4.5V - 24V Input, 6A Synchronous Buck Regulator with I²C Interface

Brief Description

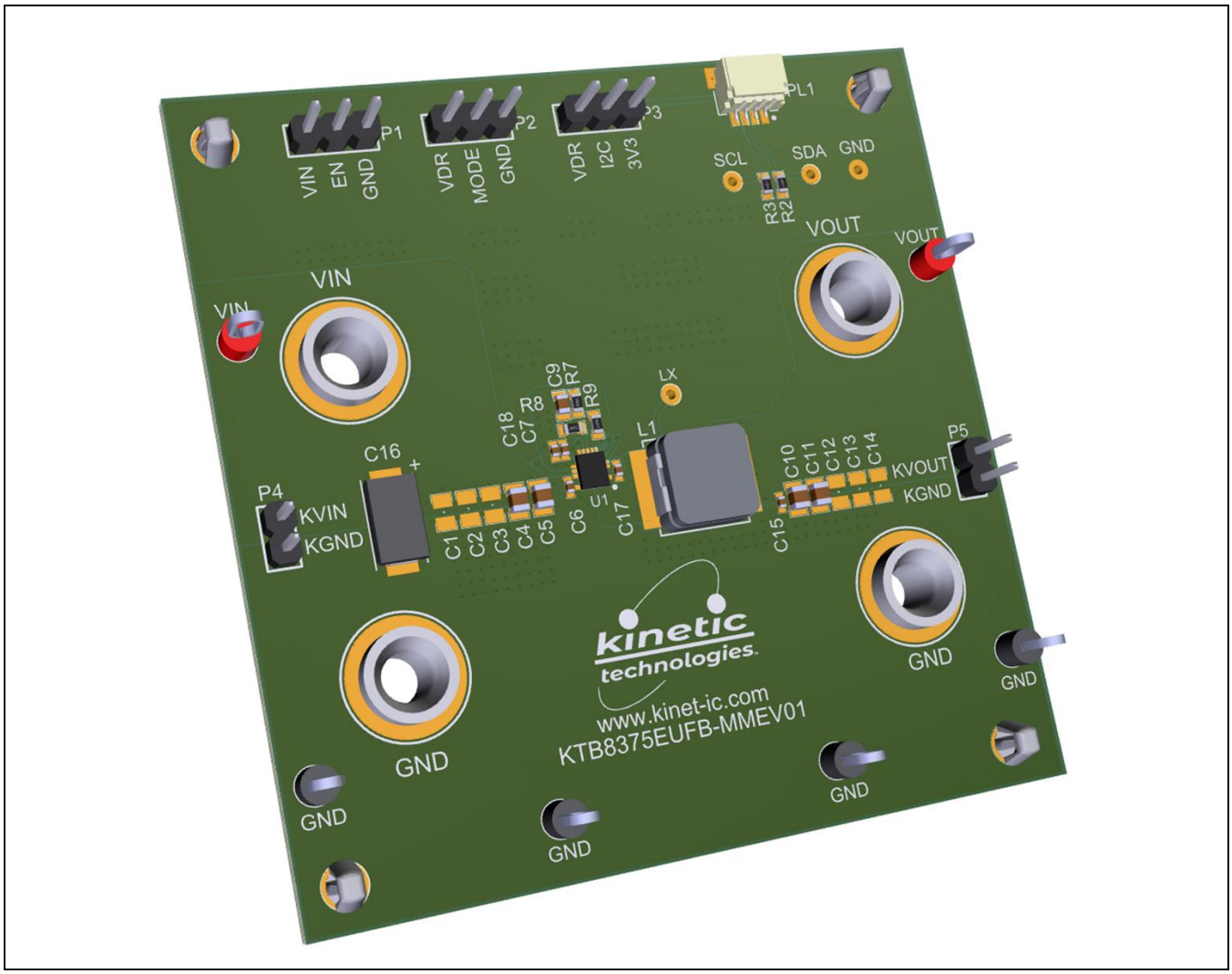
The KTB8375 is a 6A synchronous buck regulator with integrated high-side and low-side power MOSFETs. The device operates over a wide input voltage range from 4.5V to 24V. The KTB8375 Evaluation (EVAL) board is used to demonstrate the KTB8375 Buck regulator detailed functionality, performance, and the PCB layout.

The kit includes a fully assembled and tested KTB8375 EVAL board, I²C Adapter, connecting cable, and a printed copy of the Quick Start Guide.

Ordering Information

Part Number	Description	IC Package
KTB8375EUFB-MMEV01	KTB8375 EVAL Kit	FC-QFN 12L

3D CAD Image



EVAL Kit Physical Contents

Item #	Description	Included
1	KTB8375 EVAL kit fully assembled PCB	1
2	MCP2221A Board - General Purpose USB to GPIO I2C - Stemma QT / Qwiic	1
3	Stemma QT / Qwiic JST SH 4-pin Cable - 100mm Long	1
4	Anti-static bag	1
5	KTB8375 EVAL Kit Quick-Start Guide -- printed 1-page (A4 or US Letter)	1
6	EVAL Kit box	

QR Links for Documents

IC Datasheet	EVAL Kit Landing Page
https://www.kinet-ic.com/ktb8375/	https://www.kinet-ic.com/ktb8375eufb-mmev01/

User-Supplied Equipment

Required Equipment

1. Bench Power Supply for VIN – 12V/24V and 6A as needed for the intended application.
2. Digital Multimeter – used to measure input/output voltages and currents.
3. Load – either power resistors, an E-Load, or an actual system load.

Optional Equipment

1. Oscilloscope and Voltage Probes – for dynamic testing, measurements, and observe input/output voltages and currents waveforms.
2. Additional Digital Multimeters

Recommended Operating Conditions

Symbol	Description	Value	Units
V_{PVIN}	Input Withstand Voltage	-0.3 to 28	V
	Input Operating Voltage	4.5 to 24	V
V_{EN}	EN pin Voltage	3.5 to VIN	V
V_{MODE}	MODE pin Voltage	2.5 to 5.5	V
V_{IO}	V_{IO} Operating Voltage for SCL, SDA	1.1 to 5.5	V
I_{OUT}	Output Load Current	0 to 6	A

Jumper Descriptions

Designator	Name	Description	Default
P1	EN	Active-High Enable Input: • GND: Shutdown Mode – switch disabled • VIN: Enable Mode through VIN – normal switch operation	VIN
P2	MODE	Auto-Skip vs. Forced-PWM Mode Select logic input Pin: • GND: Auto-Skip Mode • VDR: Forced-PWM Mode through VDR (4V)	GND
P3	I2C	I^2C SDA/SCL pull-up rail voltage can be set to: • 3V3: supply rail (3.3V) from MC2221 board • VDR: 4V output voltage from KTB8375 VDR pin	3V3

Quick Start Procedures

1. Check the Jumpers for default setting.
2. Connect one pair of banana-to-banana cables to the connector of EVAL Kit at VIN and GND.
3. Before connecting the EVAL Kit to the VIN bench power supply, turn on the supply and adjust the voltage as close to 0V as possible. Then turn off the supply. While off, connect the banana cables to the VIN bench supply.
4. Turn on the VIN bench supply and very slowly ramp its voltage to an appropriate voltage, such as 12V. While ramping VIN slowly, use the bench supply output current indication (or a digital multimeter) to monitor the VIN current. If the current becomes high, reduce the VIN voltage quickly to prevent damage. Then inspect the setup for any wiring errors. The VIN supply current should be less than 1mA.
5. To shutdown the buck regulator, simply use a jumper at P1 to connect EN to GND.
6. With the jumper at P1 between EN and VIN, connect a voltmeter between the output KVOUT and KGND test pins in order to measure the buck regulator output voltage. The output voltage is set by the on-board resistor divider R7/R8 to 3.3V in the default configuration. Please refer to the data sheet for more details on the resistor divider.

Programming KTB8375 via the I^2C Interface

1. Connect the 4-wire Stemma cable with SDA, SCL from MCP2221A board to connector header PL1.
2. Connect the USB side of the MCP2221A board to the USB port of the computer.
3. Connect a DC power supply between the EVB test points VIN and GND.
4. With the power supply output turned off, configure the voltage to 12V.
5. Connect a voltmeter between the KVOUT and KGND.
6. Turn on the power supply, VOUT voltage should be at the set value.

Graphical User Interface (GUI)

- Download and install GUI software located on EVAL Kit Page (https://www.kinet-ic.com/ktb8375eufb-mmev01/)
- After installing software, execute the GUI program on the computer, the GUI interface window will appear with the status message “USB Device Attached” at the bottom left side of the window.
- If the displayed message is “USB Device Detached”, make sure the computer is properly connected to the adapter.

Typical Test Setup

Use the following test setup for the Quick Start Procedure.

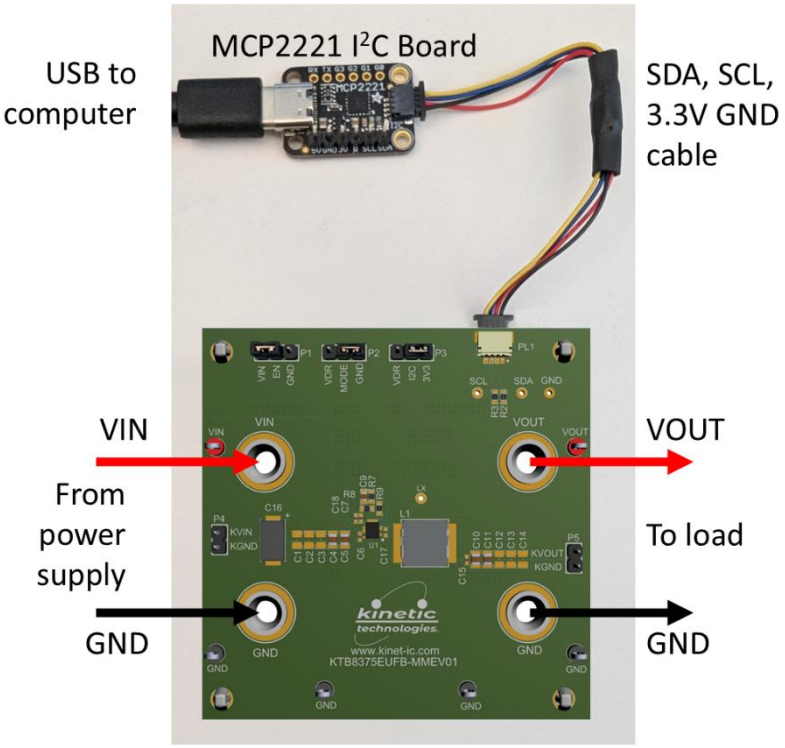
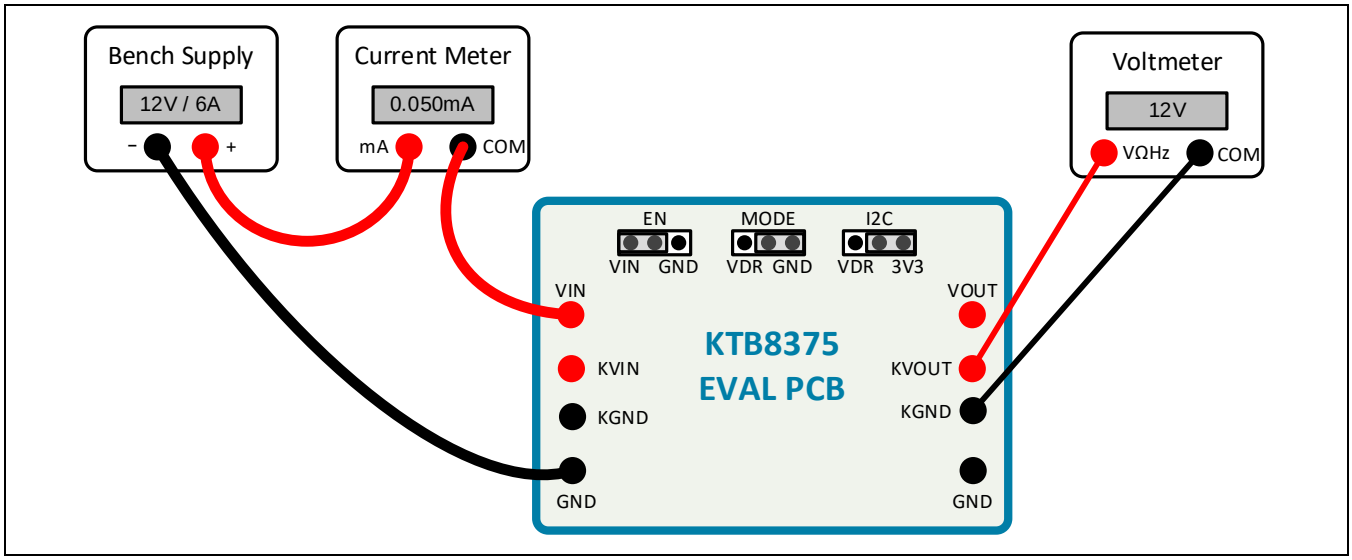


Figure 1. KTB8375 Evaluation Kit Setup

As an example, use the following test setup to measure input/output.



Graphical User Interface (GUI) Window

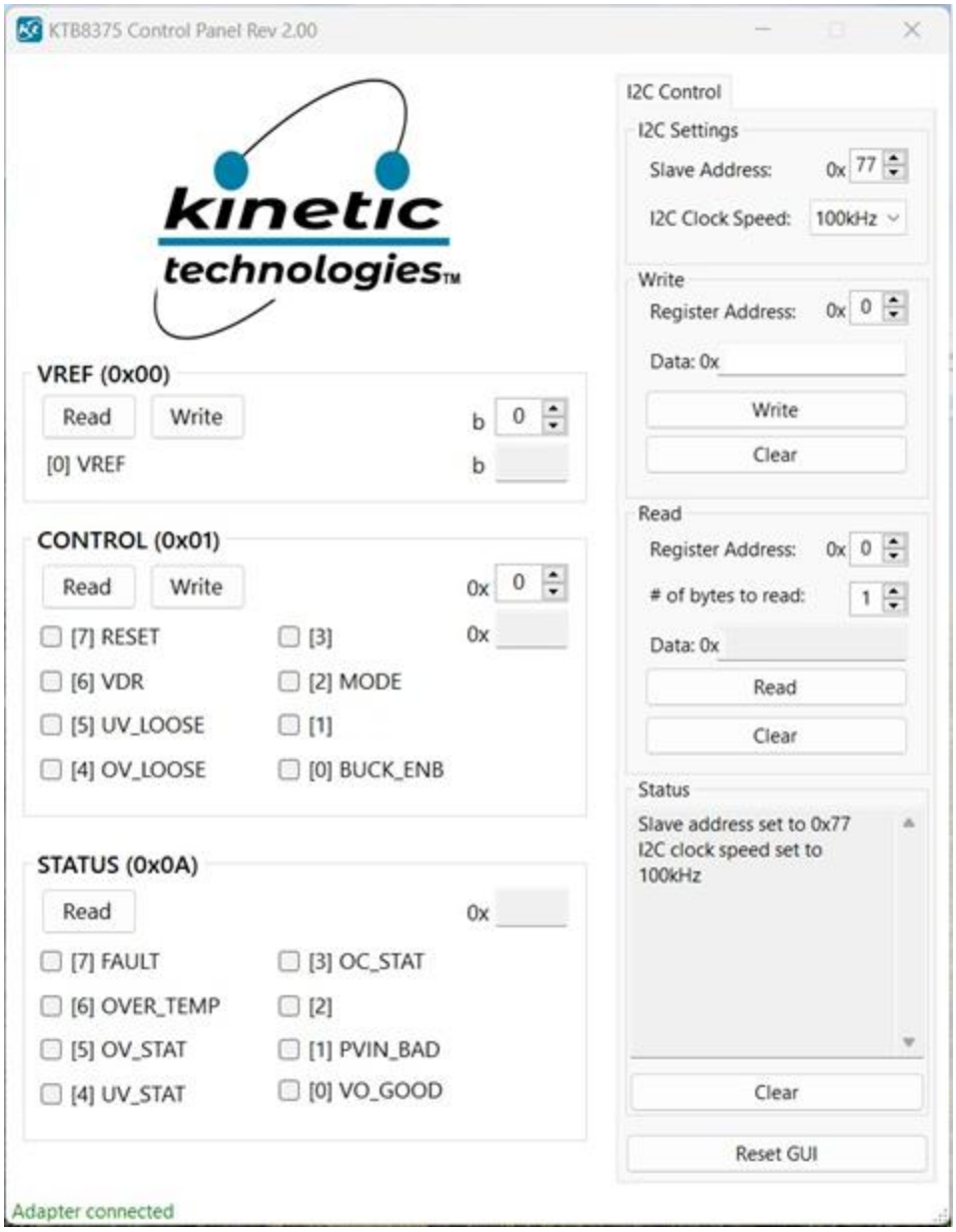


Figure 2. Graphical User Interface (GUI) window

With the power supply turned on, VOUT voltage should be at the set value and the STATUS register 0x0A bit VO_GOOD should be checked after reading the STATUS register.

To read a register, click on the register window “Read” button.

For example, to check the device status by reading the STATUS register, click on STATUS register 0x0A “Read” button, then the GUI window should be as shown below.

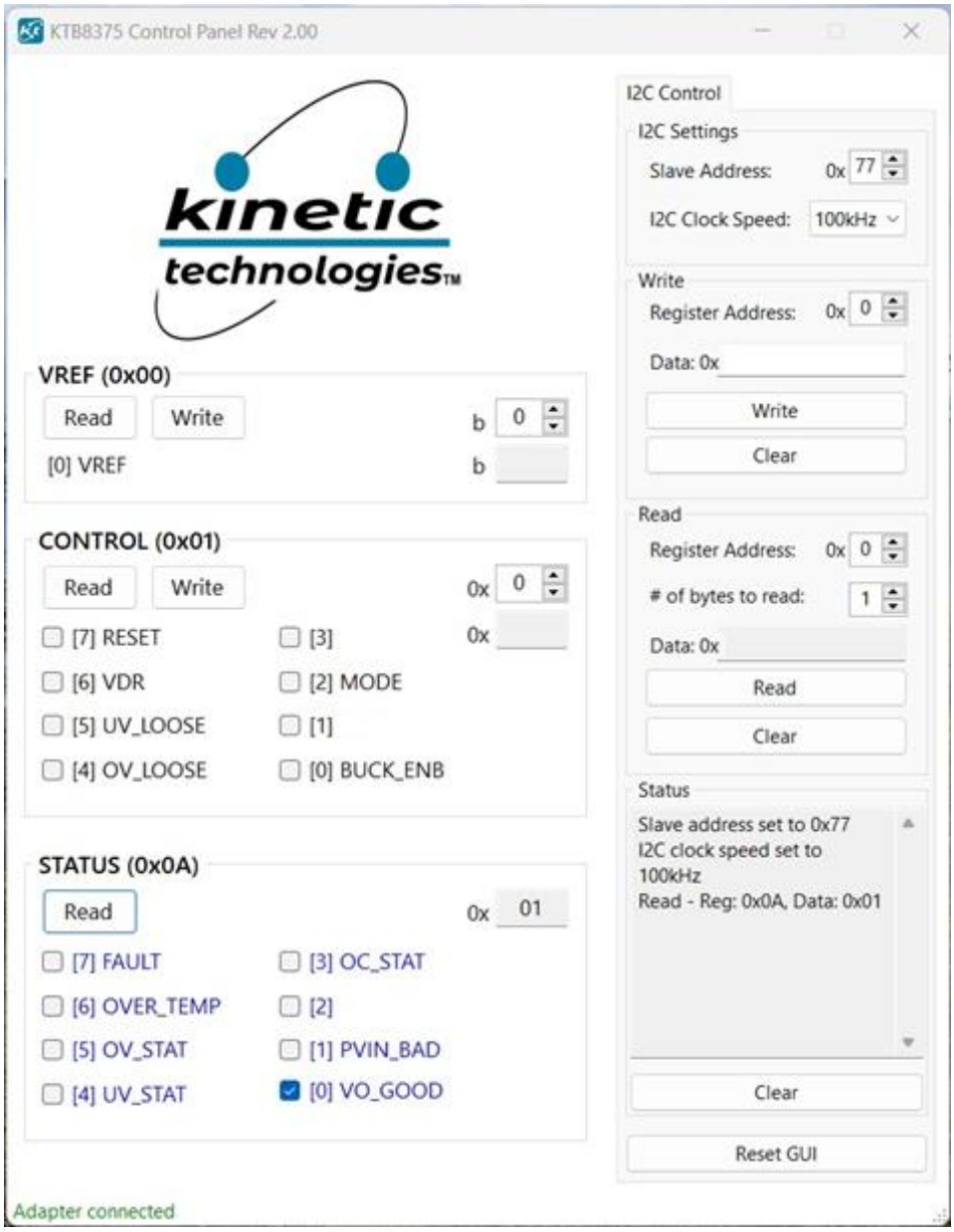


Figure 3. GUI window after Read Status register

To write to registers 0x00 or 0x01, change the bit(s) as needed, then click on the associated register window "Write" button.

For example, to change by I²C the MODE to FPWM, in the CONTROL register 0x01 section, set the MODE bit to 1, then click on the CONTROL register "Write" button.

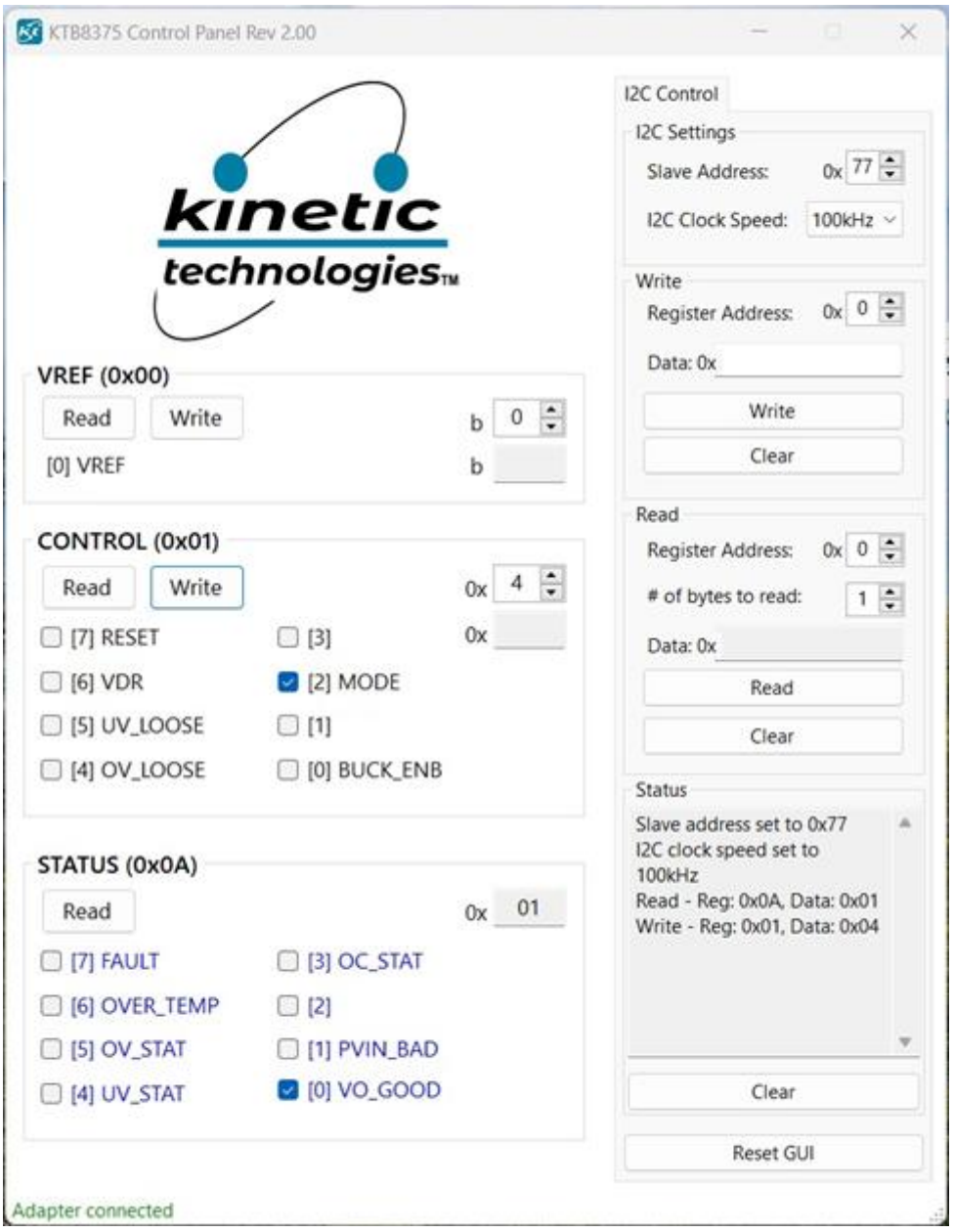


Figure 4. GUI window after Write to Control register

Electrical Schematic

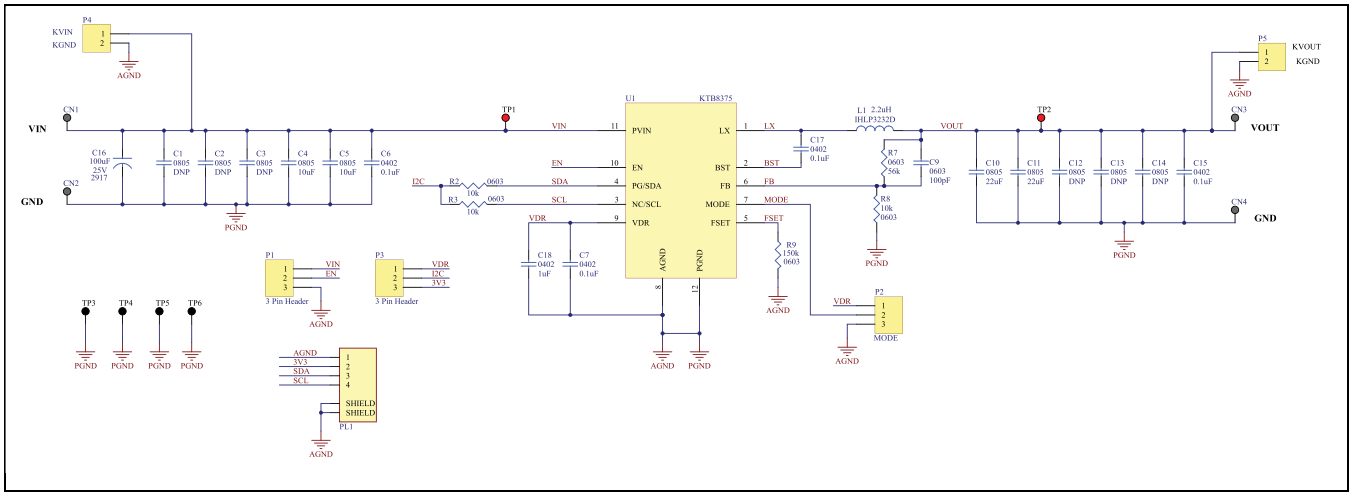


Figure 5. KTB8375 Evaluation Board Schematic for VOUT = 3.3V, f_{SW} = 500kHz

Bill of Materials (BOM)

Designator	Description	Quantity	Value	Manufacturer	Manufacturer Part Number
U1	3.5V to 24V Input, 6A Synchronous Buck Regulator with I²C Interface FCQFN-12	1		Kinetic	KTB8375EUFB
C1, C2, C3, C12, C13, C14	0805 DNP	6	DNP		
H1, H2, H3, H4	BRD SPT SNAP LOCK REST MNT 4MM	4		Essentra Components	PSD-4M-19
C7	CAP CER 0.1µF 0402 10V X7R	1	0.1µF	Murata	GCM155R71A104KA55D
C15, C17	CAP CER 0.1µF 25V X5R 0402	2	0.1µF	Samsung	CL05A104KA5NNNC
C6	CAP CER 0.1µF 35V X7R 0402	1	0.1µF	TDK Corporation	CGA2B3X7R1V104MT0Y0F
C18	CAP CER 1µF 10V X5R 0402	1	1µF	Samsung	CL05A105KP5NNNC
C4, C5	CAP CER 10µF 35V X5R 0805	2	10µF	Murata	GRM21BR6YA106KE43L
C10, C11	CAP CER 22µF 25V X5R 0805	2	22µF	Samsung	CL21A226MAYNNNE
C9	CAP CER 100PF 50V X7R 0603	1	100pF	Yageo	CC0603KPX7R9BB101
C16	CAP TANT POLY 100µF 25V 2917	1	100µF	Panasonic	25TQC100MD3
CN1, CN2, CN3, CN4	CONN BANANA JACK SOLDER	4		Keystone Electronics	575-4
PL1	CONN HEADER SMD R/A 4POS 1MM	1		JST Sales America Inc.	SM04B-SRSS-TB(LF)(SN)
P4, P5	CONN HEADER VERT 2POS 2.54MM	2		Sullins Connector Solutions	PREC002SAAN-RC
P1, P2, P3	CONN HEADER VERT 3POS 2.54MM	3		Sullins	PREC003SAAN-RC
L1	FIXED IND 2.2µH 14.5A 9.41MΩ	1	2.2µH	Vishay	IHLP3232DZER2R2M11
TP3, TP4, TP5, TP6	PC TEST POINT MULTIPURPOSE BLACK	4		Keystone	5011
TP1, TP2	PC TEST POINT MULTIPURPOSE RED	2		Keystone	5010
R2, R3, R8	RES 10KΩ 1% 1/10W 0603	3	10k	Yageo	RC0603FR-0710KL
R7	RES 56KΩ 1% 1/10W 0603	1	56k	Yageo	RC0603FR-0756KL
R9	RES 150KΩ 1% 1/10W 0603	1	150k	Yageo	RC0603FR-07150KL

Printed Circuit Board (PCB)

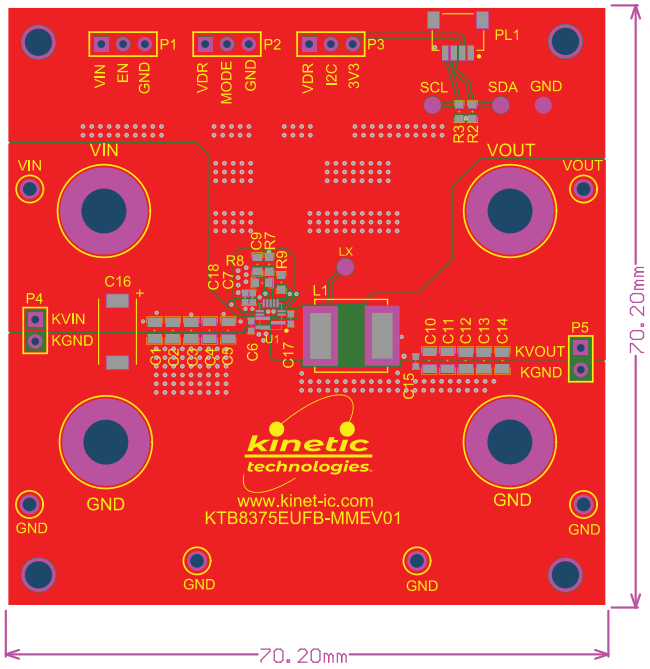


Figure 6. Top Layer

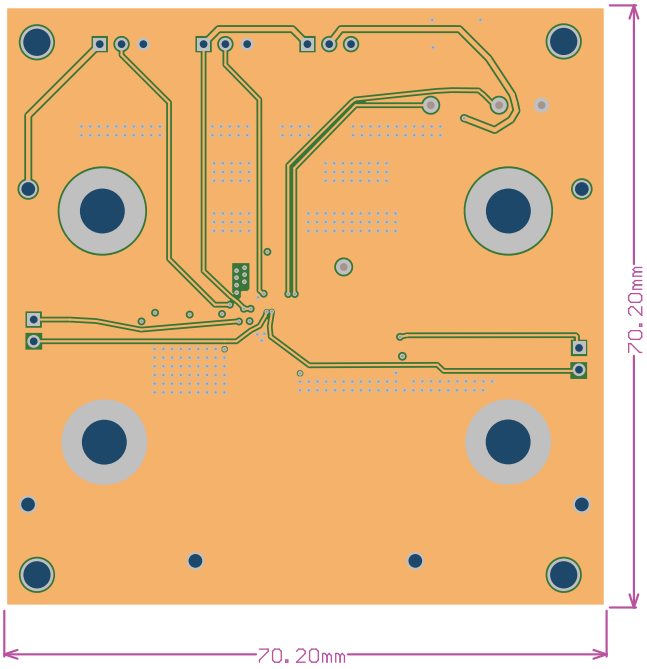


Figure 8. Inner 1 Layer

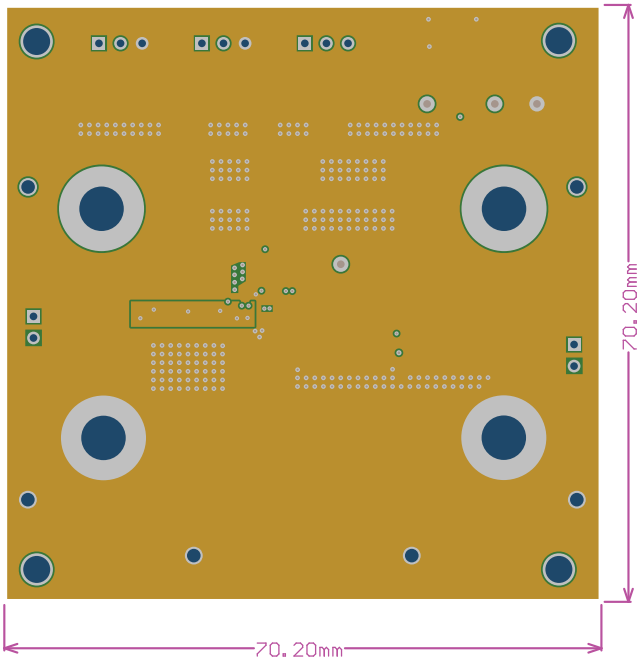


Figure 7. Inner 2 Layer

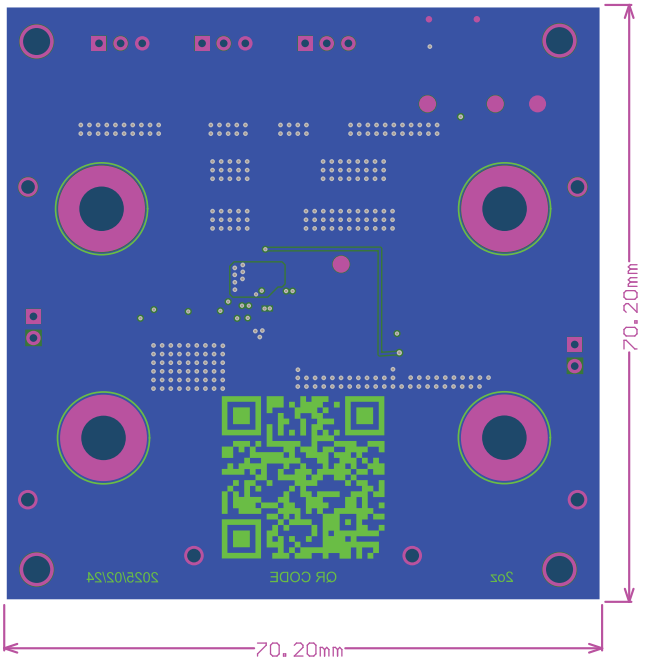


Figure 9. Bottom Layer

Buck Regulator Efficiency Measurement

Use a voltage meter to probe EVB test pins KVIN and KGND to measure input voltage, and KVOUT and KGND to measure output voltage. Also, connect current meter in series to input voltage source and output load.

The efficiency can be determined using the following equation:

$$\text{Efficiency (\%)} = [(V_{out} \times I_{out}) / (V_{in} \times I_{in})] \times 100\%$$

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