	-	1	2012670005	CONNECTOR; FEMALE; SMT; USB TYPE C RECEPTACLE; RIGHT ANGLE; 24PINS
L1	-	1	XAL1010-472ME	INDUCTOR; SMT; SHIELDED; 4.7UH; TOL=+/-20%; 17.5A
L2, L4	-	2	LQM21P24R7MGR	INDUCTOR; SMT (0805); FERRITE; 4.7UH; 20%; 0.8A
L3	-	1	XAL1060-222ME	INDUCTOR; SMT; COMPOSITE; 2.2UH; 20%; 20A
L5	-	1	BLM315N500S21	INDUCTOR; SMT (1206); FERRITE-BEAD; 50 AT 100MHZ; TOL=12.5OHMS; 12A
MISC1	-	1	FFSD-10-D-02.00-01-N	CABLE ASSEMBLY; IDC RIBBON CABLE ASSEMBLY; FEMALE-FEMALE; DOUBLE END; 0.05IN PITCH; 20 PINS
Q1-Q4	-	4	NVMF55C460NLAFT1G	TRAN; NCH; POWER MOSFET; SO-8FL; PD-(50W); I-(78A); V-(40V)
Q5	-	1	FDWS9509L-F085	TRAN; PCH; POWER-56; PD-(107W); I-(65A); V-(40V)
Q6	-	1	NVTF55C466NLTAG	TRAN; NCH MOSFET; WDFN8; PD-(38W); I-(51A); V-(40V)
R1, R12-R15, R18, R19, R22, R23, R30, R44, R45, R48, R50-R52, R61, R62	-	18	RC0402JR-070RL; CR0402-16W-000RJT	RES; SMT (0402); 0; 5%; JUMPER; 0.0630W
R4, R8	-	2	CRCW040223K2FK; RC0402FR-0723K2L	RES; SMT (0402); 23.2K; 1%; +/-100PPM/DEGC; 0.0630W
R5	-	1	PFO603FRE7T0R01Z	RES; SMT (0603); 0.01; 1%; +/-50PPM/DEGC; 0.3300W
R6, R24	-	2	ERJ-2RKF5102	RES; SMT (0402); 51K; 1%; +/-100PPM/DEGC; 0.1000W
R7, R25	-	2	CRCW040240K2FK	RES; SMT (0402); 40.2K; 1%; +/-100PPM/DEGC; 0.0630W
R9, R20, R26, R29, R39, R40, R54-R56	-	9	ERJ-2RKF1002	RES; SMT (0402); 10K; 1%; +/-100PPM/DEGC; 0.1000W
R10	-	1	ERJ-2RKF8061	RES; SMT (0402); 8.06K; 1%; +/-100PPM/DEGC; 0.1000W
R11	-	1	RC1608J000CS; CR0603-J/-000ELF; RC0603JR-070RL	RES; SMT (0603); 0; 5%; JUMPER; 0.1000W
R16, R17	-	2	KRL2012E-M-R003-F	RES; SMT (0508); 0.003; 1%; +/-50PPM/DEGC; 1W
R27, R28, R32, R42, R46, R47	-	6	ERJ-2GE0R00	RES; SMT (0402); 0; JUMPER; JUMPER; 0.1000W
R31, R33	-	2	CRCW04024K70FK; MCR01MZPF4701	RES; SMT (0402); 4.7K; 1%; +/-100PPM/DEGC; 0.0630W
R34	-	1	CRCW040213K7FK	RES; SMT (0402); 13.7K; 1%; +/-100PPM/DEGC; 0.0630W
R35	-	1	CRCW06038K87FK; RMC0603FT8K87	RES; SMT (0603); 8.87K; 1%; +/-100PPM/DEGC; 0.1000W
R36	-	1	AC0603FR-0715K8L; CRCW060315K8FK; ERJ-3EKF1582	RES; SMT (0603); 15.8K; 1%; +/-100PPM/DEGC; 0.1000W
R37	-	1	CRCW040242K2FK; RC0402FR-0742K2L	RES; SMT (0402); 42.2K; 1%; +/-100PPM/DEGC; 0.0630W
R38	-	1	TNPW060320R0BE	RES; SMT (0603); 20; 0.10%; +/-25PPM/DEGC; 0.1000W
R41	-	1	CRG0603F10K	RES; SMT (0603); 10K; 1%; +/-100PPM/DEGC; 0.1000W
R49	-	1	CRCW0402499RFK	RES; SMT (0402); 499; 1%; +/-100PPM/DEGC; 0.0630W
R57	-	1	KRL2012E-M-R005-F-T5; KRL2012E-M-R005-F	RES; SMT (0508); 0.005; 1%; +/-50PPM/DEGC; 1W
R63	-	1	CRCW0805100KFK; RK73H2ATTD1003; ERJ-6ENF1003	RES; SMT (0805); 100K; 1%; +/-100PPM/DEGC; 0.1250W
SHIELD	-	1	5006	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
SHUNT_J4, SHUNT_J6, SHUNT_J7, SHUNT_J12, SHUNT_J14, SHUNT_J34	-	6	QPC02SXGN-RC	CONNECTOR; FEMALE; 0.100IN CC; OPEN TOP; JUMPER; STRAIGHT; 2PINS
SW1	-	1	TDA04H0SB1	SWITCH; SPST; 24V; 0.025A; TDA SERIES; ULTRA-MINIATURE SURFACE MOUNT HALF-PITCH DIP SWITCH; RCOIL=0.1 OHM; RINSULATION=100M OHM

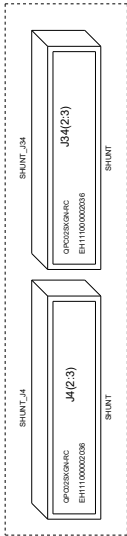
MAX25432B EV Kit Bill of Materials (continued)

REF_DES	DNI/DNP	QTY	MFG PART #	DESCRIPTION
U1	-	1	MAX25432BATLG/V+	EVKIT PART - IC; MAX25432BATLG/V+; AUTOMOTIVE 100W USB-PD-PPS BUCK-BOOST PORT CONTROLLER AND PROTECTOR; TQFN40-EP; PACKAGE OUTLINE DRAWING: 21-0141; PACKAGE CODE: T4066+5C; LAND PATTERN NUMBER: 90-0055
U2, U3	-	2	MAX4372FEUK+	IC; AMP; LOW-COST; MICROPOWER; HIGH-SIDE CURRENT-SENSE AMPLIFIER WITH VOLTAGE OUTPUT; SOT23-5
U4	-	1	MAX4372HEUK+	IC; AMP; LOW-COST; MICROPOWER; HIGH-SIDE CURRENT-SENSE AMPLIFIER WITH VOLTAGE OUTPUT; SOT23-5
U6, U7	-	2	MAX20075ATCA	IC; CONV; 36V 1A MINI BUCK CONVERTER WITH SUA IQ; TDFN12-EP
VBUS_HOST	-	1	ANY	TEST POINT; MICRO_TP; PAD DIA: 0.8128 MM(32MILS) SOLDERMASK: 0.9144 MM(36MILS) THERMAL RELIEF/ANTIPAD: 1.574MM(62MILS); SMD
VDD	-	1		TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.35IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
PCB	-	1	MAX25432	PCB:MAX25432
BST1, BST2, CSN1, CSN2, CSN2_S, CSP1, CSP2, CSP2_S, DH1_GATE, DH2_GATE, DL1_GATE, DL2_GATE, DM, DP, HVDM, HVDP, ICOMP, LX1, LX2, OUT, OUT_S, SHLD_S, VBAT_I, VBUS_I, VCC_I, VCOMP	DNP	0	N/A	TEST POINT; MICRO_TP; PAD DIA: 0.8128 MM(32MILS) SOLDERMASK: 0.9144 MM(36MILS) THERMAL RELIEF/ANTIPAD: 1.574MM(62MILS); SMD
C23	DNP	0	C0402C103K5RAC; GRM155R71H103KA88; C1005X7R1H103K050BE; CL05B103KB5NNN; UMK105B7103KV	CAP; SMT (0402); 0.01UF; 10%; 50V; X7R; CERAMIC
C44	DNP	0	C0402C101J3GACAU0	CAP; SMT (0402); 100PF; 5%; 25V; C0G; CERAMIC
C46, C48	DNP	0	C1005C0G1H271J050BA	CAP; SMT (0402); 270PF; 5%; 50V; C0G; CERAMIC
C52	DNP	0	UMK325AB7106MMHP	CAP; SMT (1210); 10UF; 20%; 50V; X7R; CERAMIC
C54, C62	DNP	0	YFF31AH2A104MT0Y0N	CAP; SMT (1206); 0.1UF; 20%; 100V; CERAMIC
C56, C57, C65	DNP	0	C0402C102K5RAC; GCM04X7R102K50NT; C0402X7R500-102K; GRM155R71H102KA01	CAP; SMT (0402); 1000PF; 10%; 50V; X7R; CERAMIC;
C63	DNP	0	C0603C104K5RAC; C1608X7R1H104K; ECJ-1VB1H104K; GRM188R71H104KA93; CGJ3E2X7R1H104K080AA; C1608X7R1H104K080AA; CL10B104KB8NNN; CL10B104KB8NFN; 06035C104KAT2A; 06035C104KAT4A	CAP; SMT (0603); 0.1UF; 10%; 50V; X7R; CERAMIC;
C66	DNP	0	GRM155R71H102JA01; GCM155R71H102JA37	CAP; SMT (0402); 1000PF; 5%; 50V; X7R; CERAMIC
C67	DNP	0	CGA2B3X7R1H104K050BB; GCM155R71H104KE02; CGA2B3X7R1H104K050BE	CAP; SMT (0402); 0.1UF; 10%; 50V; X7R; CERAMIC
C71	DNP	0	C0402X7R500-222KNE; GRM155R71H222KA01; C1005X7R1H222K050BA	CAP; SMT (0402); 2200PF; 10%; 50V; X7R; CERAMIC
C72, C73	DNP	0	C0402C101K5GAC; C1005C0G1H101K050BA	CAP; SMT (0402); 100PF; 10%; 50V; C0G; CERAMIC
L6	DNP	0	PA4341.471NLT	INDUCTOR; SMT; SHIELDED; 0.47UH; 20%; 17.5A
L7	DNP	0	TFM252012ALMAR22MTAA	INDUCTOR; SMT; THIN FILM; 0.22UH; 20%; 6.7A
R2, R3, R21, R60	DNP	0	RC0402JR-070RL; CR0402-16W-000RJT	RES; SMT (0402); 0; 5%; JUMPER; 0.0630W
R43	DNP	0	ERJ-U6QJR22	RES; SMT (0805); 0.22; 5%; 0 TO +/-150PPM/DEGC; 0.2500W
R53	DNP	0	RC0402FR-0710KL	RES; SMT (0402); 10K; 1%; +/-100PPM/DEGC; 0.0630W
R58, R59	DNP	0	ERJ-2GE0R00	RES; SMT (0402); 0; JUMPER; JUMPER; 0.1000W
TOTAL				185

MAX25432B EV Kit Schematic

MECHANICAL AND ASSEMBLY

MAX25432 CONFIGURATION SHUNTS



VCC SUPPLY CONFIGURATION SHUNTS



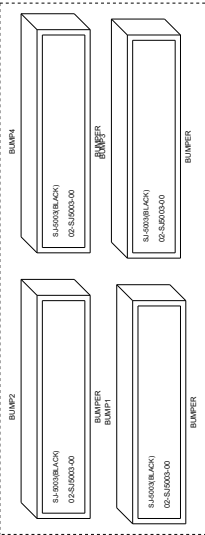
VDD SUPPLY CONFIGURATION SHUNTS



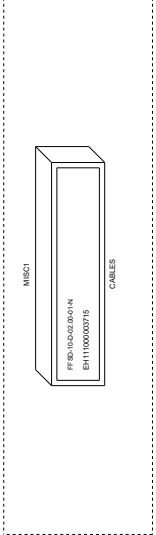
INTENTIONAL SHORTS



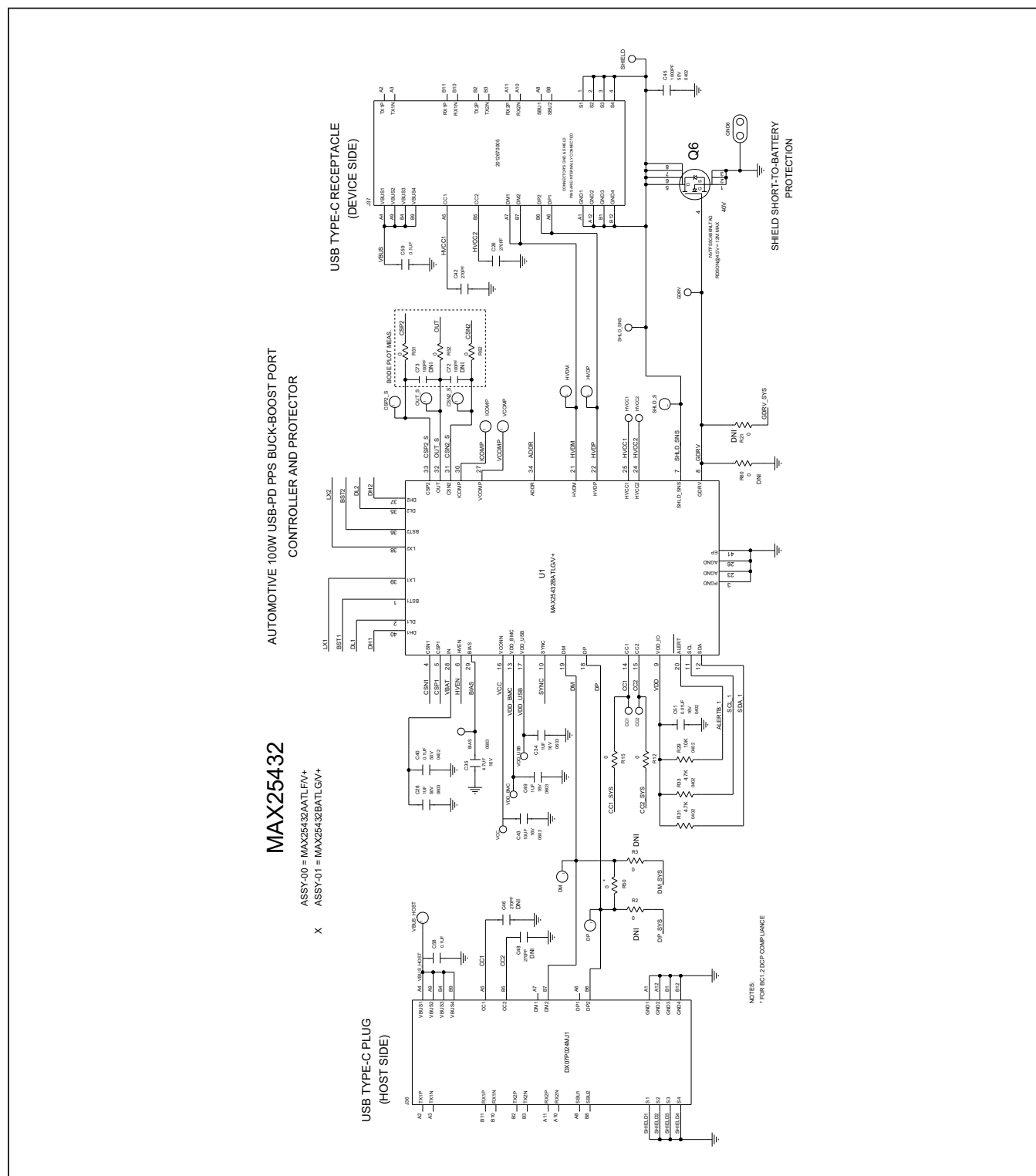
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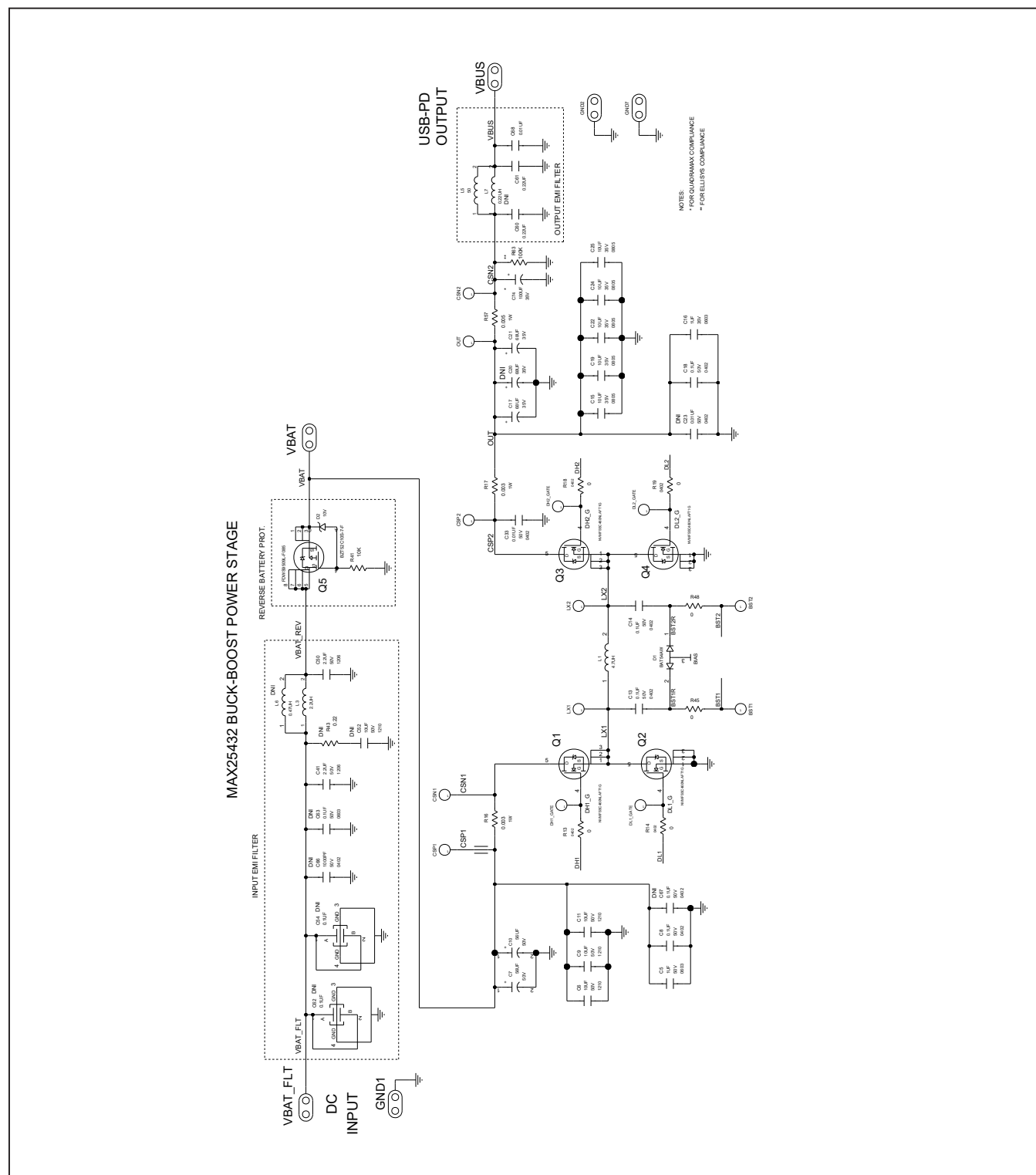
CABLES



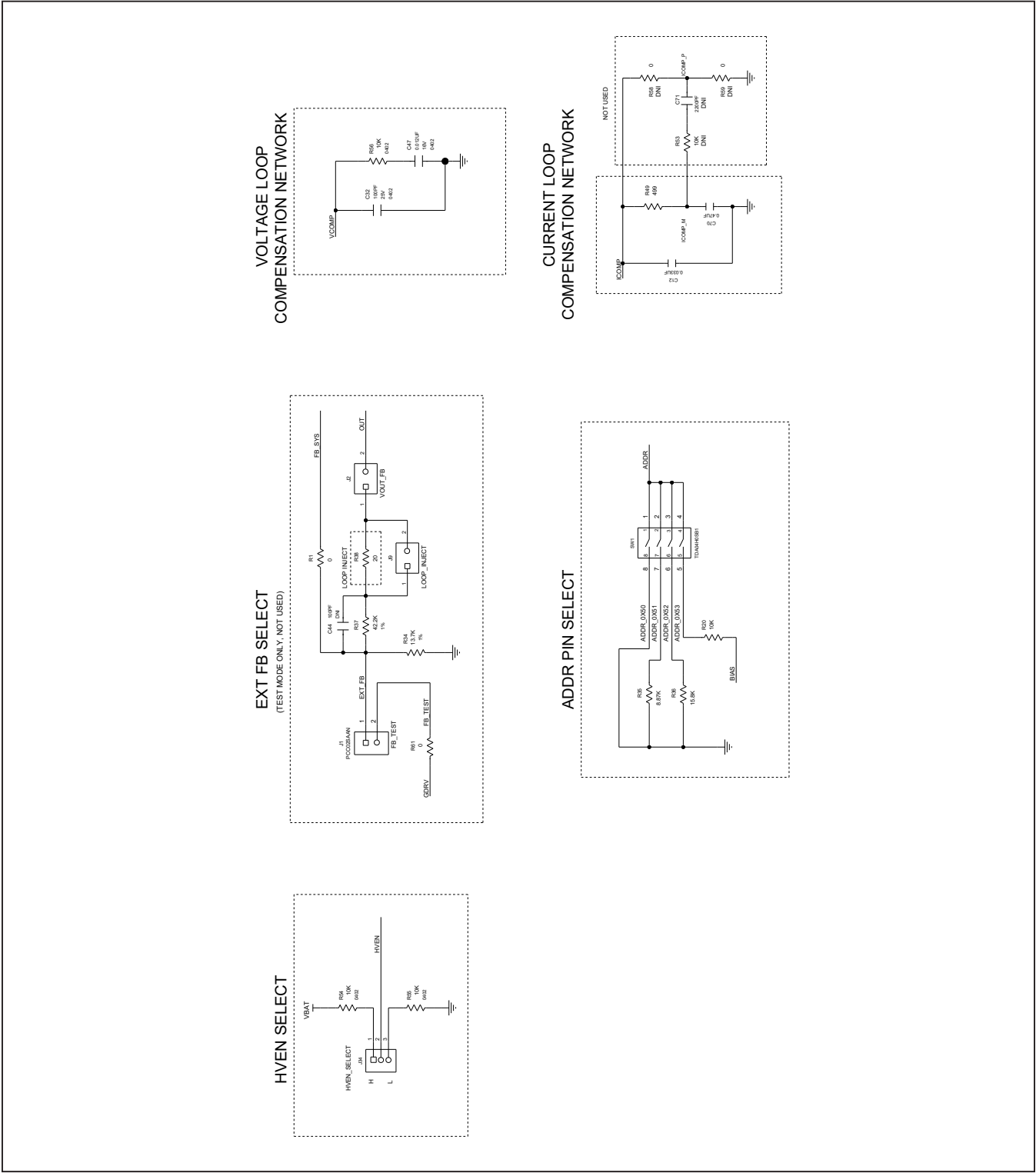
MAX25432B EV Kit Schematic (continued)



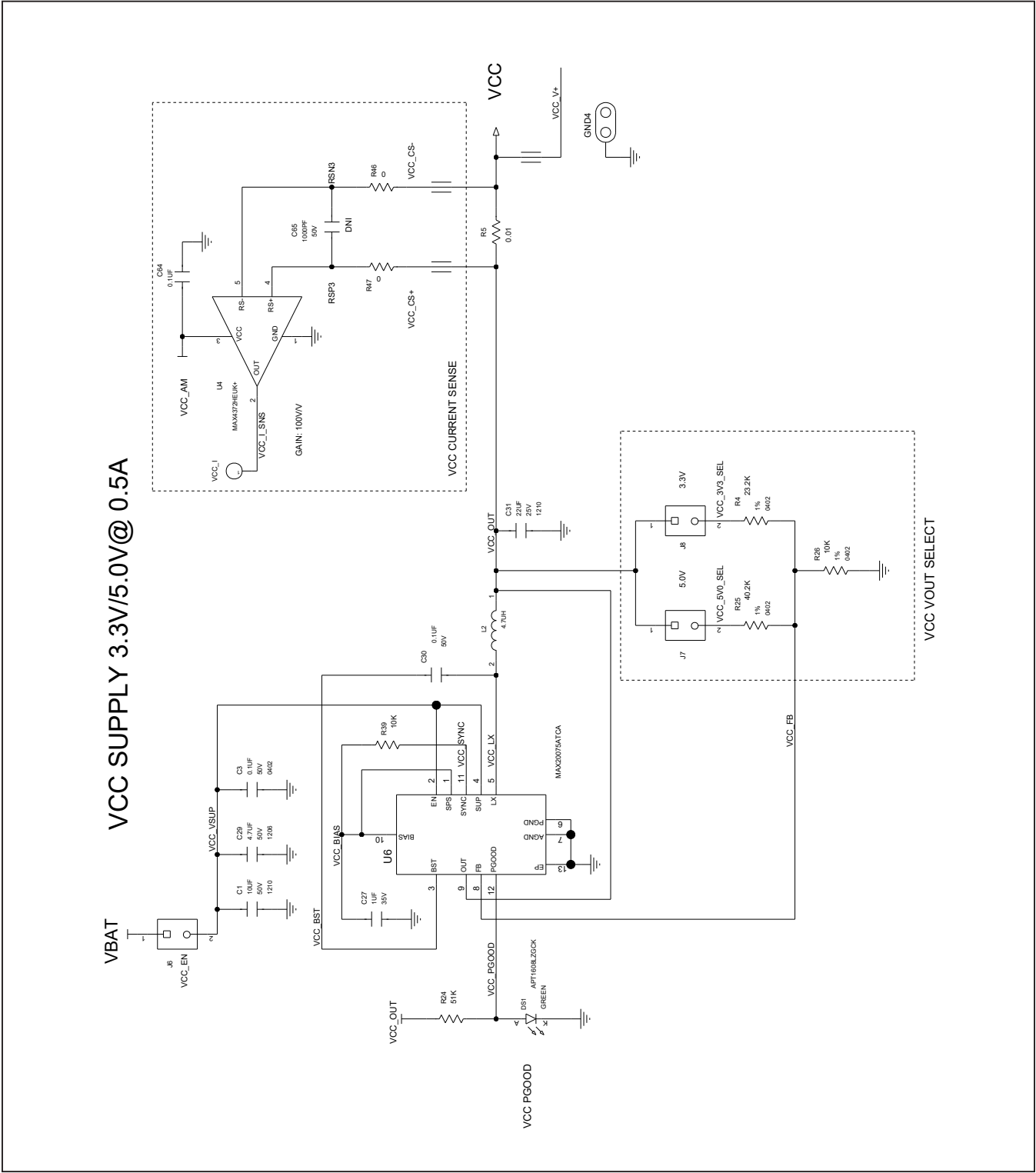
MAX25432B EV Kit Schematic (continued)



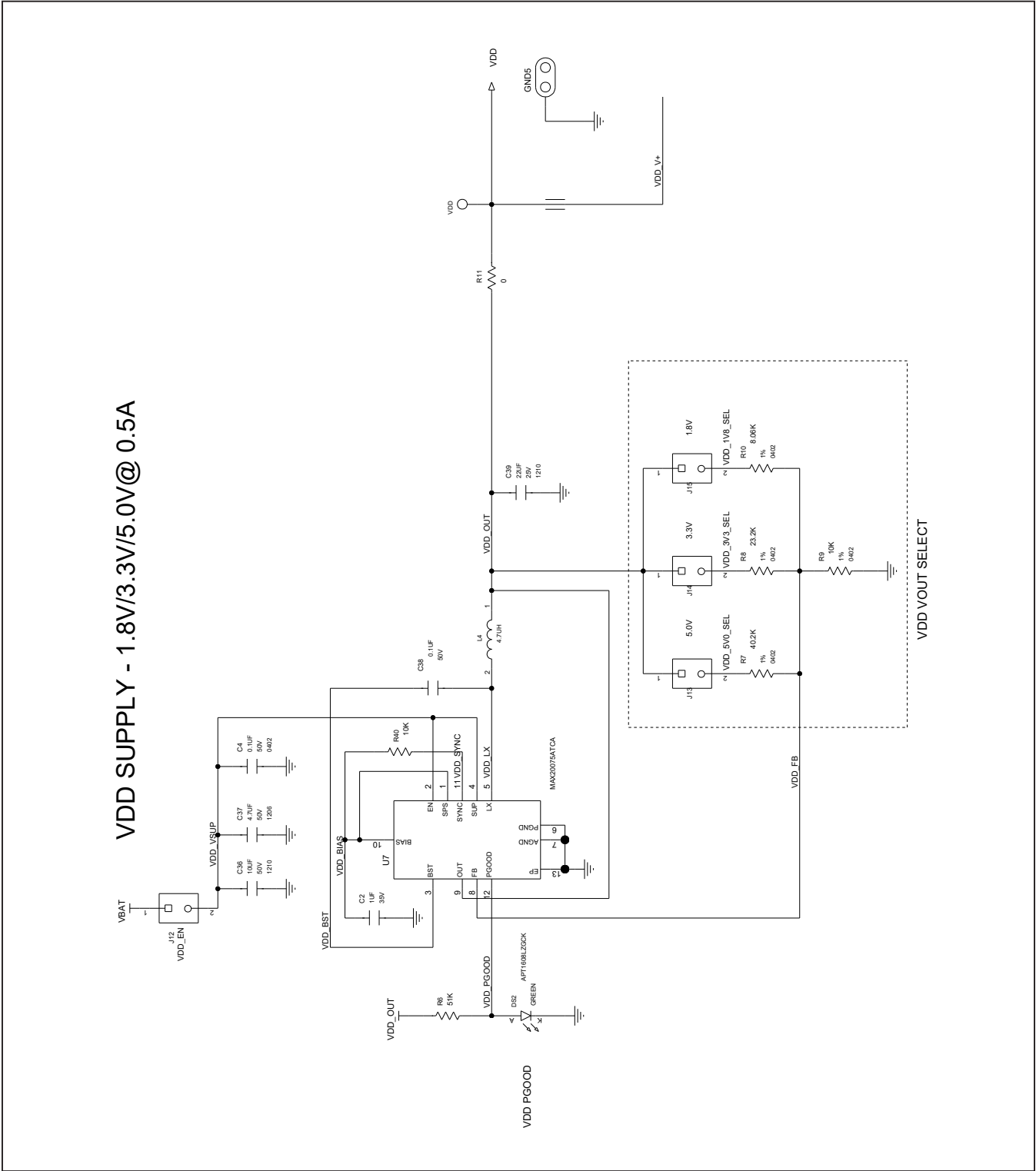
MAX25432B EV Kit Schematic (continued)



MAX25432B EV Kit Schematic (continued)

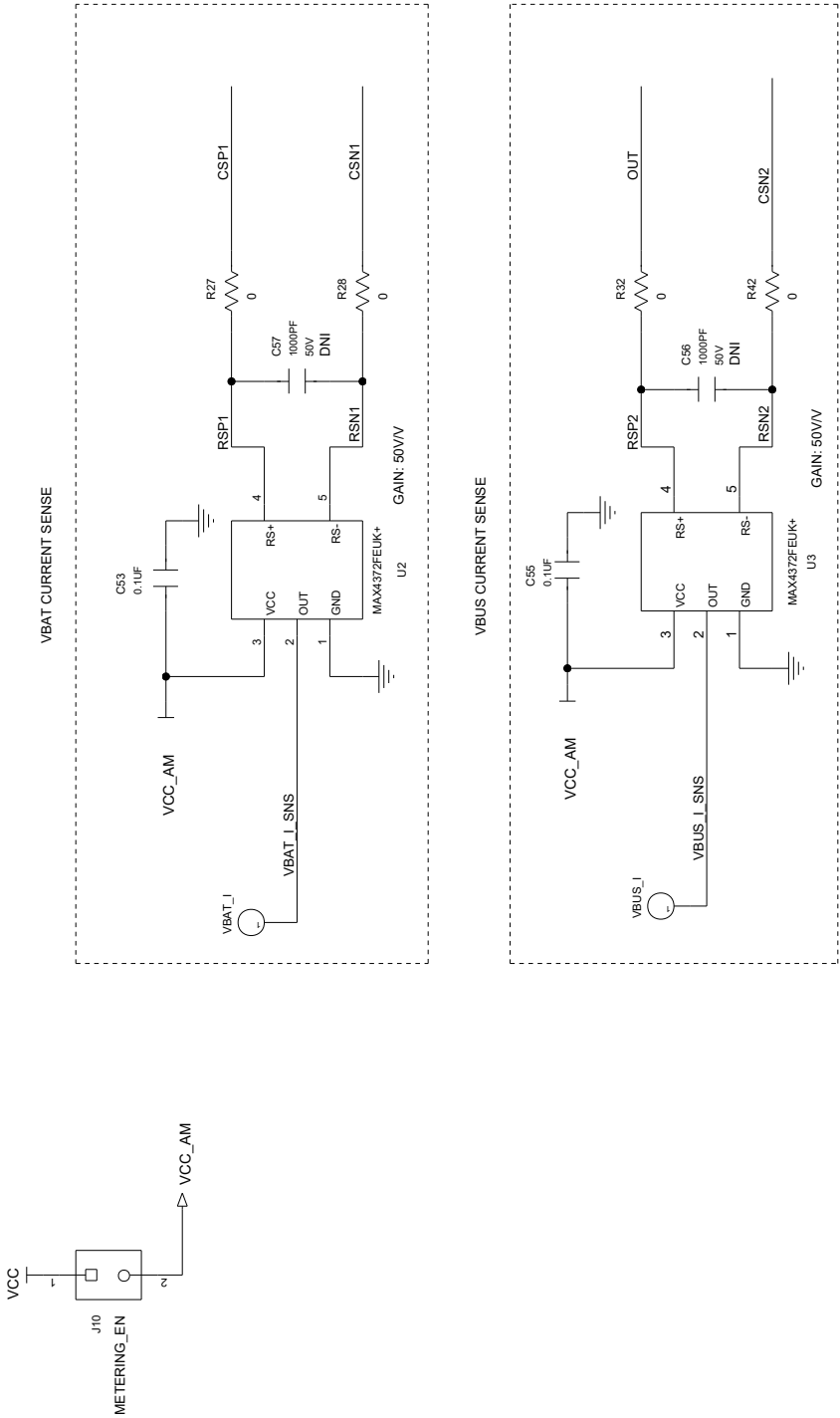


MAX25432B EV Kit Schematic (continued)



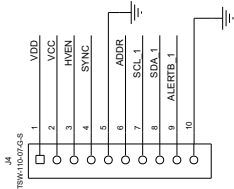
MAX25432B EV Kit Schematic (continued)

ACTIVE METERING (FOR GUI)

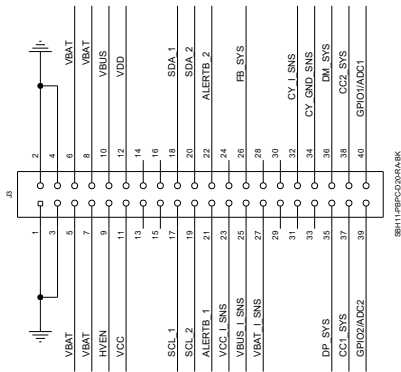


MAX25432B EV Kit Schematic (continued)

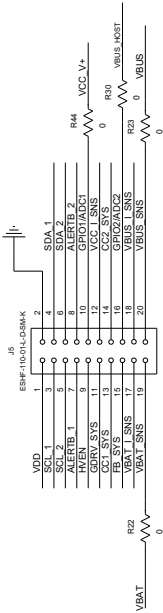
MAX25432 HEADER



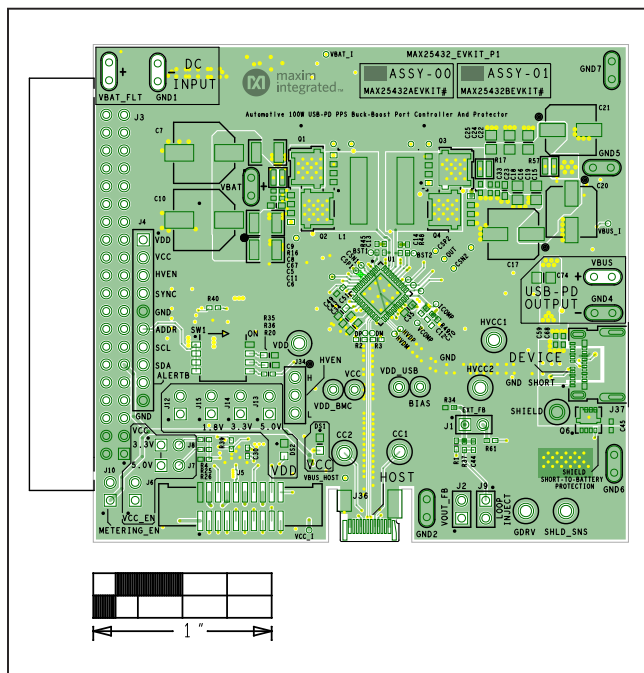
SYSTEM INTERFACE



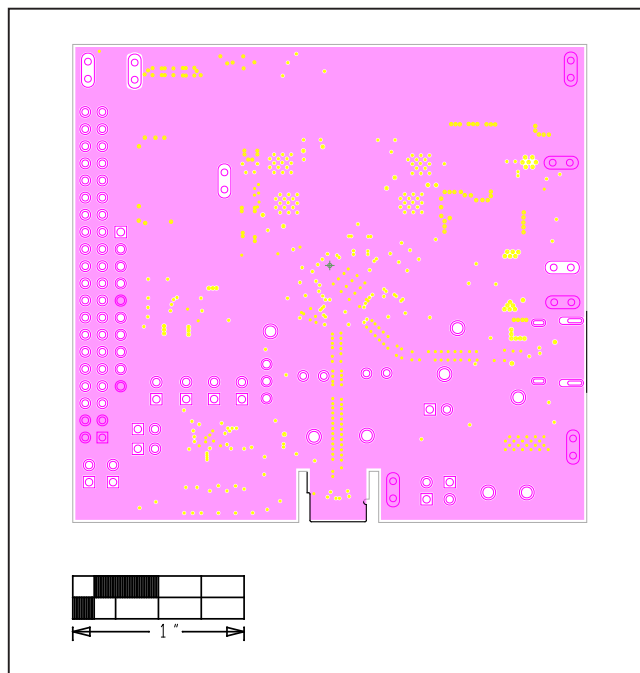
MAXPD FTHR ADAPTER INTERFACE



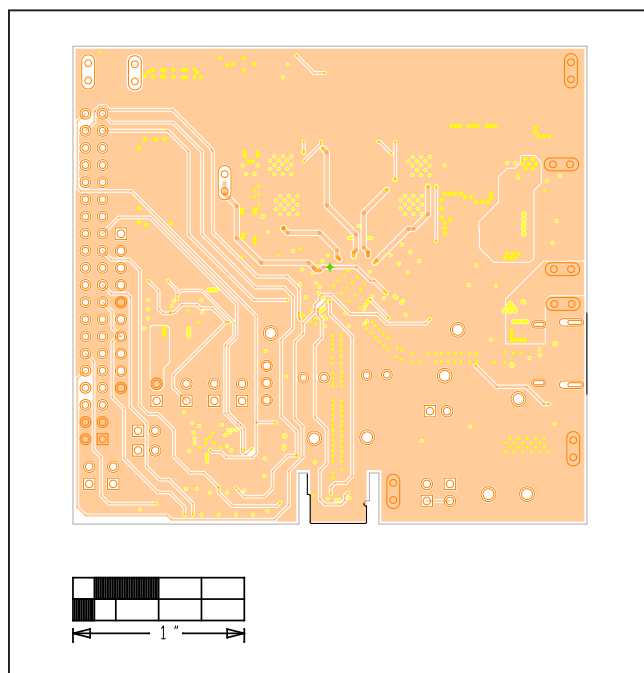
MAX25432B EV Kit PCB Layout



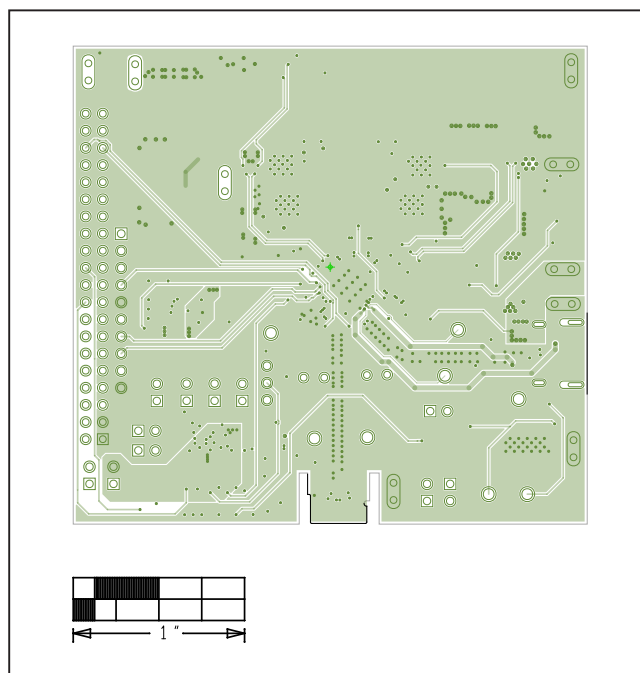
MAX25432B EV Kit PCB Layout—Top View with Silkscreen



MAX25432B EV Kit PCB Layout—Layer 2

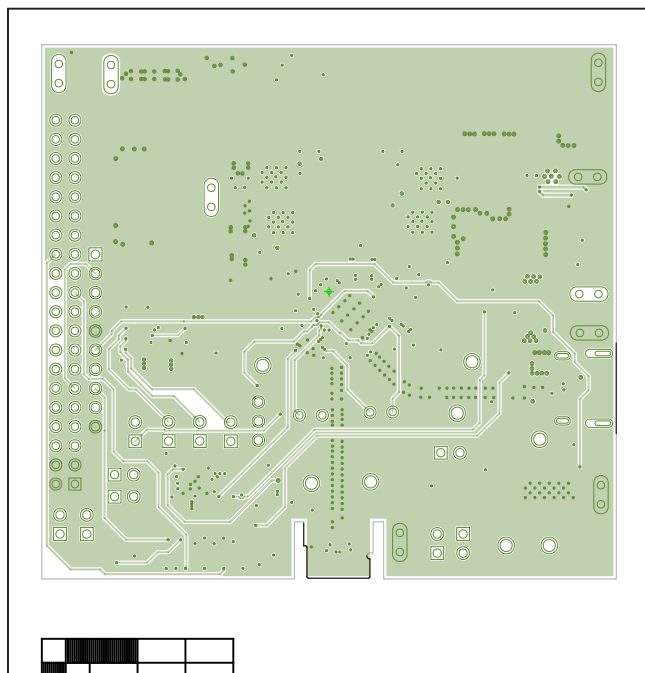


MAX25432B EV Kit PCB Layout—Layer 3

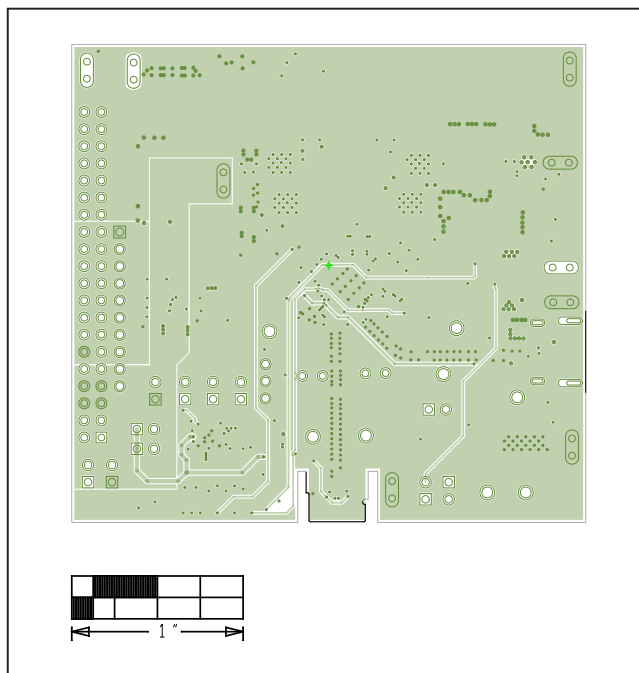


MAX25432B EV Kit PCB Layout—Layer 4

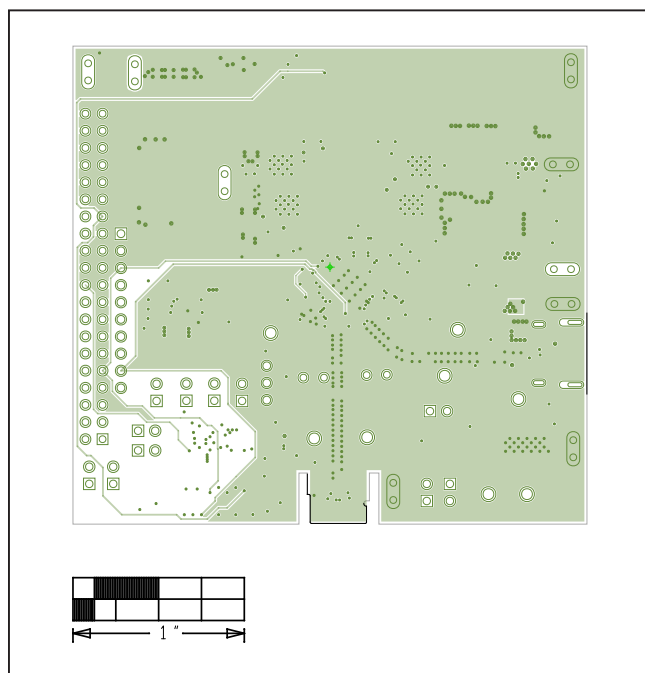
MAX25432B EV Kit PCB Layout (continued)



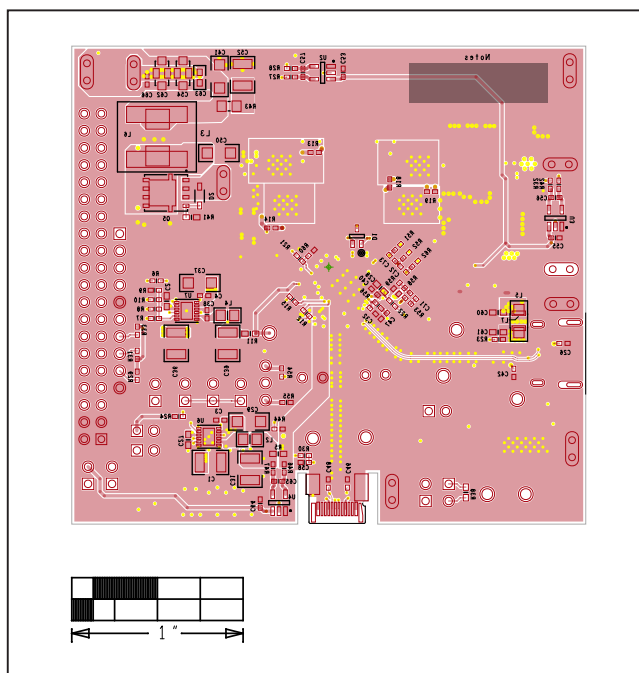
MAX25432B EV Kit PCB Layout—Layer 5



MAX25432B EV Kit PCB Layout—Layer 6

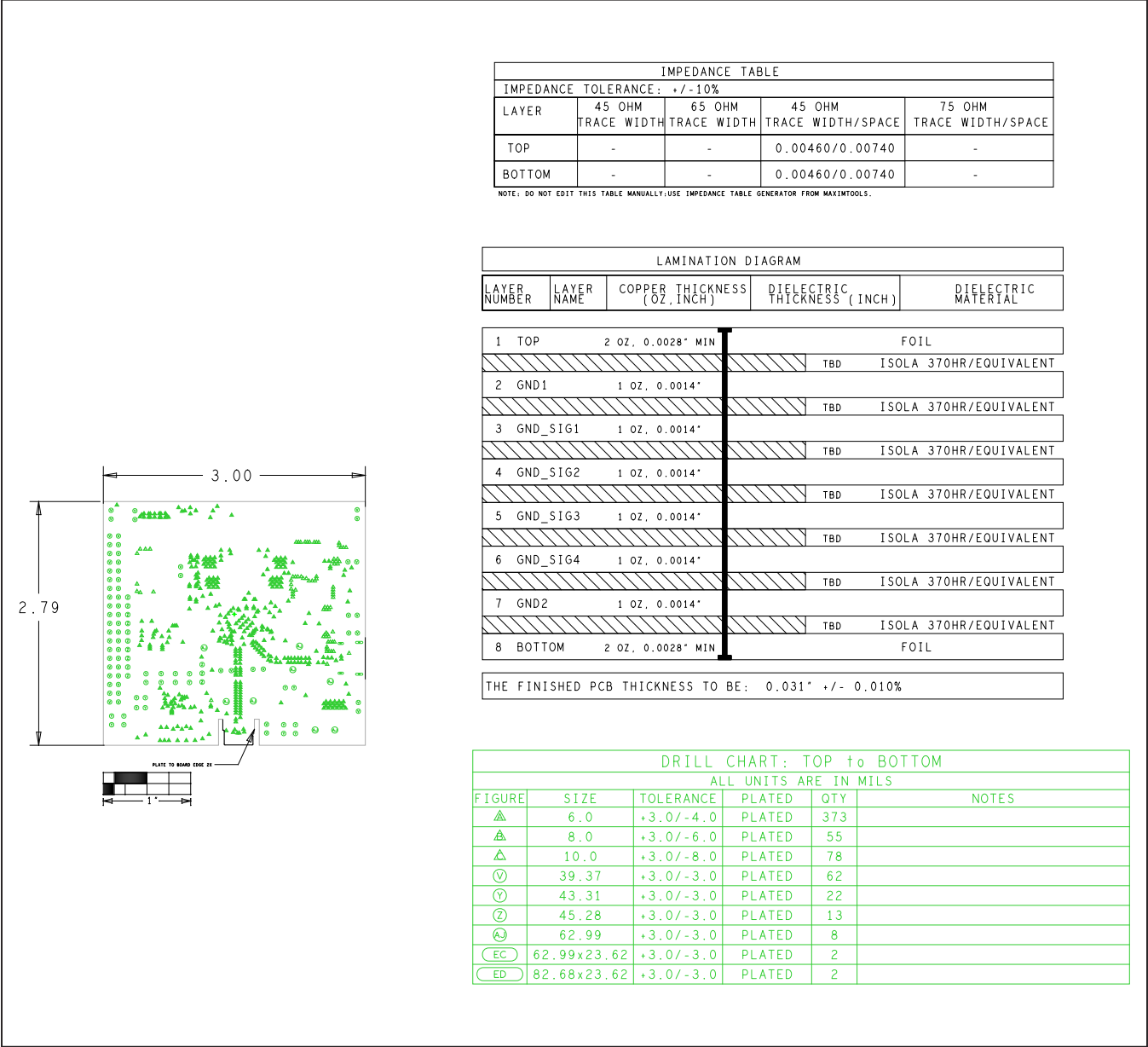


MAX25432B EV Kit PCB Layout—Layer 7



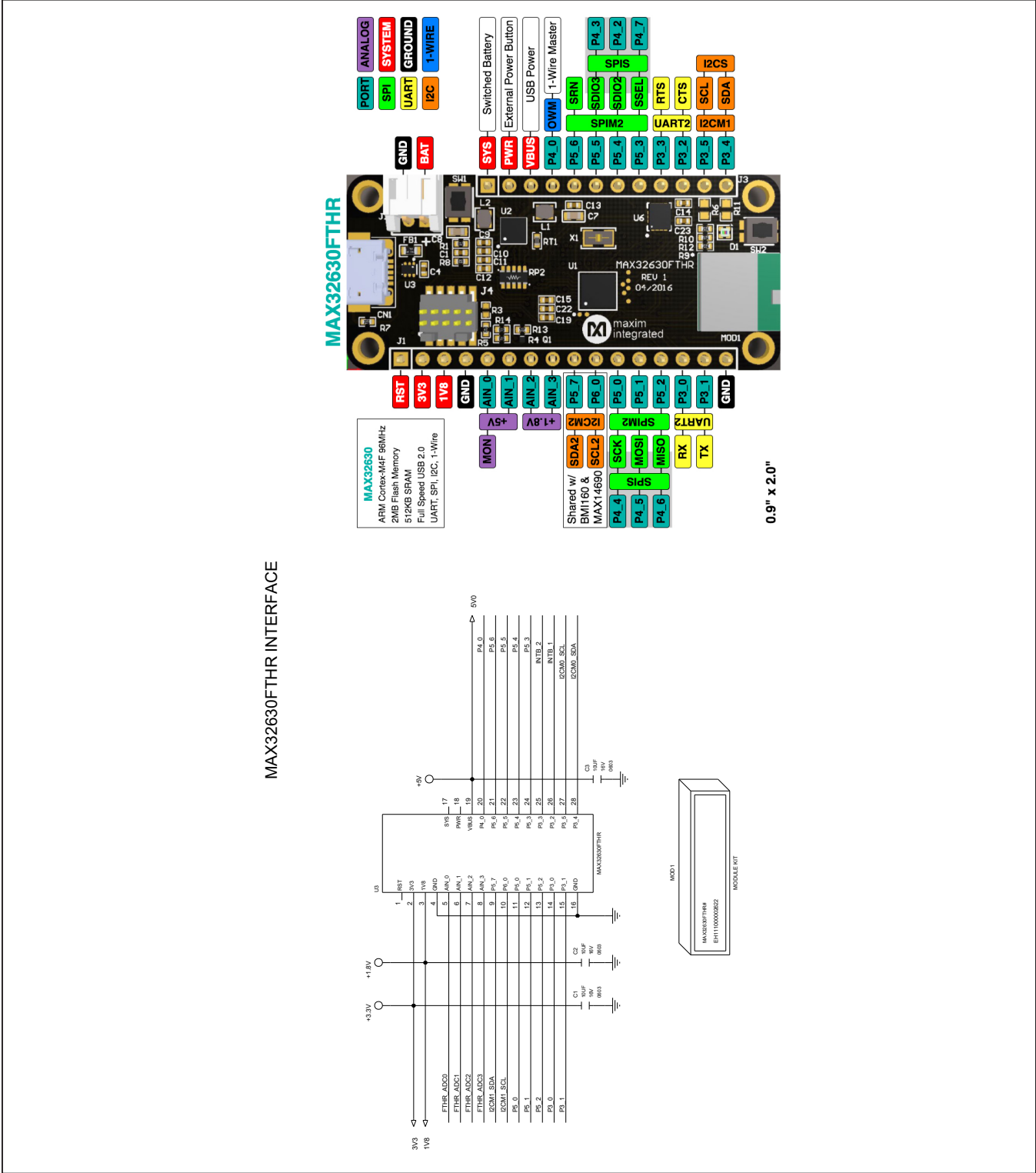
MAX25432B EV Kit PCB Layout—Bottom View with Silkscreen

MAX25432B EV Kit PCB Layout (continued)



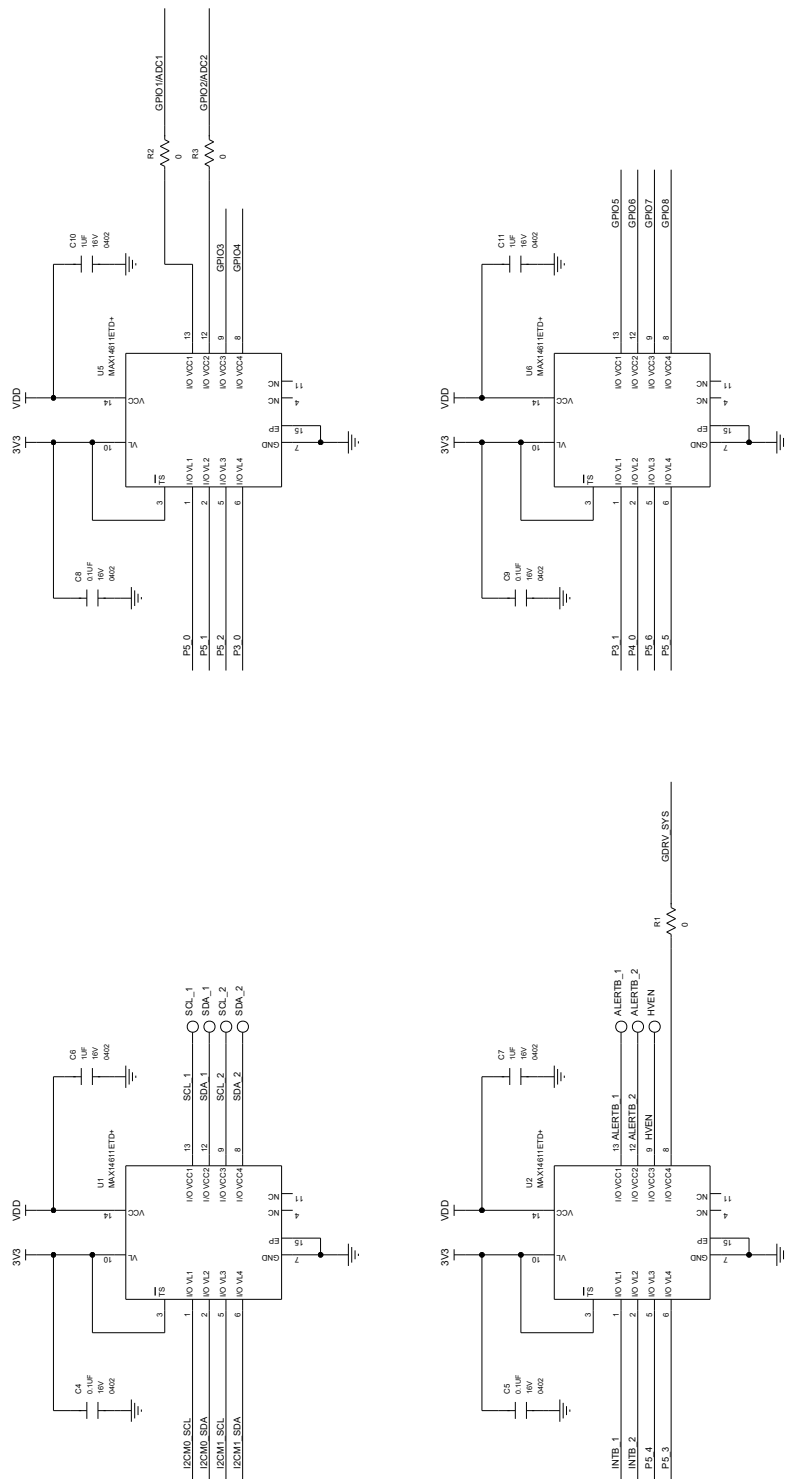
MAX25432B EV Kit PCB Layout—Fab Drawing

MAX25432B EV Kit Feather Board Schematic

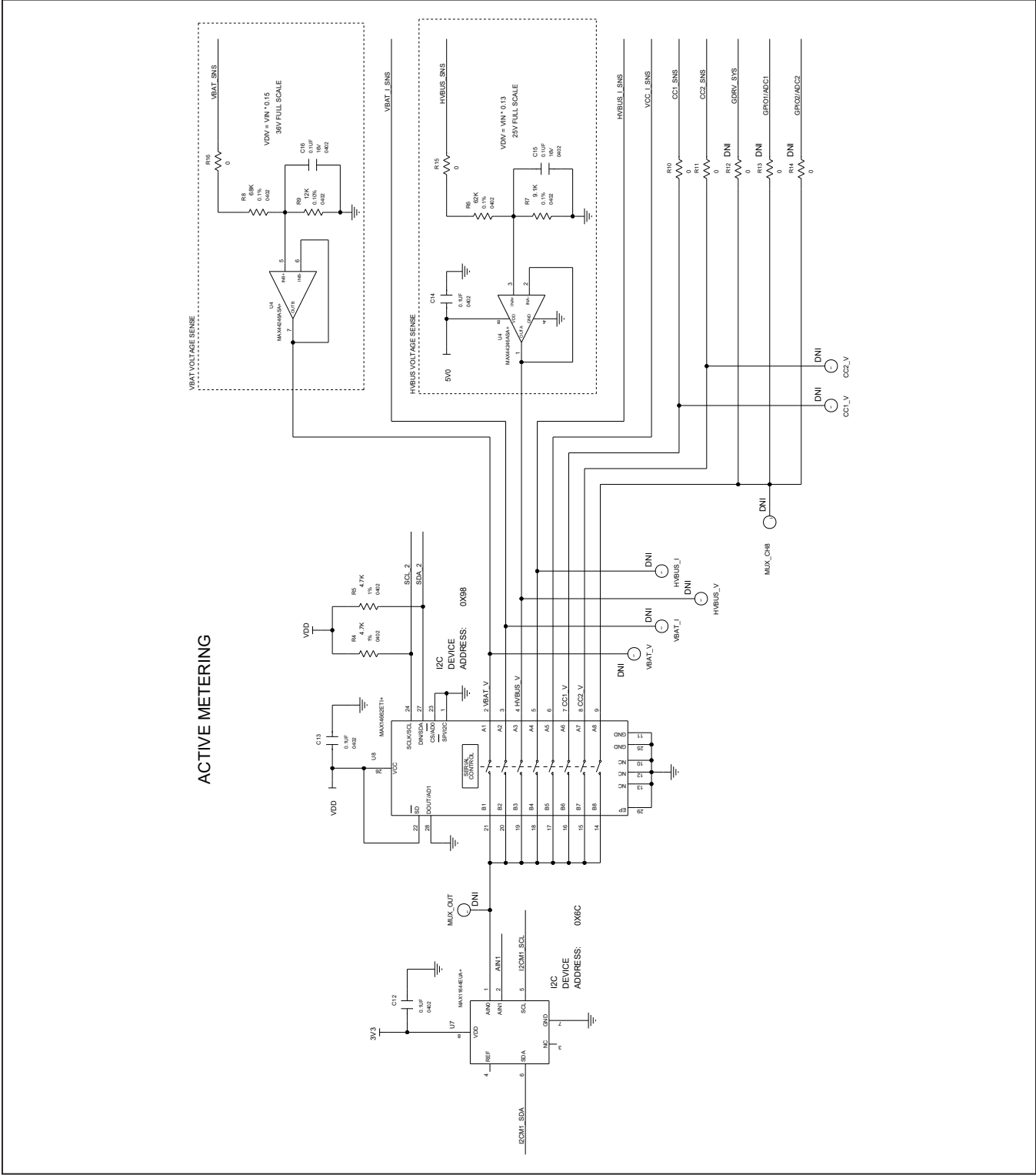


MAX25432B EV Kit Feather Board Schematic (continued)

LEVEL-SHIFTERS

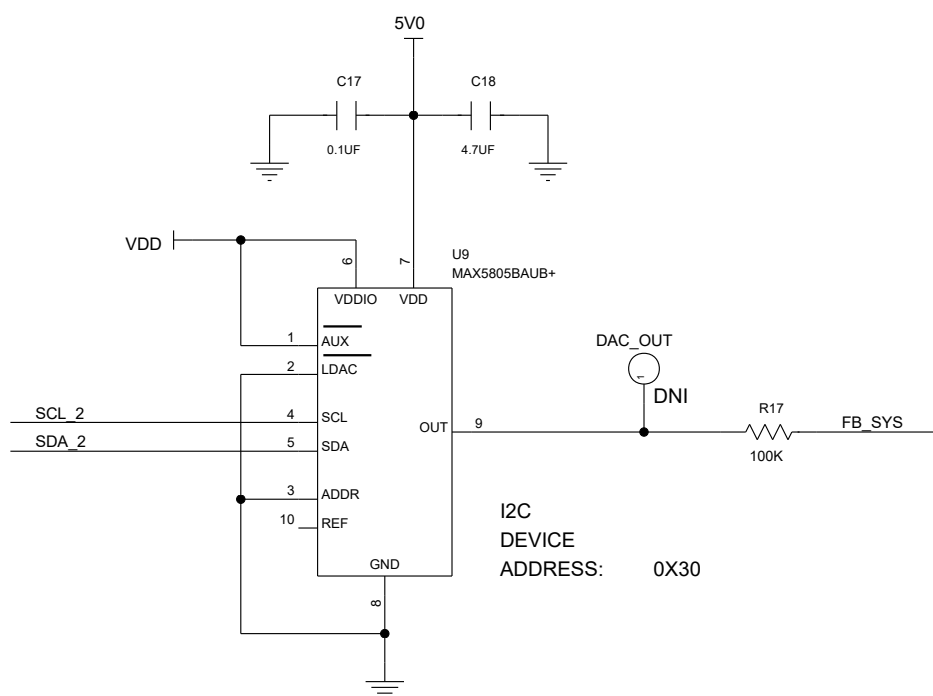


MAX25432B EV Kit Feather Board Schematic (continued)



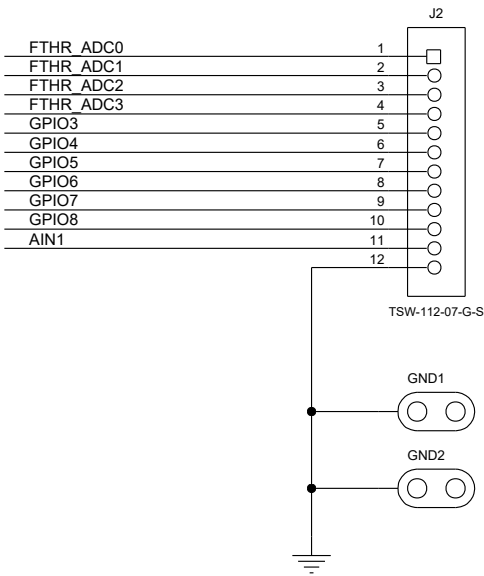
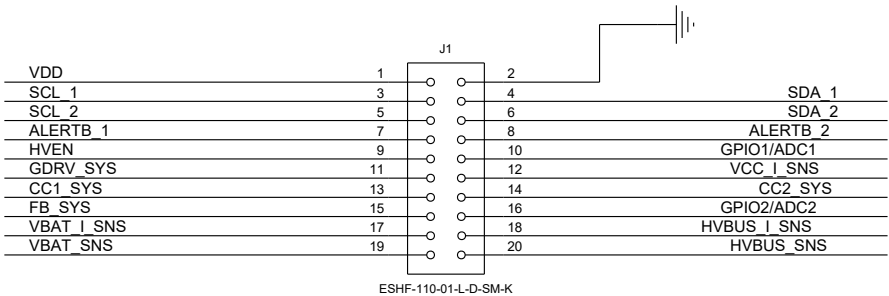
MAX25432B EV Kit Feather Board Schematic (continued)

FB DRIVE DAC



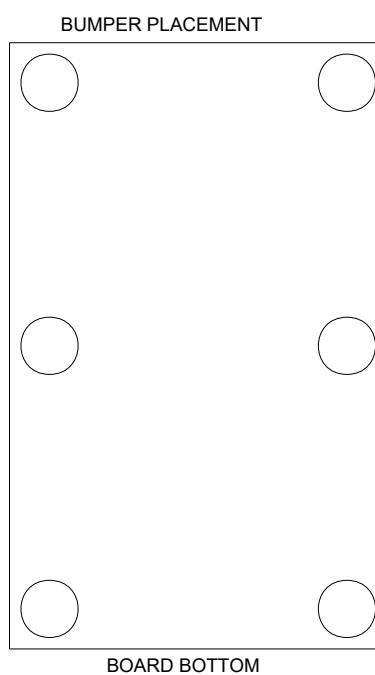
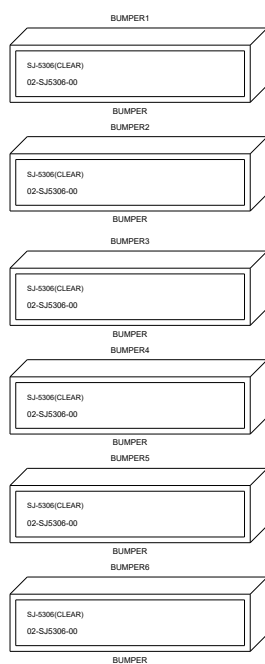
MAX25432B EV Kit Feather Board Schematic (continued)

INTERFACE CONNECTORS

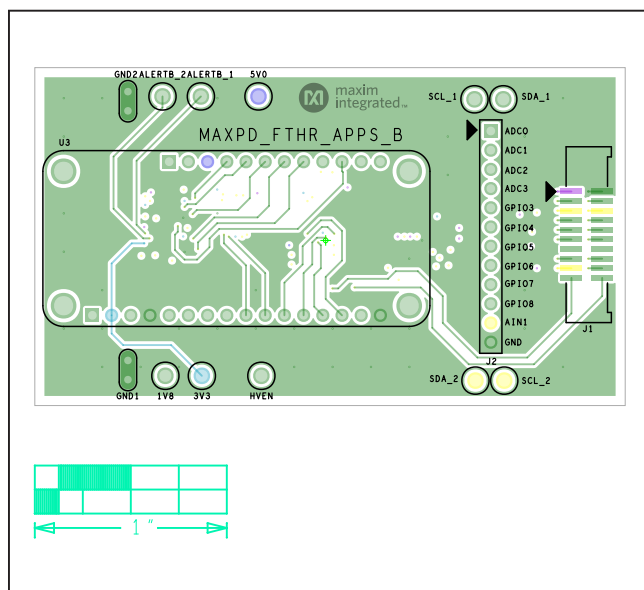


MAX25432B EV Kit Feather Board Schematic (continued)

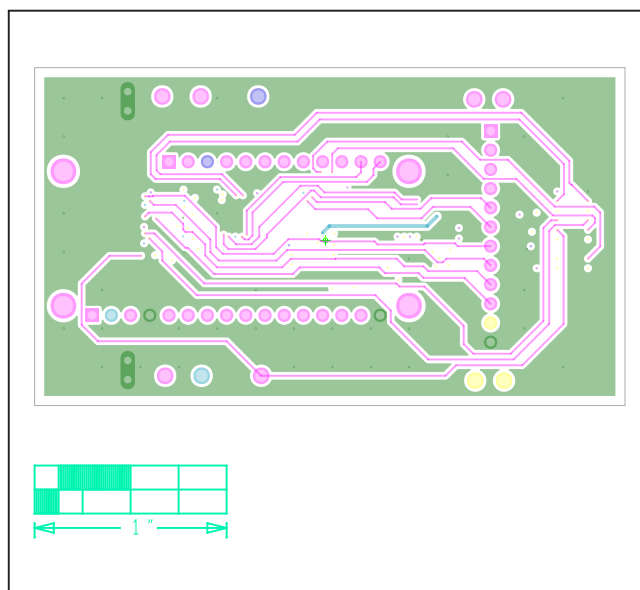
MECHANICAL & ASSEMBLY



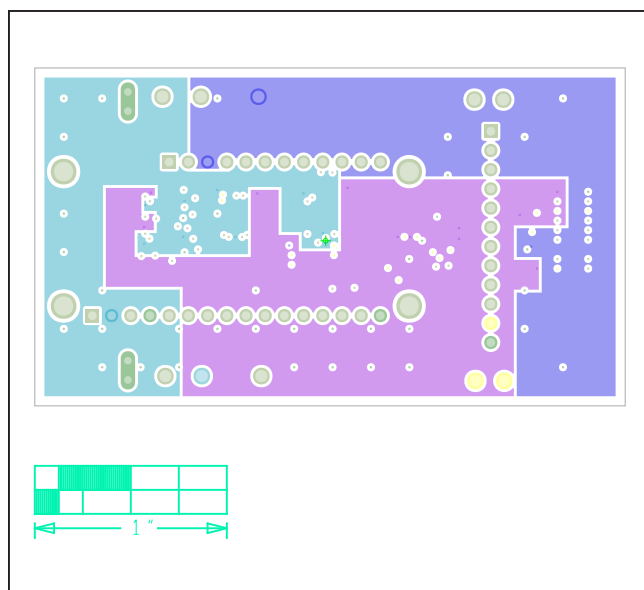
MAX25432B EV Kit Feather Board PCB Layout



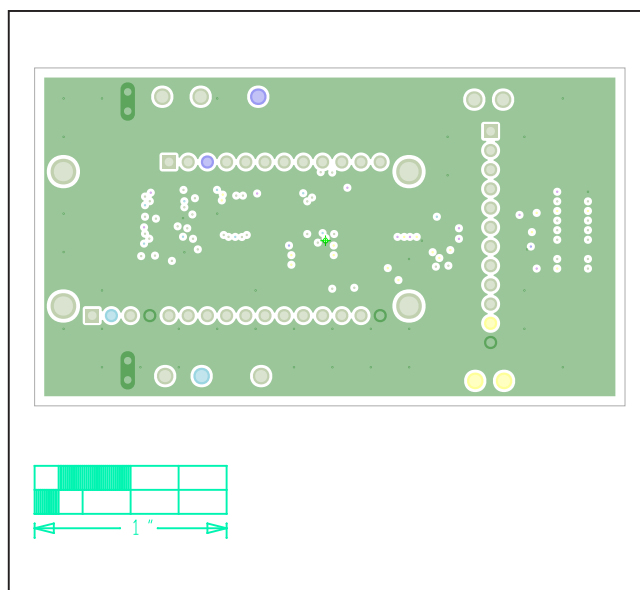
Feather Board PCB Layout - Top View with Silkscreen



Feather Board PCB Layout - Layer 2

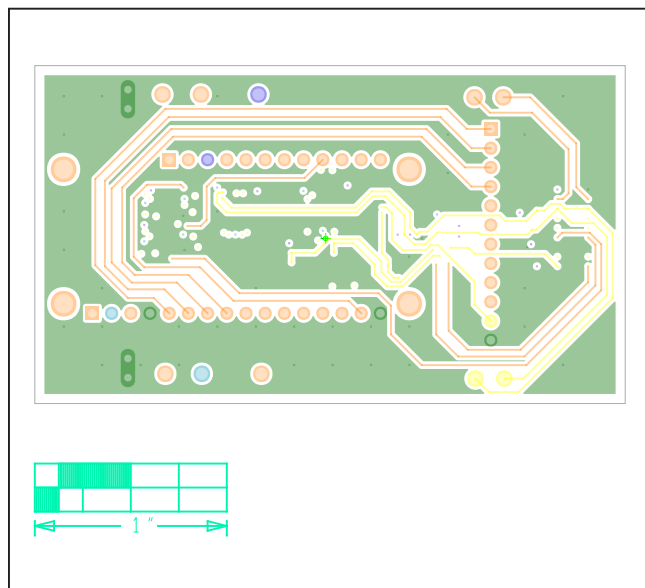


Feather Board PCB Layout—Layer 3

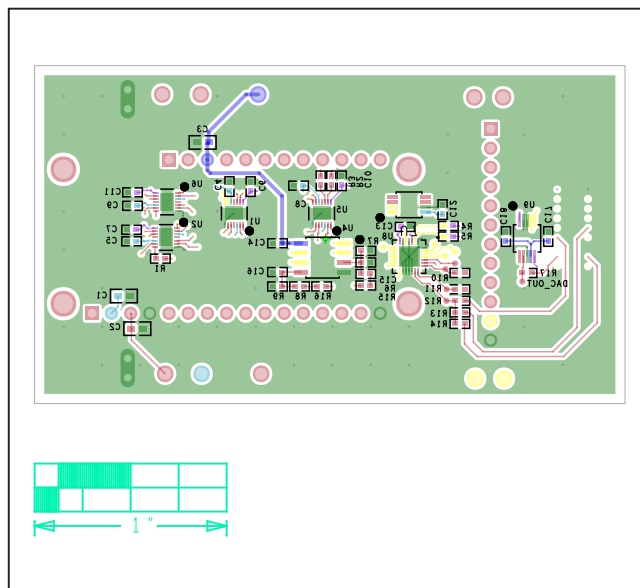


Feather Board PCB Layout—Layer 4

MAX25432B EV Kit Feather Board PCB Layout (continued)

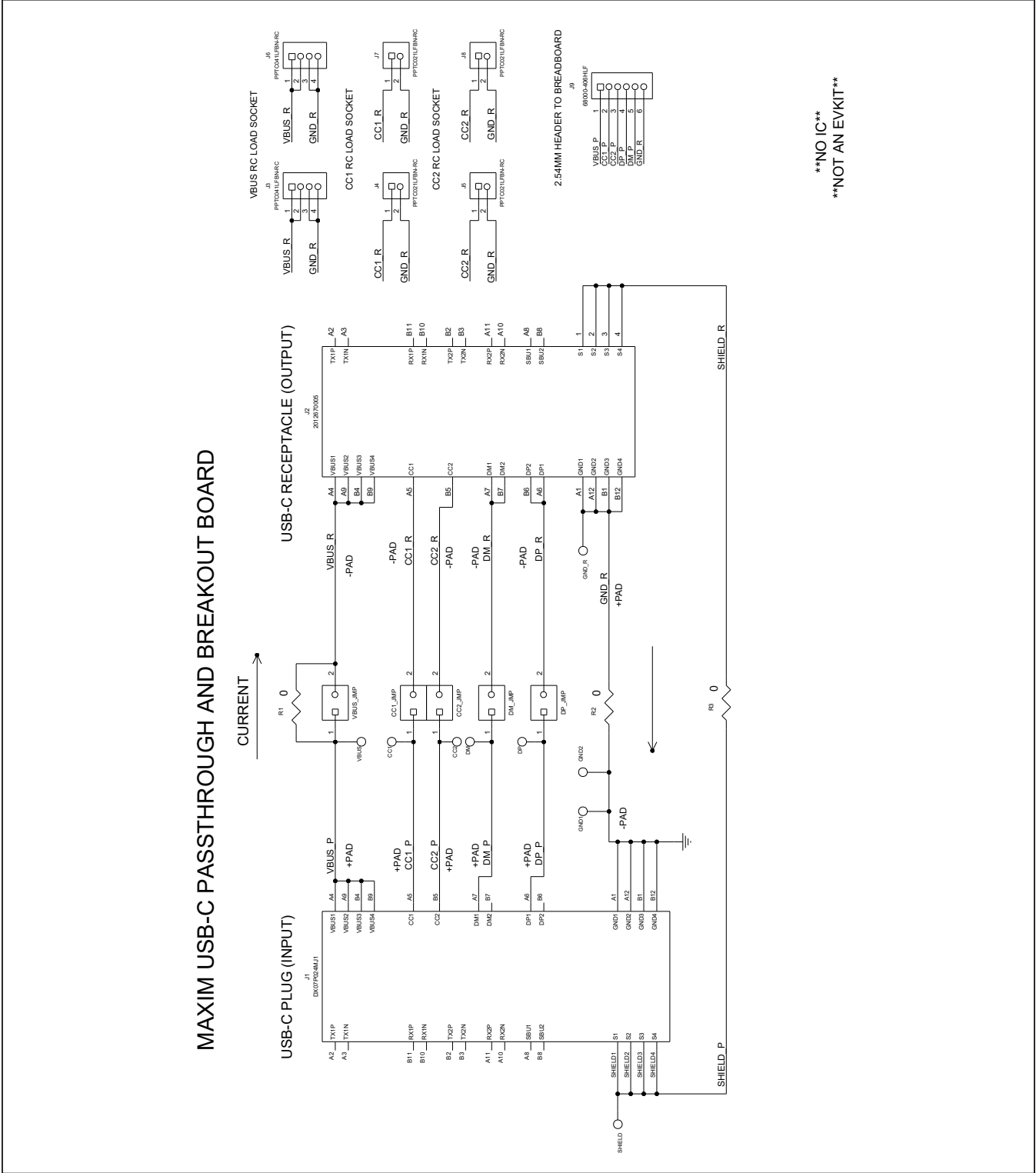


Feather Board PCB Layout—Layer 5



Feather Board PCB Layout—Bottom View with Silkscreen

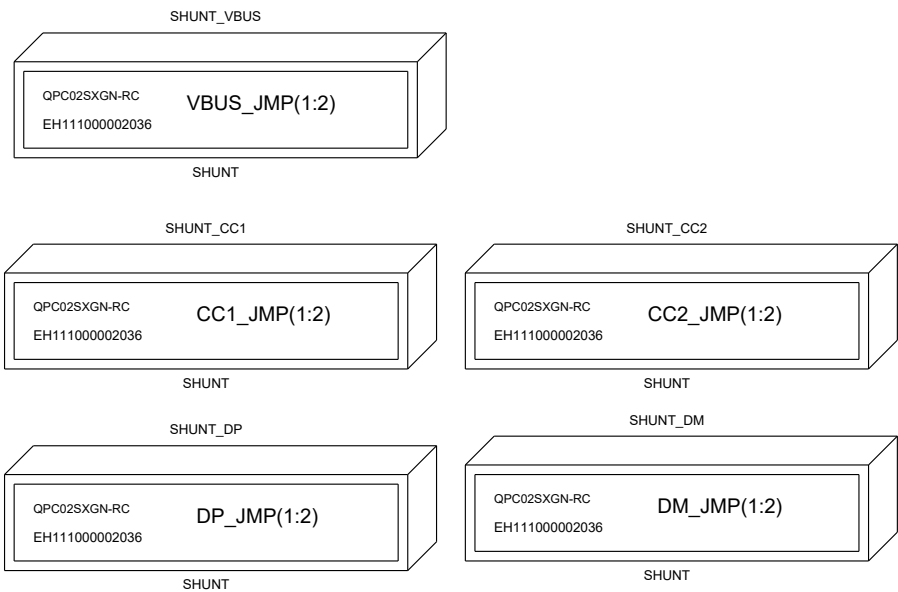
Maxim USB-C Breakout Board Schematic



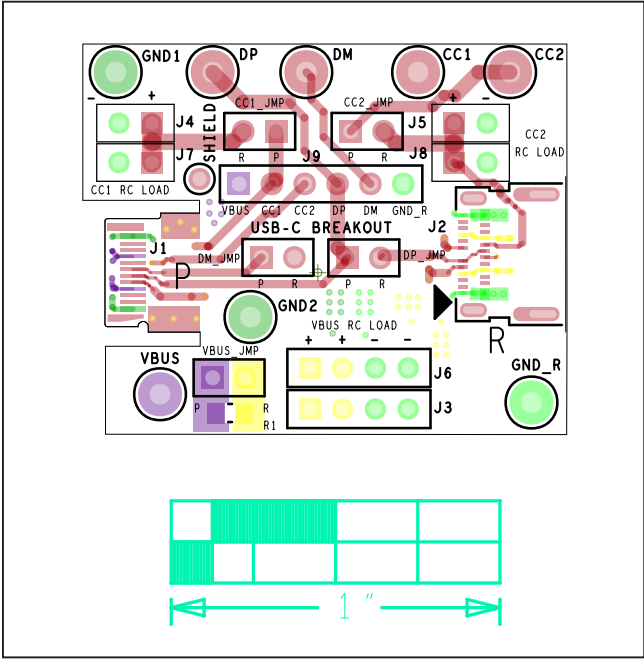
Maxim USB-C Breakout Board Schematic (continued)

MECHANICAL

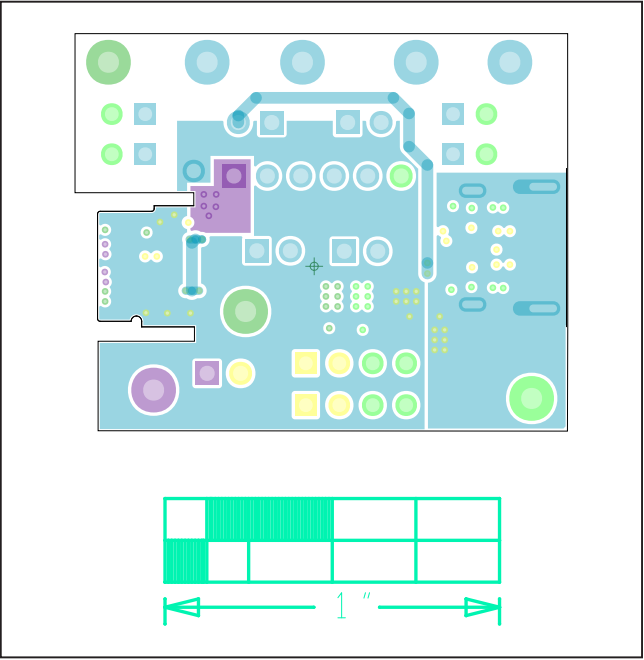
SHUNTS



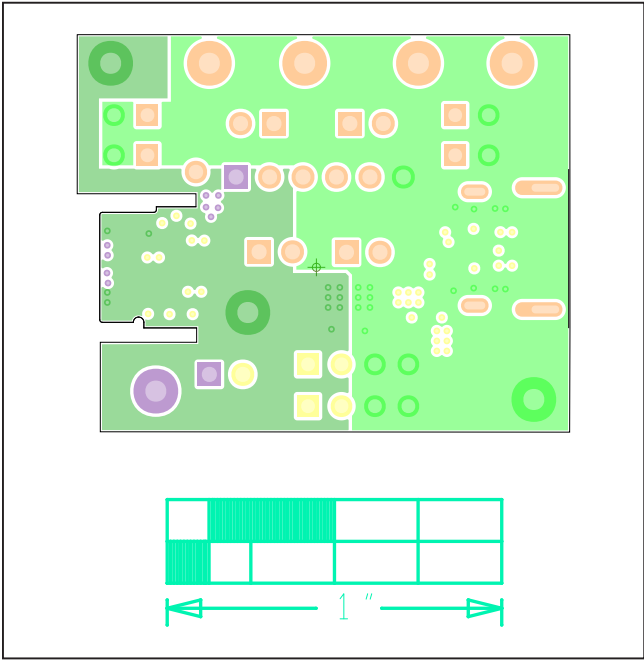
Maxim USB-C Breakout Board PCB Layout



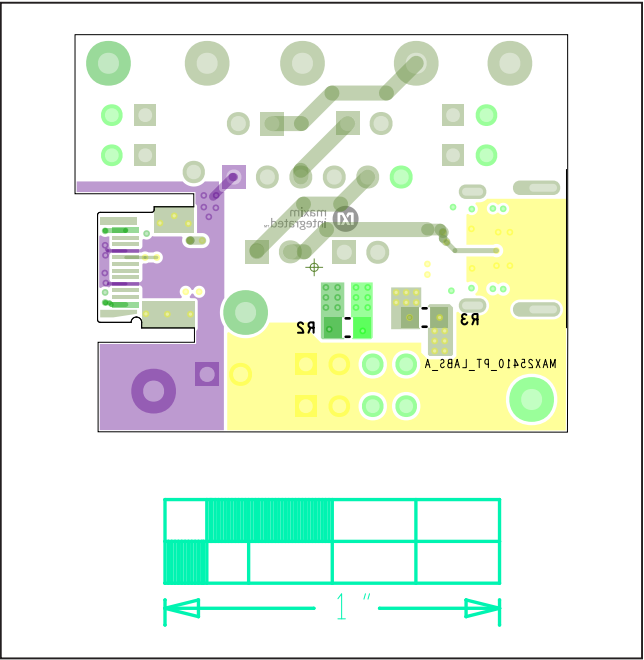
Maxim USB-C Breakout Board PCB Layout—Top View with Silkscreen



Maxim USB-C Breakout Board PCB Layout—Layer 2



Maxim USB-C Breakout Board PCB Layout—Layer 3



Maxim USB-C Breakout Board PCB Layout—Bottom View with Silkscreen

Annex 1: Feather Board Firmware Update

The Maxim Feather board already comes preprogrammed. Follow this procedure to update the Feather Board's firmware to the latest revision.

Hardware required

- 1 Feather Board: MAXPD_FTTH_APPS_B or later revision.
- 1 Programmer: Pico board (MAX32625PICO, included with above).
- 2 Micro-B USB cables.
- 1 10-pin ribbon cable.
- 2 available USB ports on a PC with USB Write access.

Software required

- Download the latest Feather Board firmware on the EV kit webpage (.bin file).
- Download and install the latest EV kit software on the EV kit webpage.

Programming steps

- 1) On the computer, plug in the Pico board first using one of the provided Micro-B cables, and wait until it installs itself as a DAP drive.
- 2) Then connect the provided 10-pin mini flat cable from the Pico board to the Feather board.
- 3) Then plug in the Feather board to another USB port on your computer, using the second Micro-B cable provided.
- 4) Drag and drop the *.bin file into the DAP drive (Pico board). The Pico board starts blinking.
- 5) Wait for the blinking to stop, about 10sec.
- 6) Now remove the ribbon cable and cycle the power to the Feather board by unplugging the USB cable, and plugging it back in. Look for the LEDs to cycle through the colors and then turn OFF.
- 7) When all is finished, launch the GUI and make sure that the Feather Board is detected.

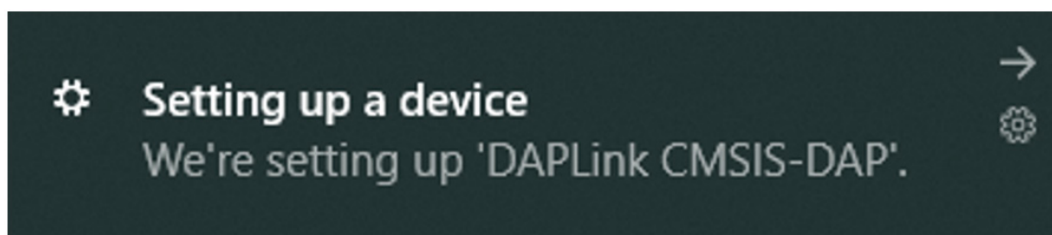


Figure 8. Pico Board DAPLink Setup Message

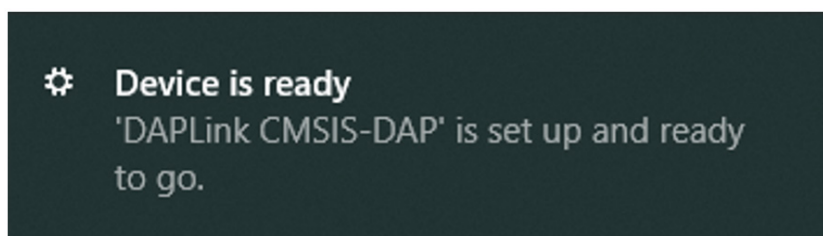


Figure 9. Pico Board DAPLink Setup Complete

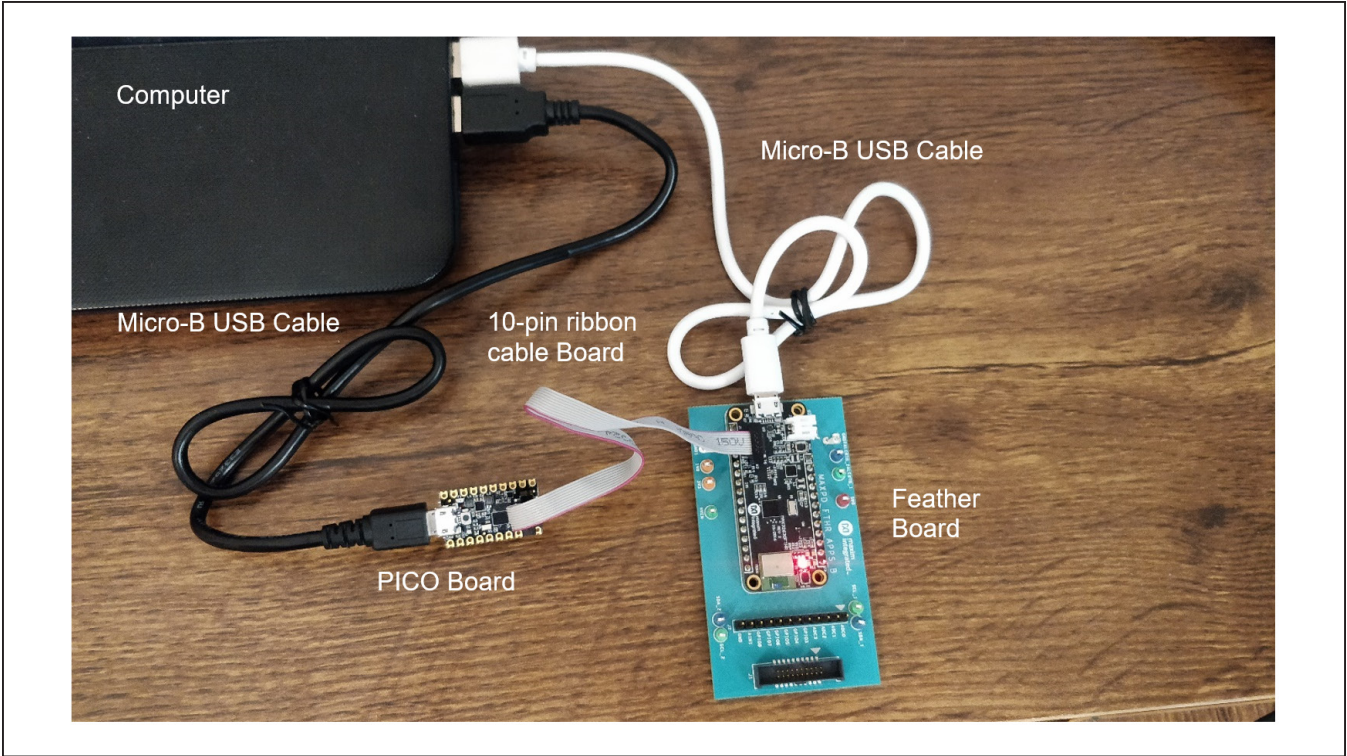


Figure 10. Setup to Perform a Feather Board Firmware Update

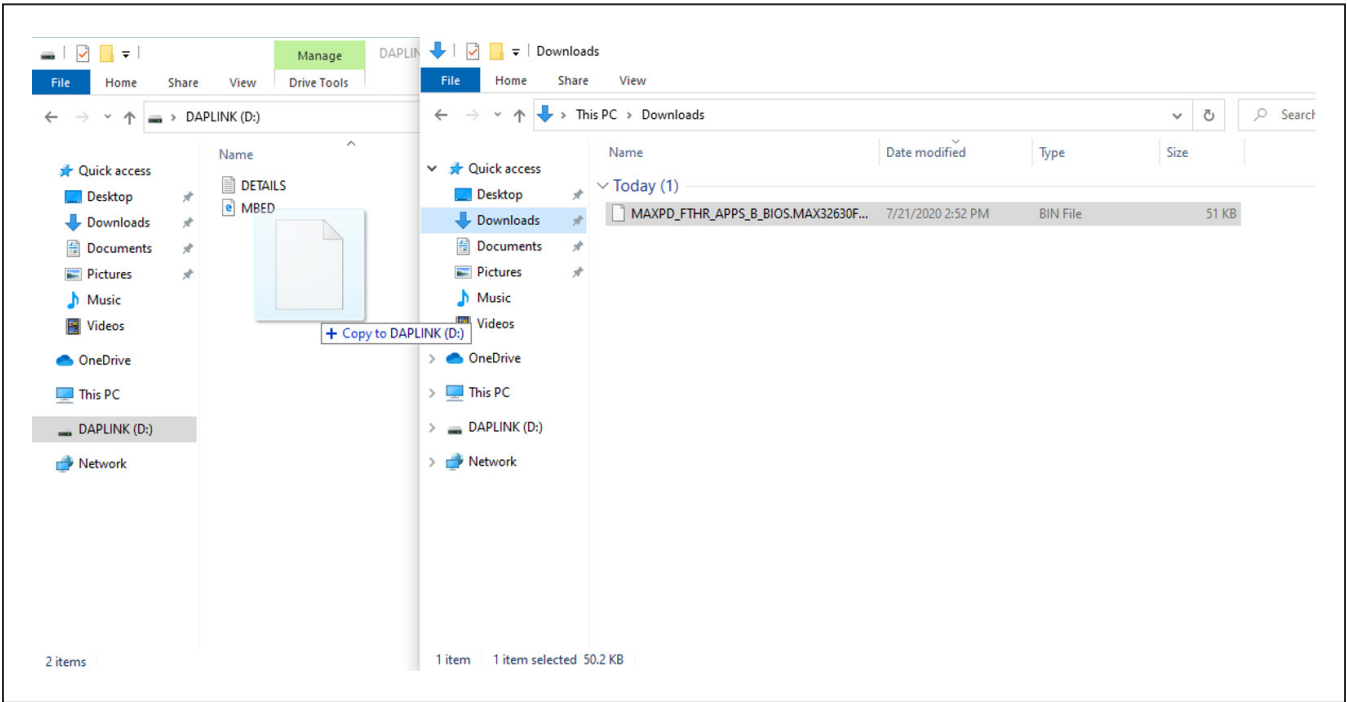
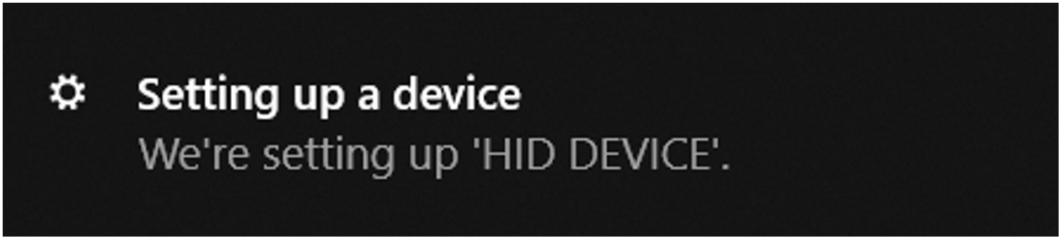
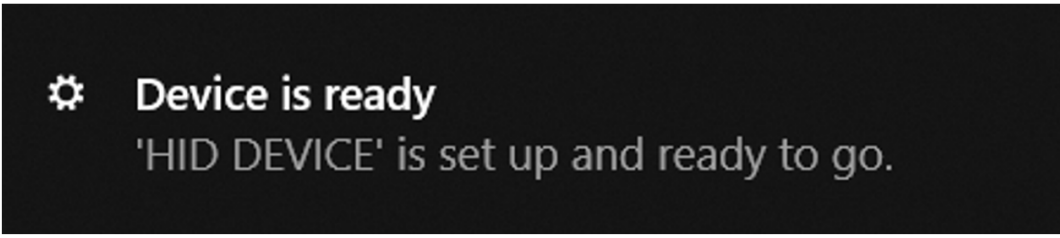


Figure 11. Drag and Drop the .bin File Onto the Pico DAP Drive

A black rectangular box with a white gear icon on the left. The text inside is white and reads: "Setting up a device" followed by "We're setting up 'HID DEVICE'." on the next line.

Setting up a device
We're setting up 'HID DEVICE'.

Figure 12. Feather Board HID Setup Message

A black rectangular box with a white gear icon on the left. The text inside is white and reads: "Device is ready" followed by "'HID DEVICE' is set up and ready to go." on the next line.

Device is ready
'HID DEVICE' is set up and ready to go.

Figure 13. Feather Board HID Setup Complete

How to verify the Feather Board firmware revision

- 1) Launch the EV kit software.
- 2) Click on **Enable Target**.
- 3) The firmware revision is displayed in the log panel.

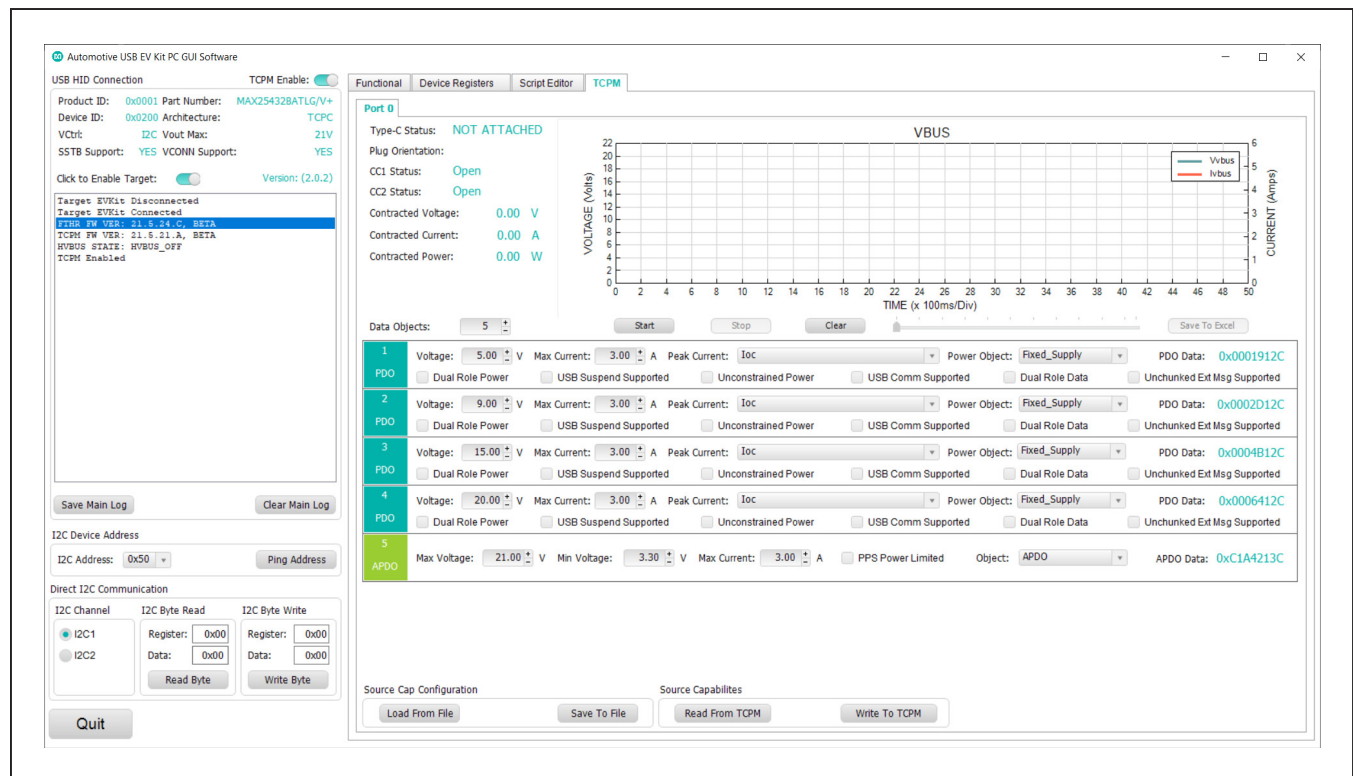


Figure 14. Feather Board Detection on the EV Kit GUI Software

Annex 2: Maxim USB-C Breakout Board

The Maxim USB-C breakout board allows for easy monitoring and pass-through of certain signals present on Type-C connectors.

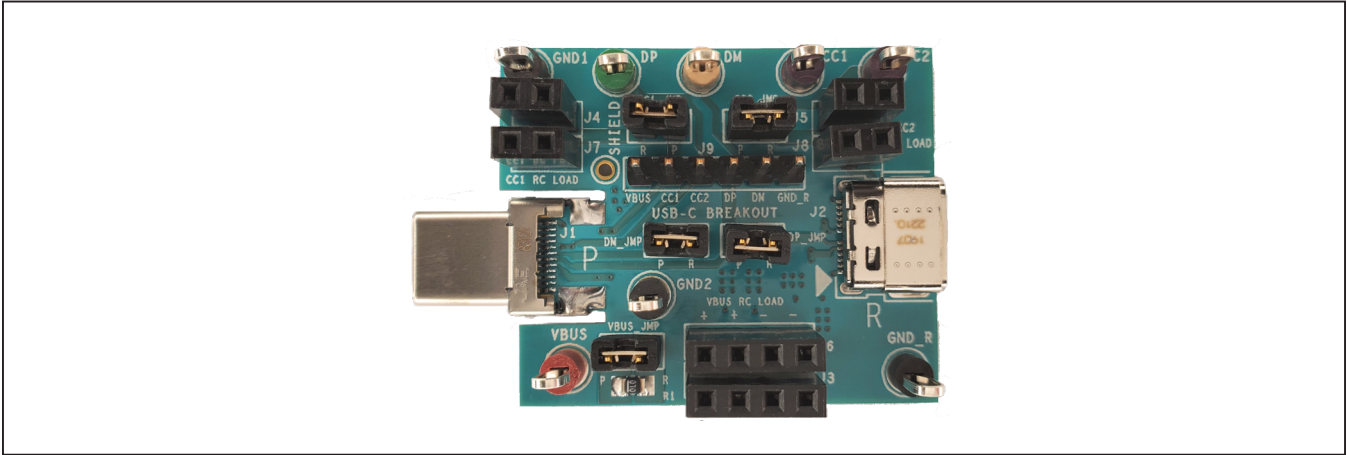


Figure 15. Maxim USB-C Breakout Board (Top View)

Table 7. Connector Descriptions

NAME	DESCRIPTION
J1	Type-C Plug. Connects to EVKIT receptacle (J37). Labeled “P”.
J2	Type-C Receptacle. Connects to Type-C cable or EV Kit plug (J36). Labeled “R”.
J3, J6	VBUS RC Load header. Can be used to connect load resistors and capacitors from VBUS to GND to test hot plug or soft start events.
J4, J7, J5, J8	CC1/CC2 RC Load header. Can be used to connect load resistors and capacitors from CC1/CC2 to GND to test hot plug or soft start events.

Table 8. Jumper Descriptions

NAME	POSITION	DESCRIPTION
CC1_JMP, CC2_JMP	1-2*	Connects CC1 or CC2 from the plug to the receptacle. When open, provides a header for current monitoring.
VBUS_JMP	1-2*	Connects VBUS from the plug to the receptacle. When open, and R1 is removed, provides a header for current monitoring. For high surge currents (>5A), it is recommended to use the two copper pads on the back side to reduce parasitics.
DP_JMP, DM_JMP	1-2*	Connects D+ or D- from the plug to the receptacle. When open, provides a header for current monitoring.

*Default position

Note: This board does not support USB 2.0 high speed, SBU or USB3.x signals.

Figure 16 shows figures to perform Bode plot measurements on the EV kit main board.

BODE PLOT MEASUREMENT – CV MODE

The diagram illustrates the Bode Plot Measurement setup in CV Mode. It shows the connection between the EVKIT SCHEMATIC and USER MODS.

EVKIT SCHEMATIC:

- Power Stage:** VBAT is connected to a BUCK-BOOST POWER STAGE, which outputs to the CSP2 test pad.
- Output Stage:** The output of the power stage passes through a $3m\Omega$ resistor (Rcs2) and a capacitor (COUT) to the CSP2 test pad.
- Input Stage:** The input to the power stage is connected to the CSN2 test pad, which passes through a $5m\Omega$ resistor (Rcs3) and a capacitor (CCSN2) to the VBUS.
- Load:** A load resistor (RLOAD) is connected between VBUS and ground.

USER MODS:

- Test Pads:** CSP2, OUT, CSN2, and OUT_S are used for measurements.
- Resistors:** R51 (0 Ω) and R52 (10 Ω) are used for signal routing. R62 (0 Ω) is also shown.
- Capacitors:** C72 and C73 (100pF) are used for signal conditioning.
- Shorts:** SHORT connections are made between CSP2 and OUT, and between CSN2 and OUT.
- Bode Plot:** The BODE OUTPUT is measured across the output stage, and the BODE INPUT is measured across the input stage.

Legend:

- EVKIT SCHEMATIC
- USER MODS
- TEST PAD

Figure 16. Schematic Changes for Bode Plot in CV

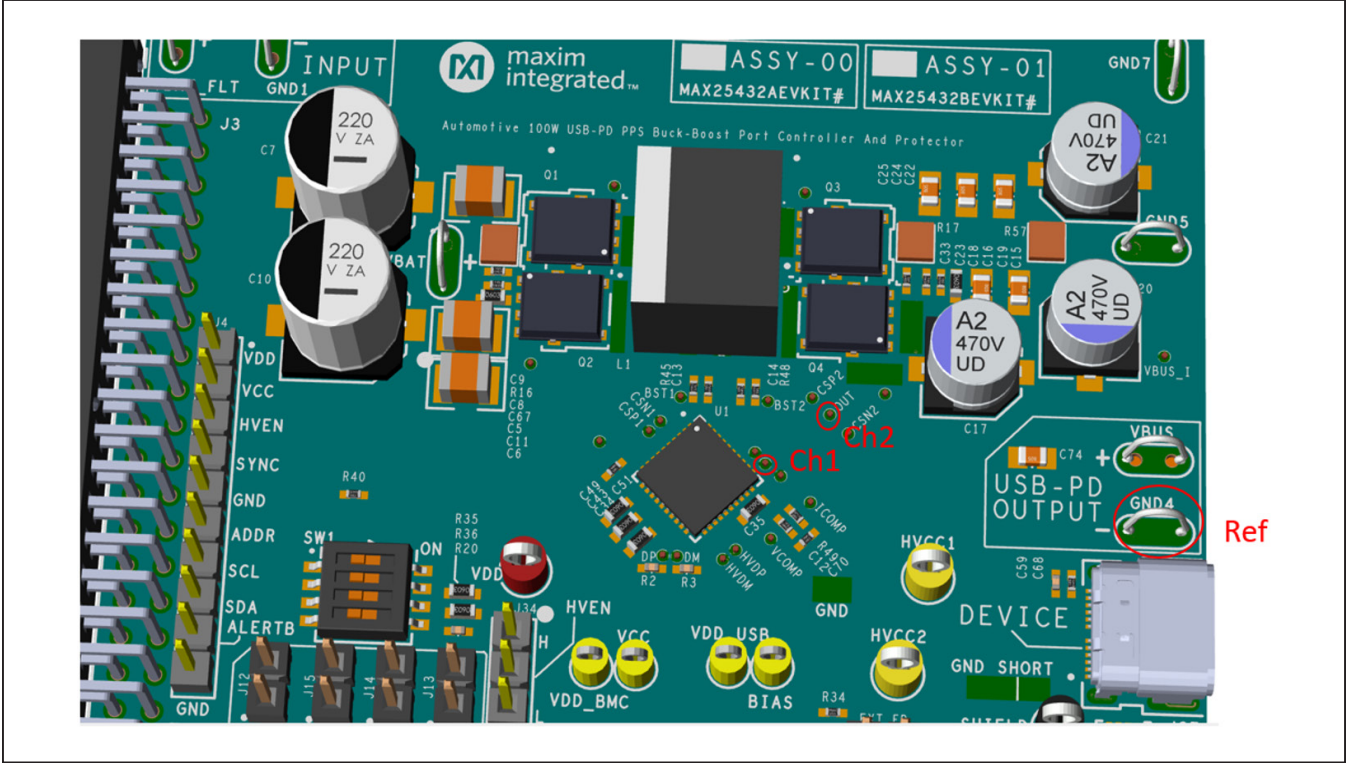


Figure 17. Probe Connections for Bode Plot in CV

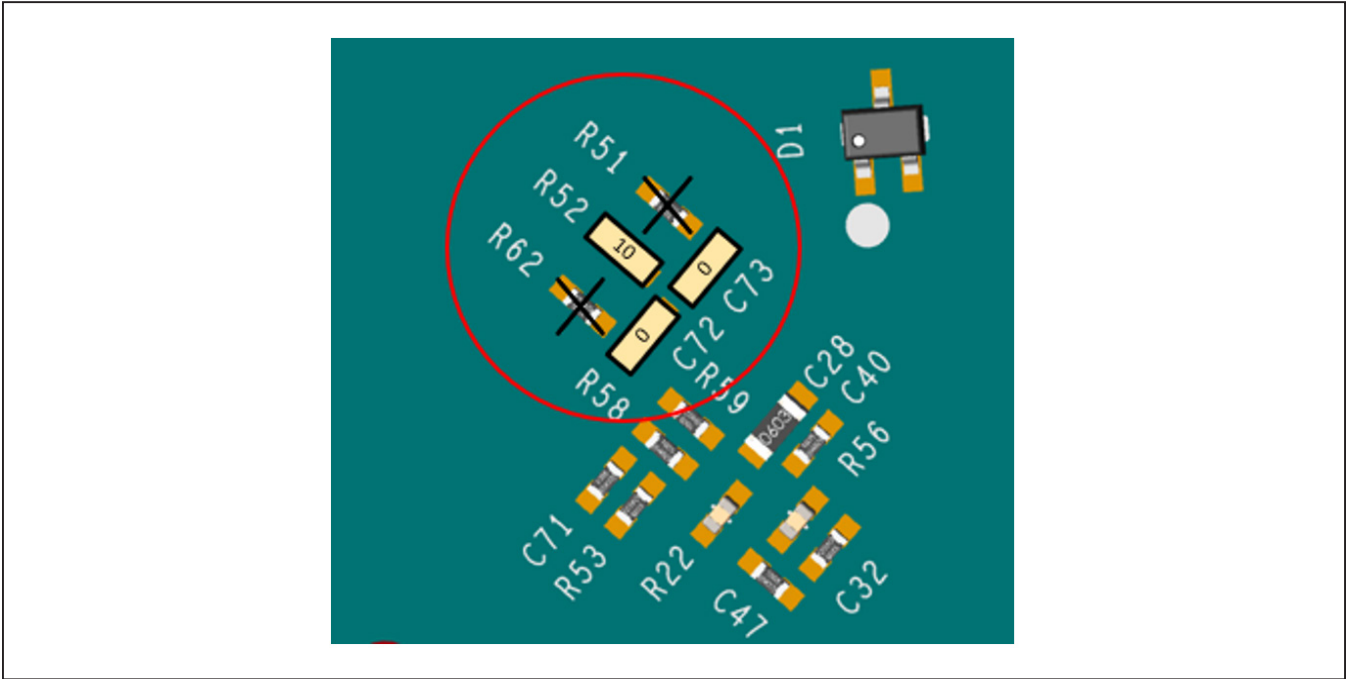


Figure 18. Bottom Layout for Bode Plot in CV

CL Mode

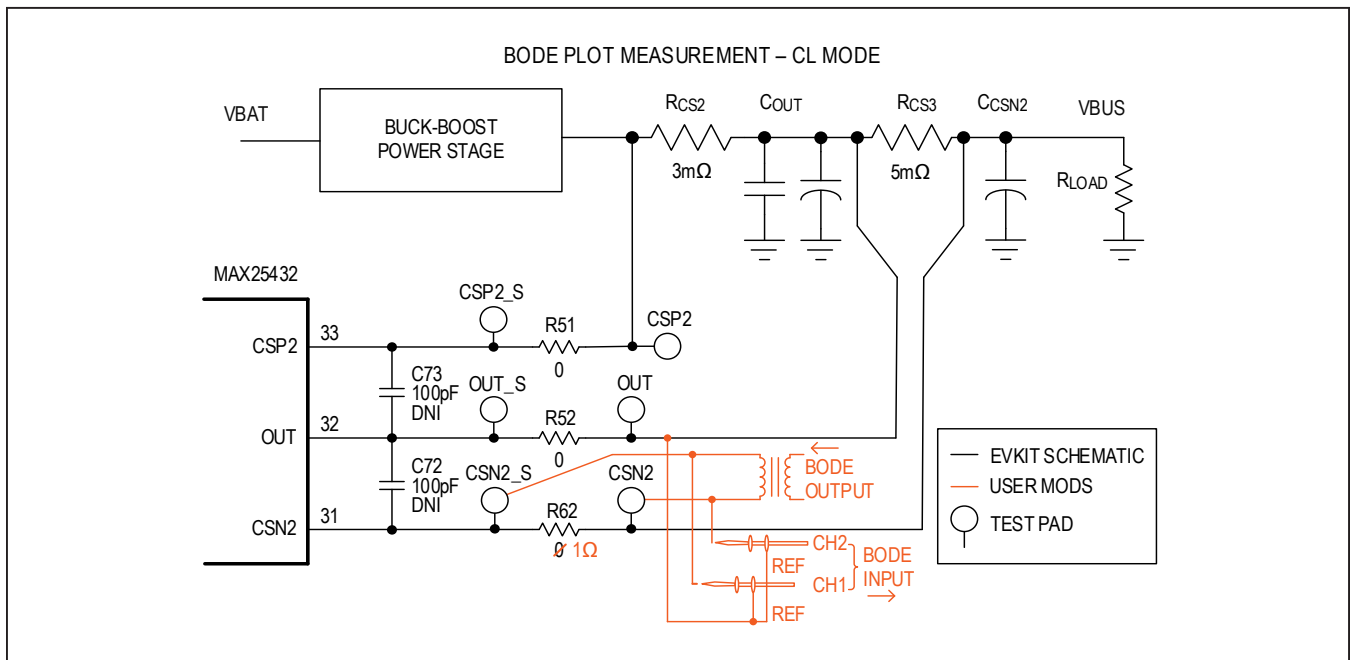


Figure 19. Schematic Changes for Bode Plot in CL

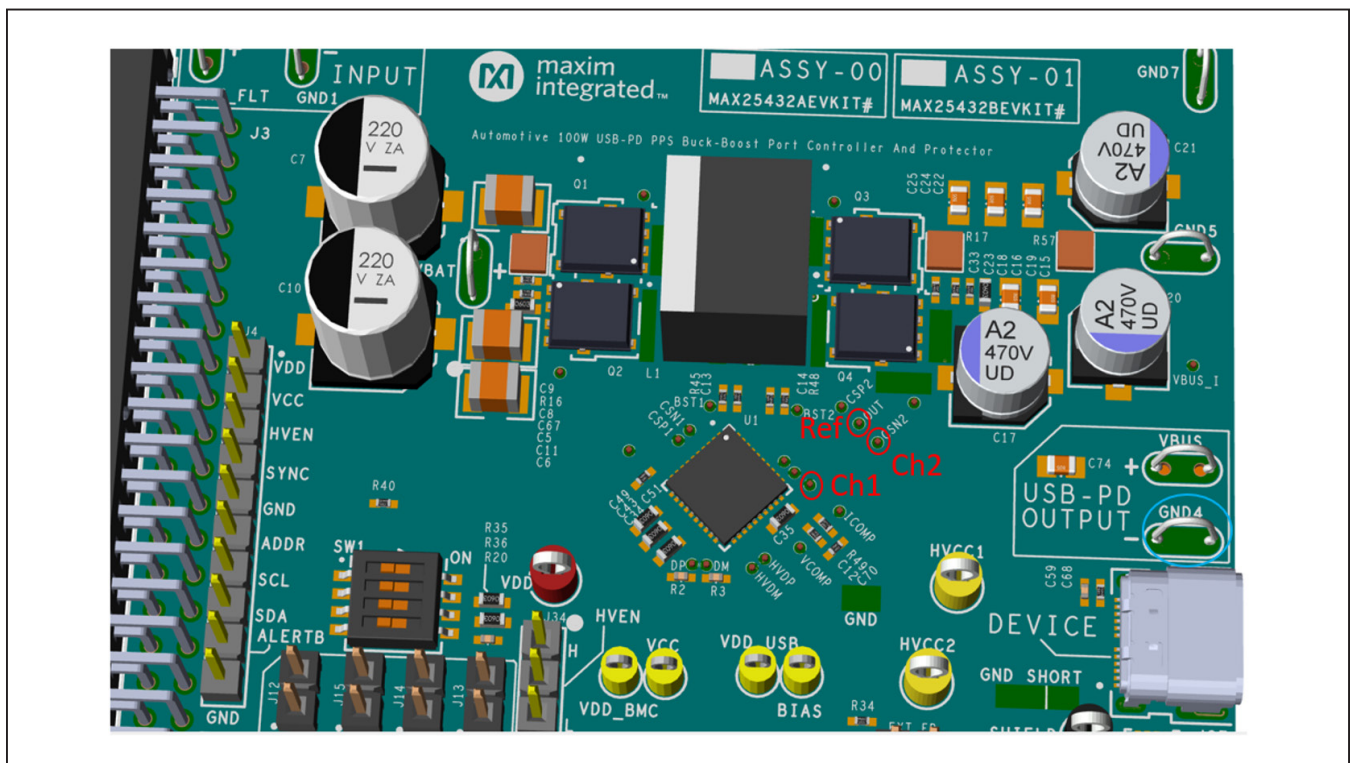


Figure 20. Probe Connections for Bode Plot in CL

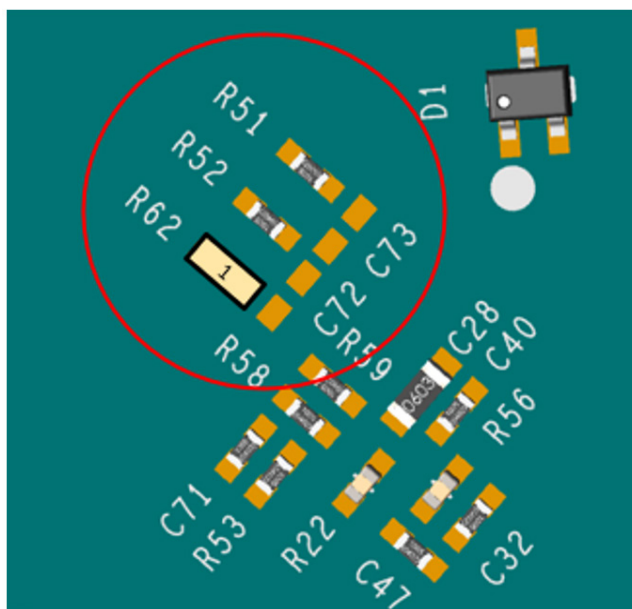


Figure 21. Bottom Layout for Bode Plot in CL

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	8/21	Initial release	—

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