Low-Voltage Buck Regulator with Accurate F_{SW} and Fast Transient Response

Brief Description

This Manual describes the detailed operation of the KTB8400 evaluation board. KTB8400 is a unique OptiComp™ buck switching regulator with class-leading accuracy, transient response, efficiency, and solution size optimized for mobile and non-mobile applications. The KTB8400 Evaluation (EVAL) board is used to demonstrate the KTB8400 Buck regulator detailed functionality, performance, and the PCB layout.

The kit includes a fully assembled and tested KTB8400 EVAL board, I²C Adaptor, connecting cable, and a printed copy of the Quick Start Guide.

Ordering Information

Part Number	Description	IC Package
KTB8400AEDAA-MMEV01	KTB8400 EVAL Kit	WLCSP-15

3D CAD Image

EVAL Kit Physical Contents

Item #	Description	Included	Download
1	KTB8400 EVAL fully assembled PCB in Anti-static bag	1	
2	I^2C Adaptor: Adafruit MCP2221A General Purpose USB to GPIO ADC I^2C	1	
3	STEMMA QT 4-pin Cable	1	
4	Hard copy for the Quick Start Guide, 1 page (A4 or US Letter)	1	
5	EVAL Kit box	1	
6	EVAL Kit Manual, available at clickable URL		1
7	GUI, available at clickable URL		1

QR Links for Documents

IC Datasheet	EVAL Kit Landing Page
https://www.kinet-ic.com/ktb8400/	https://www.kinet-ic.com/ ktb8400aedaa-mmev01/

User-Supplied Equipment

Required Equipment

1. Bench Power Supply for VIN – 5V/9V and 3A 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
VIN	Input Withstand Voltage	-0.3 to 6	V
	Input Operating Voltage	2.5 to 5.5	V
VIO	VIO Operating Voltage	1.15 to 5.5	V
I_{OUT}	Output Load Current	0 to 3	A

Jumper Descriptions

Designator	Name	Description	Default
P1	VIO	Connected: Connect VIO to Input Voltage to disable I^2C Pins Float: Connect to the I^2C pins	Connected
P2	EN	Active-Low Enable Input: L: Shutdown Mode – switch disabled H: Enable Mode through VIO – normal switch operation	H
P3	VSEL	Auto-Skip vs. Forced-PWM Mode Select logic input Pin: L: Auto-Skip Mode H: Forced-PWM Mode through VIO	H
CN1	VIN	Connecting Header for VIN	-
CN2	GND	Connecting Header for GND	-
CN3	VOUT	Connecting Header for VOUT	-
CN4	GND	Connecting Header for GND	-
CN5	I^2C	Connecting Header SMD for I^2C SDA/SCL Input Pins	-

Quick Start Procedures

1. Install GUI file located on EVAL Kit Landing page (https://www.kinet-ic.com/ ktb8400aedaa-mmev01/).
2. Check the Jumpers for default setting.
3. Connect one pair of power cables to the connector of EVAL Kit at VIN and GND.
4. Before connecting the EVAL Kit to the VIN bench supply, turn on the supply and adjust the voltage as close to 0V as possible. Then turn off the supply. While off, connect the power cables ends to the VIN bench supply.
5. Turn on the VIN bench supply and very slowly ramp its voltage to an appropriate voltage, such as 3.6V. While ramping VIN slowly, use the bench supply's 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.
6. To hardware shutdown the buck regulator, simply use a jumper at P2 to connect EN to GND.
7. Connect a voltage meter to the output KVOUT and KGND test pins, it should measure the voltage of the buck regulator, which is specified on Page 4 of the datasheet.

Graphical User Interface (GUI)

- Download and install GUI software located on EVAL Kit Page (https://www.kinet-ic.com/ ktb8400aedaa-mmev01/).
- After installing software, the interface 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 board.

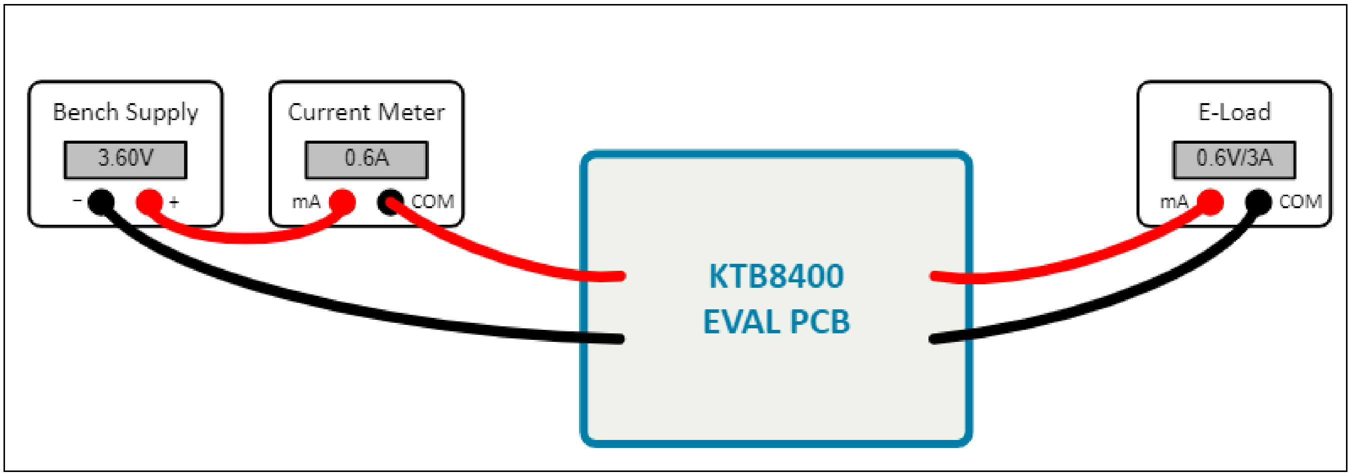
Additional Test Procedures to Program KTB400 Using I²C Pins

1. Take out P1 and P3 connectors.
2. Connect SDA, SCL and GND from the USB Adapter (Adafruit MCP2221A) to connector Logic Pins CN1.
3. Connect the USB end of the Adapter to the USB port of the computer.
4. Connect a DC power supply between the EVB test points VIN and GND.
5. With the power supply output turned off, configure the voltage to 3.6V.
6. Connect a voltage meter between the KVOUT and KGND.
7. Turn on the power supply output.
8. Start the "KTB8400 Control Panel" GUI program on the computer.
9. Verify that the USB Adapter has been detected in the GUI.
10. In order to establish the I²C communication, you need to type in the corresponding slave address for the IC under test. Please check KTB8400 datasheet (page 4) for the pre-defined address. Some of them can be found in the table below:

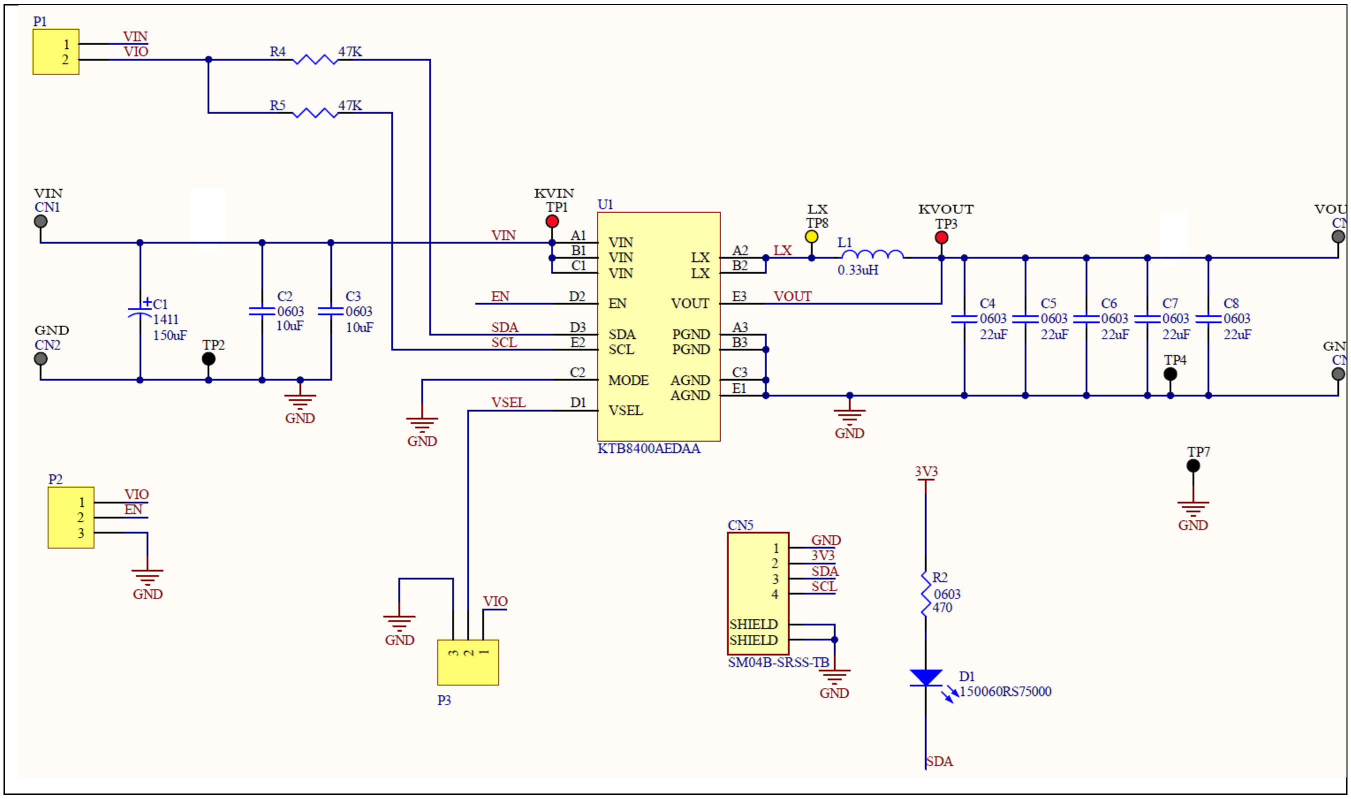
Part Number	7-bit I²C Slave Address
KTB8400AEDAA-TR	1100 000=0x60h

Typical Test Setup Diagram

As an example, use the following test setup to measure input/output in the Quick Start Procedures.



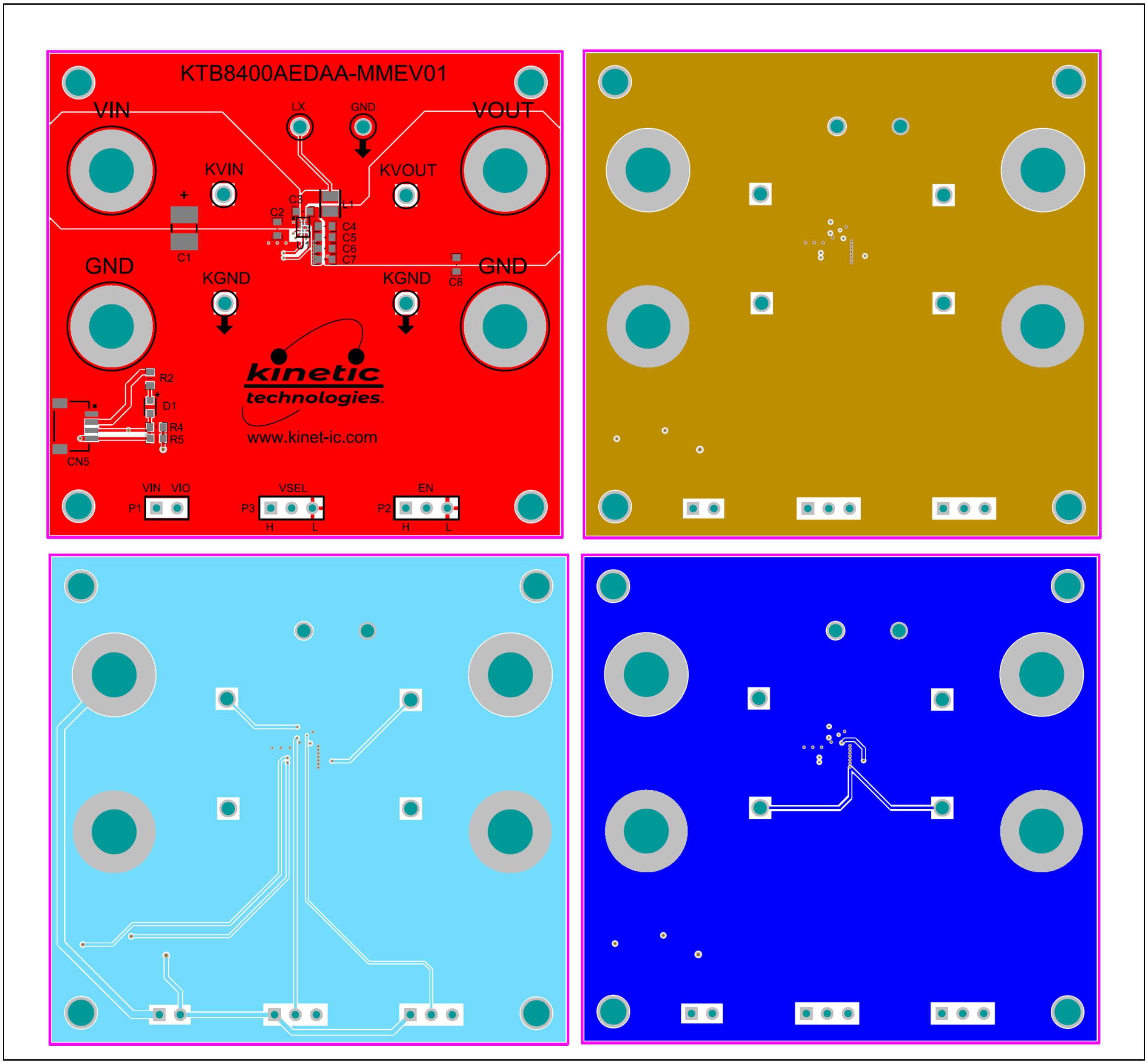
Electrical Schematic



Bill of Materials (BOM)

Quantity	Designator	Description	Value	Package	Manufacturer	Manufacturer Part Number
1	C1	CAP TANT POLY 150UF 6.3V 1411	150uF	1411	Kemet	T520B157M006ATE070
2	C2, C3	CAP CER 10UF 6.3V X5R 0603	10uF	0603	Murata	GRM188R61A106ME69D
5	C4, C5, C6, C7, C8	CAP CER 0.22UF 25V X7R 0603	22uF	0603	Murata	GRM188R60J226MEA0D
4	CN1, CN2, CN3, CN4	CONN BANANA JACK SOLDER		TH	Keystone Electronics	575-4
1	CN5	CONN HEADER SMD R/A 4POS 1MM		SMD	JST Sales America Inc.	SM04B-SRSS-TB(LF)(SN)
1	D1	Red 625nm LED Indication - Discrete 2V 0603 (1608 Metric)		0603	Würth Elektronik	150060RS75000
4	H1, H2, H3, H4	BRD SPT SNAP LOCK REST MNT 4MM			Essentra Components	PSD-4M-19
1	L1	FIXED IND 330NH 4A 26 MOHM SMD	0.33uH	0806	Murata Electronics	DFE201610E-R33M=P2
1	P1	CONN HEADER VERT 2POS 2.54MM		Through Hole	Sullins Connector Solutions	PREC002SAAN-RC
2	P2, P3	CONN HEADER VERT 3POS 2.54MM		TH	Sullins Connector Solutions	PREC003SAAN-RC
1	R2	RES SMD 470 OHM 1% 1/10W 0603	470	0603	YAGEO	AF0603FR-07470RL
2	R4, R5	RES 47K OHM 1% 1/10W 0603	47K	0603	Yageo	RC0603FR-0747KL
2	TP1, TP3	PC TEST POINT MULTIPURPOSE RED		TH	Keystone	5010
3	TP2, TP4, TP7	PC TEST POINT MULTIPURPOSE BLACK		TH	Keystone	5011
1	TP8	PC TEST POINT MULTIPURPOSE YELLOW		TH	Keystone	5014
1	U1	Low Voltage Buck with Accurate Fsw and Fast Transient Response		WLCSP-15	Kinetic Technologies	KTB8400AEDAA-TR

Printed Circuit Board (PCB)

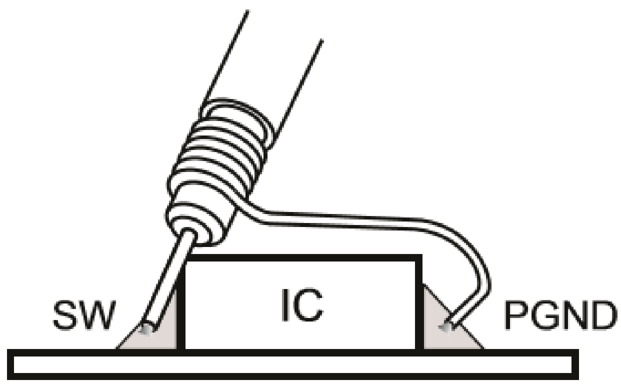


Buck Regulator Efficiency Measurement

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 equation:

Efficiency (%) = [(V_out x I_out) / (V_in x I_in)] x 100%



Low Inductance Probe Connection

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