

BD18397RUV-M/BD18398RUV-M LED Drivers for Automotive Exterior Lamp.

BD18397RUV-M/BD18398RUV-M Evaluation Board



Figure 1. BD18397/98RUV-EVK-302 Evaluation Kit Contents

The BD18397/98RUV-EVK-302 Evaluation Board is an easy-to-use hardware platform that allows evaluation of both BD18397RUV-M and BD18398RUV-M devices for demonstration of LED dimming, sequencing, and protection performance.

The Evaluation Kit consists of BD18397/98RUV-EVK-302 evaluation board, plug-in board CY8CKIT-059 and Micro USB cable.

The ROHM EVK GUI SW used in conjunction with the BD18397/98RUV-EVK-302 evaluation board provides a user-friendly graphical interface for demonstrating features such as:

- digital and analog PWM dimming.
- demo mode for easy demonstration of specific used cases.
- data monitoring of real-time device signals.
- polling for protection status.
- device register editor for adaption of individual registers.

The BD18397/98RUV-EVK-302 evaluation board can also be operated in MCU-only mode where no USB connection to PC/laptop is required. MCU-only mode FW is available on request from ROHM and can be flashed into the CY8CKIT-059 plug-in board. MCU-only mode allows simple demonstration of dimming, LIMPHOME mode, OPEN/SHORT output protection with LED indication.

In addition, SPI parallel connection of two boards is possible for both GUI and MCU only modes for 5 or 6 channel LED driver operation.

Contents

LIST OF FIGURES	4
LIST OF TABLES	5
REVISION HISTORY	6
1. SYSTEM BLOCK DIAGRAM	7
1.1. BD18397/98RUV-EVK-302 SYSTEM BLOCK DIAGRAM	7
2. SPECIFICATION	8
2.1. BD18397/98RUV-EVK-302 HARDWARE / SOFTWARE SPECIFICATION OVERVIEW	8
3. CIRCUIT APPLICATION	9
3.2. BD18397/98RUV-EVK-302 CIRCUIT SCHEMATIC	9
3.2. BD18397/98RUV-EVK-302 BILL OF MATERIALS	10
3.3. BD18397/98RUV-EVK-302 PCB LAYERS	13
4. BOARD OPERATION	16
4.1. HARDWARE SET-UP	16
4.2. SOFTWARE SET-UP	18
4.2.1 ROHM EVK GUI software installation and configuration	18
4.2.2 Board Operation with ROHM EVK GUI	20
5. ROHM EVK GUI OVERVIEW	21
5.1. OVERVIEW	21
6. ROHM EVK GUI USER INTERFACE AND DROP-DOWN MENUS	24
6.1. USER INTERFACE AND DROP-DOWN MENUS	24
6.1.1. FILE MENU	24
6.1.2. DATA MENU	24
6.1.3. CONNECTION MENU	24
6.1.4. REGISTERS MENU	24
6.1.5. SETTINGS MENU	24
6.1.6. STREAM MENU	25
6.1.7. BOARD MENU	25
6.1.8. VIEW MENU	25
6.1.9. DEMO MODE MENU	27
6.2.0. HELP MENU	27
7. USER INTERFACE TABS	29
7.1. PLOTTER - TAB	29
7.2. BD18398 - TAB	30
7.3. BD18397/98RUV-EVK-302 CONNECTION INFO – TAB	31
8. SHORTCUTS	32

9.	MCU-ONLY MODE	33
10.	SPI PARALLEL CONNECTION MODE	36
11.	MEASUREMENTS.....	37
11.1.	BD18397RUV-M AND BD18398RUV-M EFFICIENCY MEASUREMENTS.....	37
11.2.	BD18398RUV-M THERMAL MEASUREMENTS IN THE BD18398RUV-EVK-302 BOARD	38
11.3.	BD18398RUV-M LED OPEN AND LED SHORT TO GND IN THE BD18398RUV-EVK-302 BOARD	39

List of Figures

Figure 1: BD18397/98RUV-EVK-302 Evaluation Kit Contents.....	1
Figure 2: System Block Diagram	7
Figure 3: BD18397/98RUV-EVK-302 evaluation board	8
Figure 4: BD18397/98RUV-EVK-302 circuit schematic	9
Figure 5: Top Layer.....	13
Figure 6: Ground Layer.....	13
Figure 7: Power Layer	14
Figure 8: Bottom Layer	14
Figure 9: Silkscreen.....	15
Figure 10: BD18397/98RUV-EVK-302 headers and switches plus two BD18312 ROHM LED modules	16
Figure 11: BD18397/98RUV-EVK-302 measurement pins.....	17
Figure 12: BD18397/98RUV-EVK-302 LED indication during start-up.....	20
Figure 13: GUI BD18398 Registry	22
Figure 14: Plotter Function	23
Figure 15: Write events during LED Pattern 1 Turning Light.....	26
Figure 16: Reference Line (dotted line at 0)	27
Figure 17: ROHM EVK GUI version and Host Adapter Board Information.....	28
Figure 18: Plotter Tab	29
Figure 19: BD18398 Registry Tab.....	30
Figure 20: THE BD18397-98RUV-EVK-302	31
Figure 21: BD18397/98RUV-EVK-302.....	33
Figure 22: BD18397/98RUV-EVK-302.....	34
Figure 23: BD18397/98RUV-EVK-302 in MCU only mode during demo sequence	35
Figure 24: SPI Parallel connection mode using the BD18398RUV-M and BD18397RUV-M devices	36
Figure 25: ISET = 500mA, 3 channels enabled	38
Figure 26: ISET = 1000mA, 3 channels enabled	38
Figure 27: VSW and ILED Waveforms for VOUTx shorted to GND.....	39
Figure 28: VSW and ILED Waveforms for VOUTx open.....	39

List of Tables

Table 1: BoM List 12

Table 2: Headers, Jumper and Switches Default state and function. 16

Table 3: Measurement pin functions. 17

Table 4: Short Key Functions..... 32

Revision History

Revision	Date	Description
001	July 2024	Final Version

1. SYSTEM BLOCK DIAGRAM

1.1. BD18397/98RUV-EVK-302 System Block Diagram

The System Block Diagram is shown in Figure 2.

The BD18398RUV-M (3-channel) or BD18397RUV-M (2-channel) devices can be assembled on the evaluation board.

In addition, SPI parallel connection is possible where two evaluation boards can be connected with SPI interface and controlled with one CY8CKIT-059 MCU in order to have a 5 channel (BD18397RUV-M plus BD18398RUV-M) or a 6 channel (BD18398RUV-M + BD18398RUV-M) LED driver application.

Communication via CAN bus to other devices is possible using the CAN transceiver BD41041FJ-C device which is powered with a linear regulator BD450M2EFJ-C.

The BD450M2EFJ-C device supplies 5V to the BD18397/98RUV-M if an external 5V is required instead of VREG.

The BD450M2EFJ-C device also supplies the CY8CKIT-059 when MCU-only mode is used (no 5V from USB connector).

Reverse polarity protection on VIN is implemented using MOSFET RSR010N10HZG and diode RF081MM2STF.

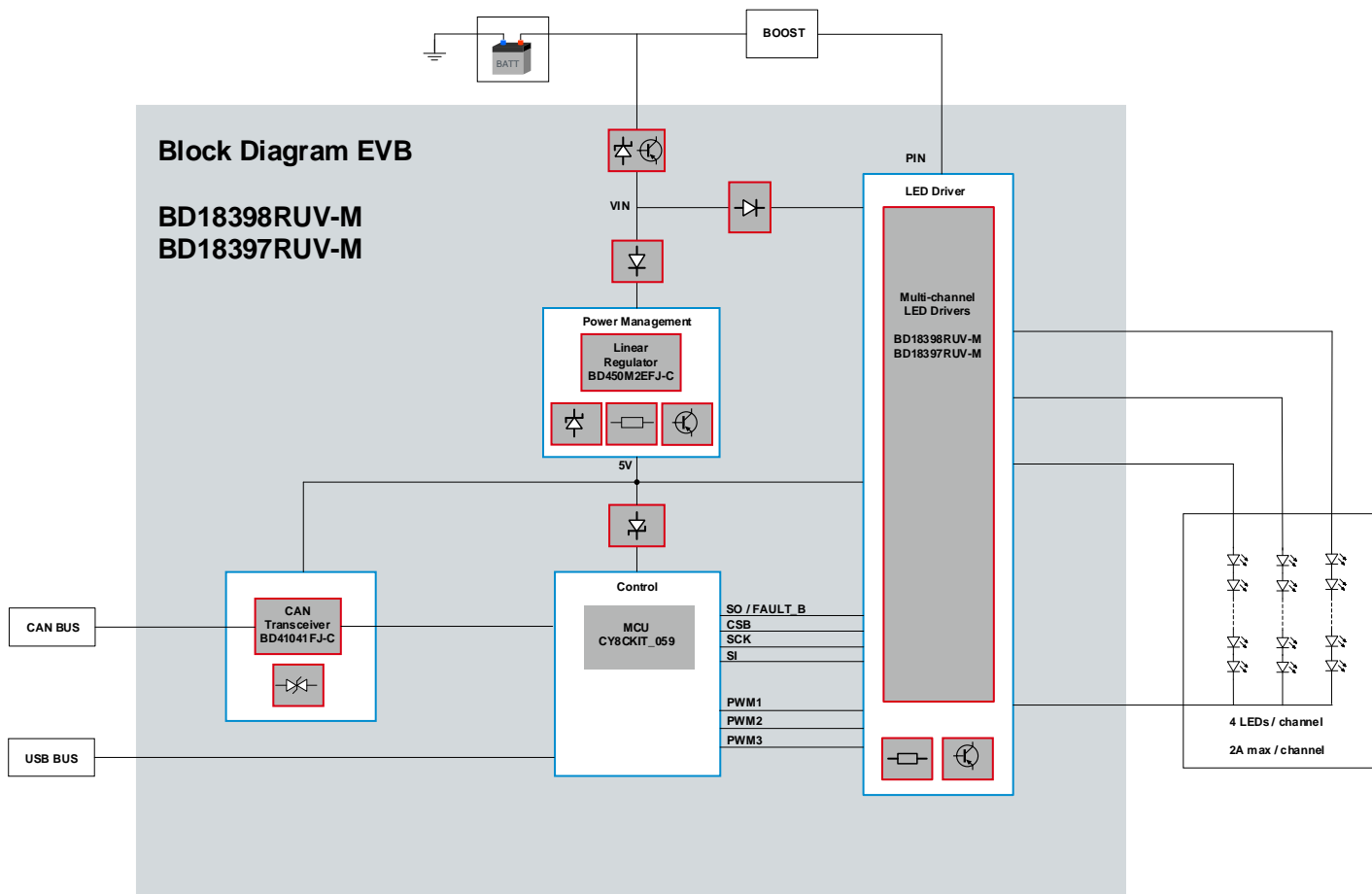


Figure 2. System Block Diagram

2. SPECIFICATION

2.1. BD18397/98RUV-EVK-302 Hardware / Software specification overview

- VIN input protection in application for BD18397/98RUV-M and BD450M2EFJ-C against battery load dumps.
- Internal 5V regulator or external 5V regulator selection.
- VOUTx protection test for VOUT short to GND and open LED.
- Interfacing to CANBUS using BD41041FJ-C transceiver.
- Push-button switch for sequencing during MCU-only mode.
- SPI interface for BD18397/98RUV-M interfacing to MCU using either GUI or MCU-only mode
- SPI parallel connection of two boards with one MCU using either GUI or MCU-only mode
- Windows GUI for demonstration mode, monitoring and display of BD18397/98RUV-M signal data (plotter), register adaptation and polling for protection monitoring.
- Analog and Digital PWM Dimming.
- LIMPHOME mode Operation.
- LED indications for 5VREG, FIRMWARE READY, PROTECTION and FAULT_B.
- MCU only mode with demonstration of Digital PWM, LIMPHOME mode and OPEN/SHORT protection features.

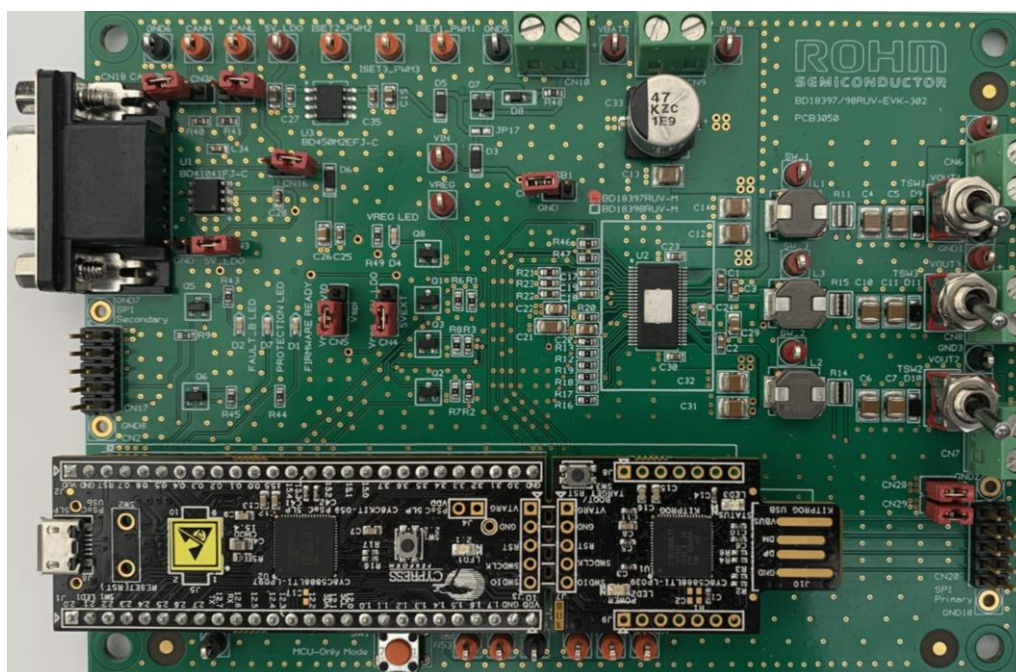


Figure 3: BD18397/98RUV-EVK-302 evaluation board

3. CIRCUIT APPLICATION

3.2. BD18397/98RUV-EVK-302 Circuit Schematic

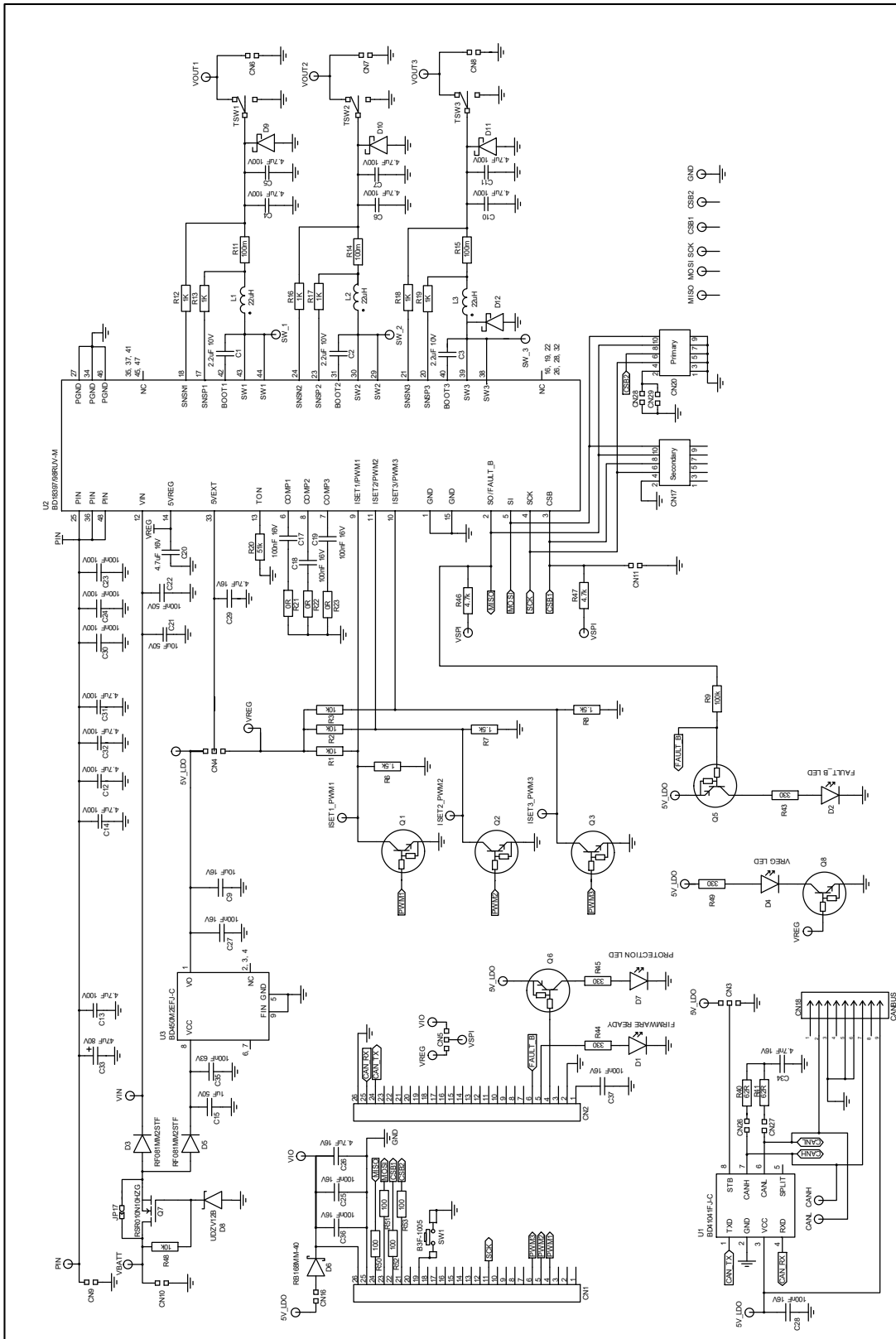


Figure 4: BD18397/98RUV-EVK-302 circuit schematic

3.2. BD18397/98RUV-EVK-302 Bill of Materials

Reference	Contents	Parts Number	Description, Size	Package	Manufacturer
Resistors					
R11, R14, R15	Resistor	LTR18EZPFLR100	100m, 1206 wide	SMD 0612	ROHM
R1, R2, R3, R48	Resistor	ESR03EZPJ103	10K, 0603	SMD 0603	ROHM
R6, R7, R8	Resistor	ESR03EZPJ152	1.5K, 0603	SMD 0603	ROHM
R43, R44, R45, R49	Resistor	ESR03EZPJ331	330R, 0603	SMD 0603	ROHM
R12, R13, R16, R17, R18, R19	Resistor	ESR03EZPJ102	1K, 0603	SMD 0603	ROHM
R9	Resistor	ESR03EZPJ104	100k, 0603	SMD 0603	ROHM
R20	Resistor	ESR03EZPJ513	51K, 0603	SMD 0603	ROHM
R40, R41	Resistor	ESR03EZPJ620	62R, 0603	SMD 0603	ROHM
R46, R47	Resistor	ESR03EZPJ472	4.7K, 0603	SMD 0603	ROHM
R21, R22, R23	Resistor	SFR03EZPJ000	0R, 0603	SMD 0603	ROHM
R50, R51, R52, R53	Resistor	ESR03EZPJ101	100R, 0603	SMD 0603	ROHM
Capacitors					
C33	Capacitor	EEH-ZC1K470P	47uF, 80V, Radial, G (φ10x10.2L), Polymer	CAP ALUM POLY HYB 47UF 80V SMD	Panasonic
C17, C18, C19, C25, C27, C28, C36, C37	Capacitor	GCM188R71C104KA37J	100nF, 16V, 0603	SMD 0603	Murata
C4, C5, C6, C7, C10, C11, C12, C13, C14, C31 C32	Capacitor	GCM32DC72A475KE02L	4.7uF, 100V, 1210, MLCC	SMD 1210	Murata
C1, C2, C3	Capacitor	GRM188R71A225ME15E	2.2uF, 10V, 0603, MLCC	SMD0603	Murata
C23, C24, C30	Capacitor	GCJ188R72A104KA01D	100nF, 100V, 0603	SMD 0603	Murata
C20, C26, C29	Capacitor	GCM21BR71C475KA73K	4.7uF, 16V, 0805	SMD 0805	Murata
C21	Capacitor	GRT31CR61H106ME01L	10uF, 50V, 1206	SMD 1206	Murata
C22	Capacitor	GCM21BR71H104KA37K	100nF, 50V, 0805	SMD 0805	Murata
C9	Capacitor	GRT21BC81C106ME01L	10uF, 16V, 0805	SMD 0805	Murata
C15	Capacitor	GCJ21BR71H105MA01L	1uF, 50V, 0805	SMD 0805	Murata

Reference	Contents	Parts Number	Description, Size	Package	Manufacturer
C34	Capacitor	C0603C472K4RECAUTO	4.7nF, 16V, 0603	SMD 0603	Murata
C35	Capacitor	GCM188R71H104KA57D	100nF, 63V, 0603	SMD 0603	Murata
Inductors					
L1, L2, L3	Inductor	SPM7054VT-220M-D	22uH (7.5 x 7.0 x 5.4)	SMD (7.5 x 7.0 x 5.4)	TDK
ICs					
U2	IC	BD18397/98RUV-ME2	2/3 ch LED Driver, HTSSOP-C48R	HTSSOP-C48R	ROHM
U3	IC	BD450M2EFJ-CE2	LDO 5V/200mA, HTSOP-J8	SMD HTSOP-J8	ROHM
U1	IC	BD41041FJ-CZE2	CAN transceiver, SOPJ8	SMD SOPJ8	ROHM
Transistors					
Q1, Q2, Q3, Q8	Transistor	DTC113ZCAT116	NPN, SST3	SMD SOT-23	ROHM
Q5, Q6	Transistor	DTA113ZCAHZGT116	PNP, SST3	SMD SOT-23	ROHM
Q7	Transistor	RSR010N10HZGTL	N-Channel	SOT-346T	ROHM
Diodes					
D1, D4	LED Diode (G)	SML-D12P8WT86C JKLM	COMM_ON_LED / 5V_ON_LED	SMD 0603	ROHM
D2	LED Diode (R)	SML-D12U8WT86C PQRS	FAULT_ON_LED	SMD 0603	ROHM
D3, D5	Diode	RF081MM2STFTR	Back protection Vin for BD18398 and BD450M2	SOD-123F	ROHM
D6	Diode	RB168MM-40TFTR	External supply for microcontroller	SOD-123F	ROHM
D7	LED Diode (Y)	SML-D12Y8WT86C PQRS	LIMPH_ON_LED	SMD 0603	ROHM
D8	Zener diode	UDZVTE-1712B	VZ 12, I _z 5mA	SOD-323FL	ROHM
D9, D10, D11, D12	SBD	RB068MM100TF	100V/2A	SOD-123FL	ROHM
Connector					
CN1, CN2	Connector, male header	TSW-126-07-L-S	HDR 1X26 2.54mm	THT	Samtec
CN3, CN4, CN5	Connector, male header	TSW-103-07-F-S	HDR 1X3 2.54mm	THT	Samtec

Reference	Contents	Parts Number	Description, Size	Package	Manufacturer
CN6, CN7, CN8, CN9, CN10	Connector	Phoenix Contact 1729128	VIN, PVIN, VOUT1, VOUT2, VOUT3	THT	Phoenix
CN11, CN16, CN26, CN27, CN28, CN29	Connector, male header	TSW-102-07-F-S	HDR 1X2 2.54mm	THT	Samtec
CN17, CN20	Connector, male header	TMM-105-03-G-S	HDR 2x5 2.54mm	THT	ASSMAN
CN18	Connector	A-DF 09 A/KG-T1	9 pin Sub D for Can Bus, Female connector	THT	Assmann
Switches					
TSW1, TSW2, TSW3	Toggle switch	108-2MS3T1B1M1QE-EVX	SPDT 3-way toggle switch 3A rating	THT	E-Switch
Other					
MCU	Plug-in board	CY8CKIT-059	Cypress board	Plug-in board	Cypress
MCU headers	Connector, female headers	SSQ-126-01-G-S	HDR 1X26 2.54mm	THT	Samtec
Heatsink	Anodized heat sink for BD18397/98	SK 437 25 STS Fischer w/o pin	Heat sink	NA	Fischer Elektronik
Thermal Interface Material	TIM	WLFT 405 R25 10128079	Thermal Interface Material between IC and HS	NA	Fischer Elektronik
SW1	Switch	B3F-1005	Push button SW	THT	Omron
5V_LDO, PIN, VIN, VREG, SW_1, SW-2, SW_3, VOUT1, VOUT2, VOUT3	Red TP	5005	Test point pin	THT	Keystone
GNDx	Black TP	5006	Test point pin	THT	Keystone
CANH, CANL, MISO, MOSI, SCK, CSB1, CSB2, ISET1_PWM1, ISET2_PWM2, ISET3_PWM3	Orange TP	5008	Test point pin	THT	Keystone

Table 1: BoM List

3.3. BD18397/98RUV-EVK-302 PCB Layers

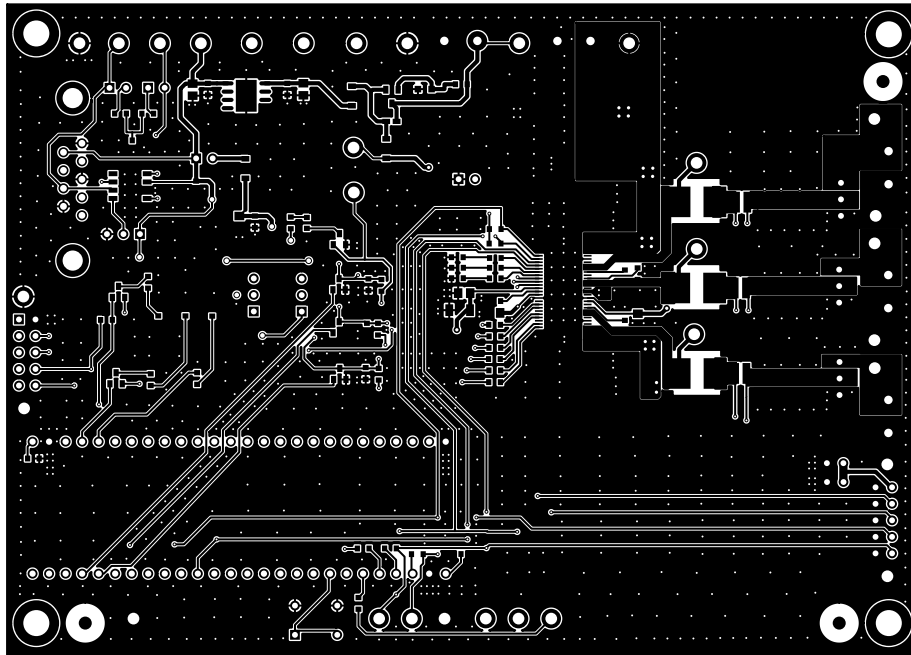


Figure 5: Top Layer

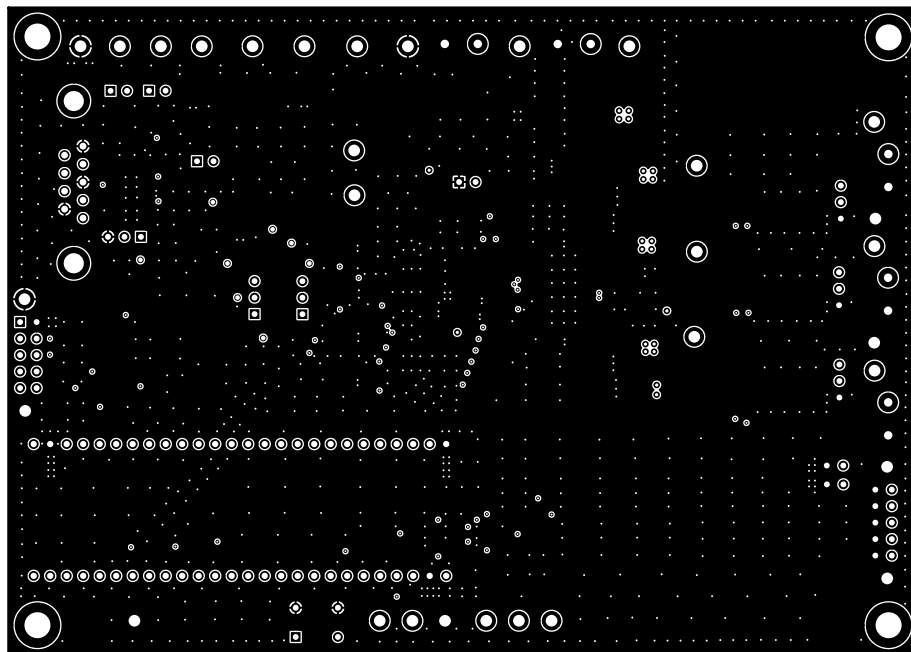


Figure 6: Ground Layer

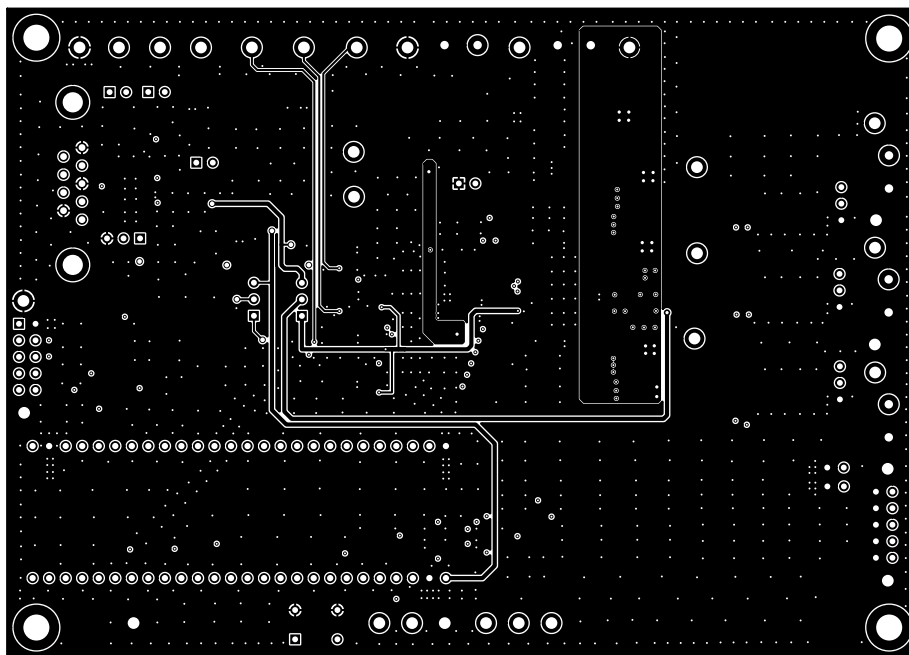


Figure 7: Power Layer

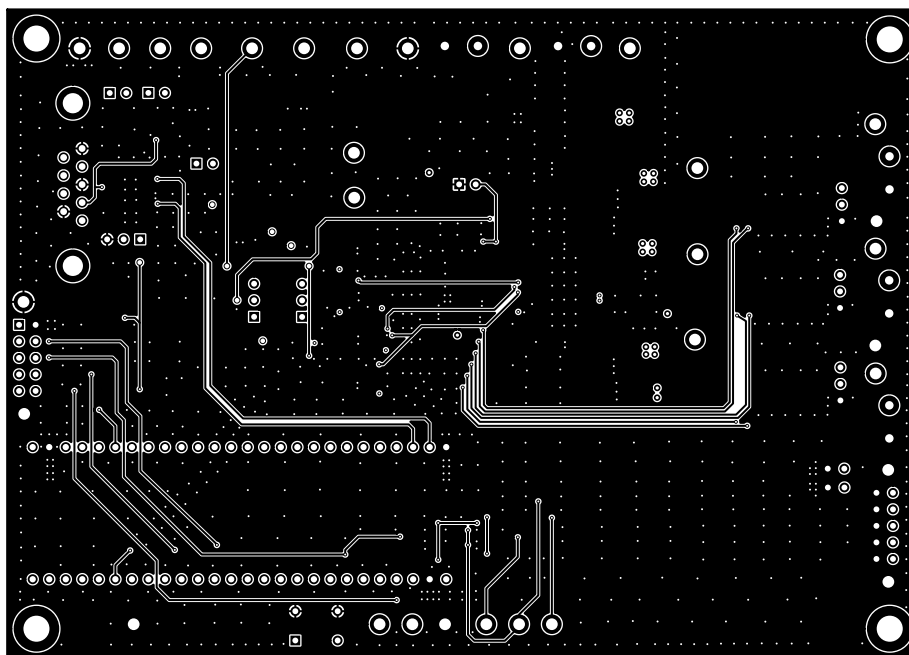


Figure 8: Bottom Layer

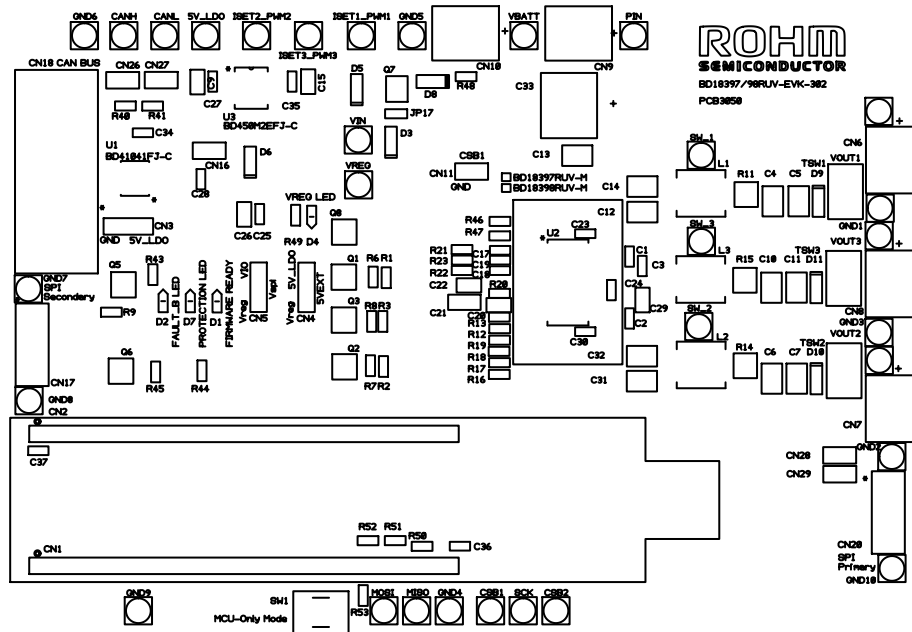


Figure 9: Silkscreen

4. BOARD OPERATION

4.1. Hardware Set-up

Connect the VBATT and PIN as shown in diagram where VBATT range is 5V to 45V and PIN range is 5V to 65V.

There is no reverse protection diode in series with PIN in application so connect PIN and GND correctly as shown.

The number of series LED per channel allowed at VOUT must be within the allowed voltage range of VOUT of 2V – 60V.

For example, VBATT=12V, PIN= 20V, 3 output channels with 4 series LEDs for each channel.

The ROHM BD18312 LED module uses XPLAWT-00-0000-0000V5051 LEDs.

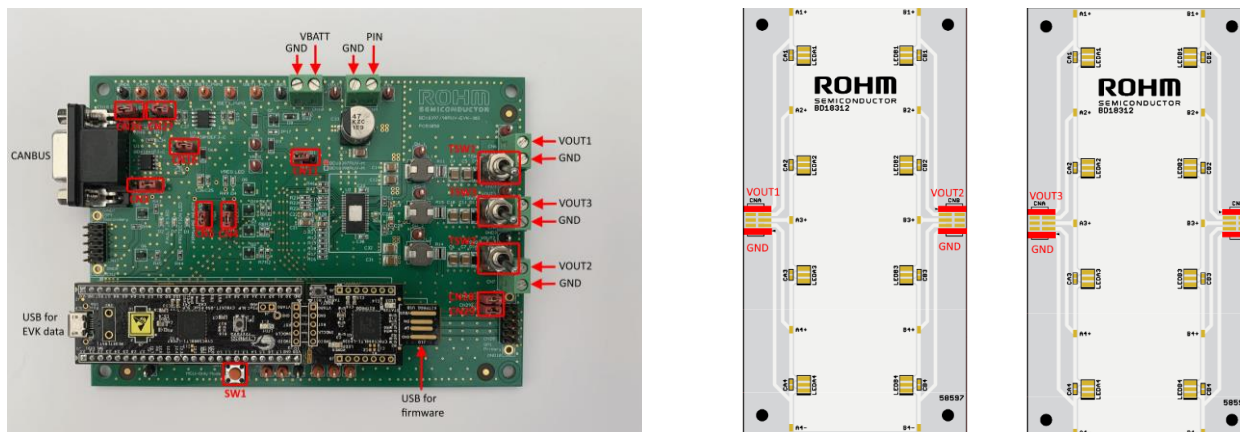


Figure 10: BD18397/98RUV-EVK-302 headers and switches plus two BD18312 ROHM LED modules

Headers/Switches	Default State	Function
CN26, CN27	Open	For measurement or for resistor termination of CANH/L signals.
CN3	Connect to 5V_LDO	Standby function of the BD41041FJ-C.
CN4	Connect to Vreg	Pull up of SPI signals to Vreg or VIO.
CN5	Connect to Vreg	5VEXT connected to VREG or 5V from LDO.
CN11	Open	Pull down CSB to GND.
TSW1	Set TSW in down position to connect to LED module. <i>Short is up position, open is mid position</i>	3-way toggle switch to connect VOUT1 to LED module or to short/open VOUT1.
TSW2	Set TSW in down position to connect to LED module. <i>Short is up position, open is mid position</i>	3-way toggle switch to connect VOUT2 to LED module or to short/open VOUT2.
TSW3	Set TSW in down position to connect to LED module. <i>Short is up position, open is mid position</i>	3-way toggle switch to connect VOUT3 to LED module or to short/open VOUT3.
CN16	Open: USB cable supplies VDD to CY8CKIT-059 Closed: No USB cable and LDO supplies MCU	Supply configuration of CY8CKIT-059.
Headers/Switches	Default State	Function
SW1	Push button type (GPIO to GND once pressed and when released generates interrupt to MCU)	MCU only mode demonstrating user case sequence and protection polling.
CN28, CN29	Open: no GND connection to 2nd board Closed: GND connection for SPI parallel mode	GND connection of 2 Evaluation boards for SPI parallel mode

Table 2: Headers, Jumper and Switches Default state and function.

Measurement pins for different test points are indicated in Figure 11 with summary given on Table 3.

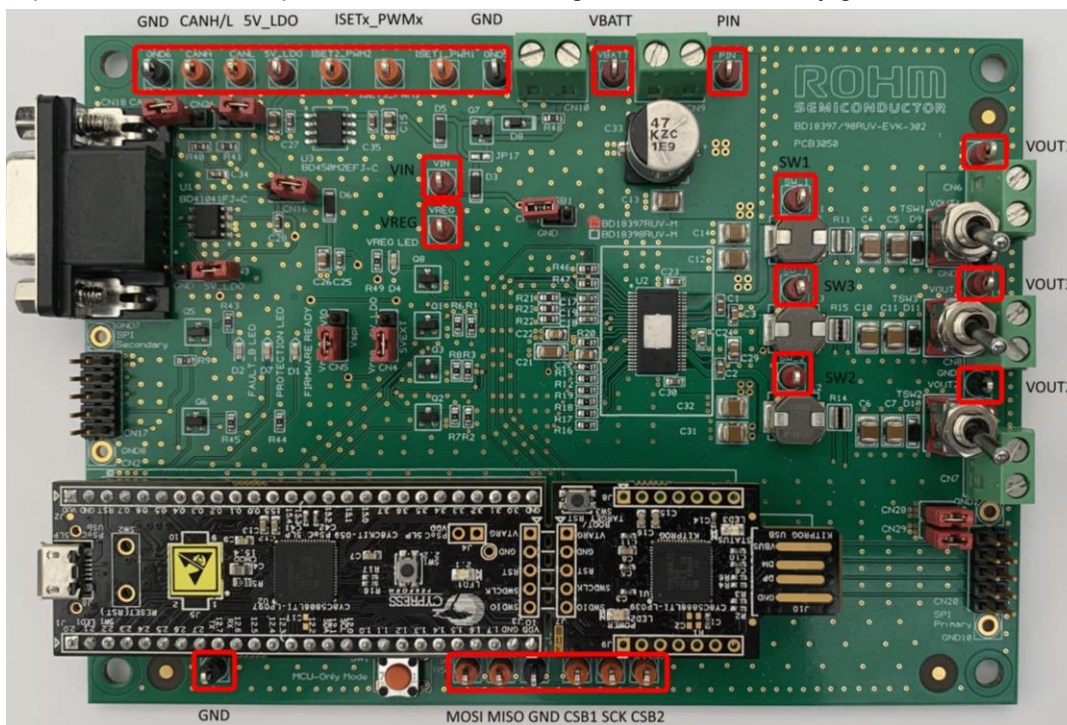


Figure 11: BD18397/98RUV-EVK-302 measurement pins.

Measurement pins	Function
CANH/L	CANH, CANL measurement pins.
5V_LDO	5V LDO measurement pin.
ISETx_PWMx	ISET1_PWM1, ISET2_PWM2 and ISET3_PWM3 measurements pins.
VBATT	VBATT measurement pin.
PIN	PIN measurement pin.
VIN	VIN measurement pin.
VREG	VREG measurement pin.
SWx	SW1, SW2 and SW3 measurement pins.
VOUTx	VOUT1, VOUT2 and VOUT3 measurement pins.
SPI	MOSI, MISO, CSB1, SCK, and CSB2 measurement pins.
GND	GND reference pins.

Table 3: Measurement pin functions.

4.2. Software Set-up

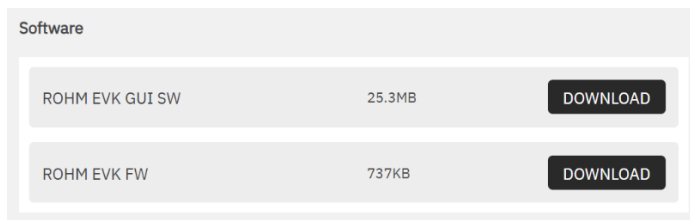
4.2.1 ROHM EVK GUI software installation and configuration

STEP 1:

Download and Install the ROHM EVK GUI SW for your Windows PC/Laptop.

The download link is <https://www.rohm.com/support/accelerometer-evk-support>.

Press Download for ROHM EVK GUI SW



After installation, ROHM EVK GUI appears in startup menu



The CY8CKIT-059 is already flashed with the ROHM's custom firmware (hex file).

- 📄 ROHM-EVK-CY8CKIT059-firmware-v3.5.0-0.cyacd
- 📄 ROHM-EVK-CY8CKIT059-firmware-v3.5.0-0.hex

The firmware is in the installation directory:

[//Documents/ROHM_EVK_v3/ROHM-EVK-Firmware/CY8CKIT-059](#)

Firmware can also be flashed for non-programmed CY8CKIT-059 boards.

Detailed instructions for updating firmware are given under Firmware section in the Software User Guide found in the installation directory:

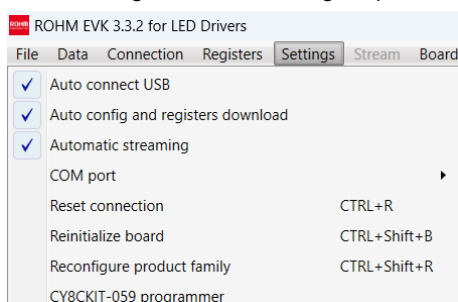
[//Documents/ROHM_EVK_v3/ROHM-EVK-Docs](#)

Any further firmware update, if required, is flashed by selecting "CY8CKIT-059 programmer" in the GUI, snapshot in Step 2.

STEP 2:

Configuration of the LED Driver is performed once an internet connection is available:

- Launch ROHM EVK GUI SW
- In Settings select "Reconfigure product family"



- In Pop-Up menu select: "ROHM EVK 3.2 for LED Drivers"

Press OK

ROHM EVK product family selection
✕

Please select the used product family for your ROHM EVK GUI:

Product Family	Local Package	Update Status
ROHM EVK 3.3.2 for Power Devices	✔	✔
ROHM EVK 3.3.2 for LED Drivers	✔	✔
ROHM EVK 3.3.2 for Sensors and AFE.	✔	⬆

Current product family configuration:

for Power Devices

Configurations updated: 2023-11-28 (RN1EkA==)

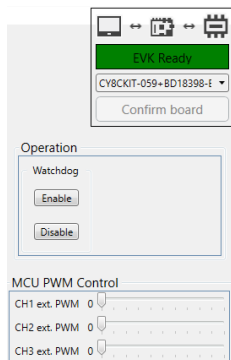
Registers updated: 2023-11-28 (P82nsA==)

OK

Cancel

4.2.2 Board Operation with ROHM EVK GUI

With the ROHM EVK GUI software installed and configured, connect the USB cable between PC/laptop and the CY8CKIT-059 plug-in board; the blue LED on CY8CKIT-059 plug-in board lights up. Start the ROHM EVK GUI and press “Confirm board” for example BD18398-EVK-302. EVK Ready goes to green and the green Firmware Ready LED on BD18397/98RUV-EVK-302 board lights up and the default registry values are automatically loaded.



Connect VBATT for example to 12V and VREG green LED lights up. Connect PIN, the 3 output LED channels are operational and can be controlled using Demo Mode, analog PWM Mode, LIMPHOME Mode or adjusting register entries to appropriate values (refer to BD18398RUV-M / BD18397RUV-M datasheet for complete registry table).

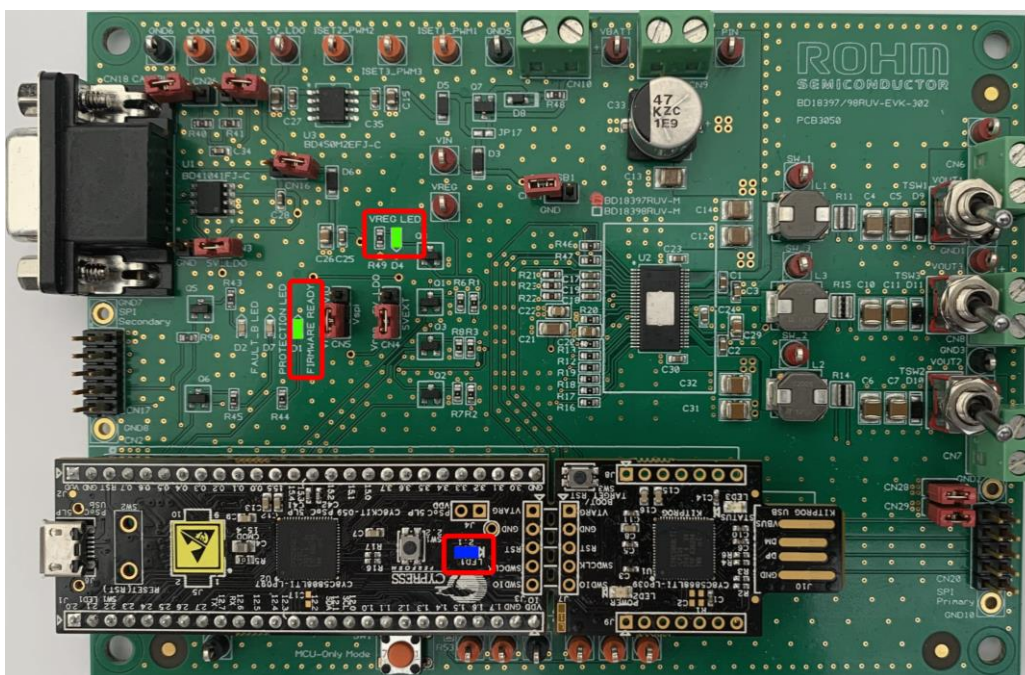


Figure 12: BD18397/98RUV-EVK-302 LED indication during start-up.

5. ROHM EVK GUI OVERVIEW

5.1. Overview

The ROHM EVK GUI provides an easy-to-use graphical user interface demonstrating high level device features.

Some of the features include:

- A visual display of real-time device data using the plotter tab function.

- Ability to record device data onto a file.

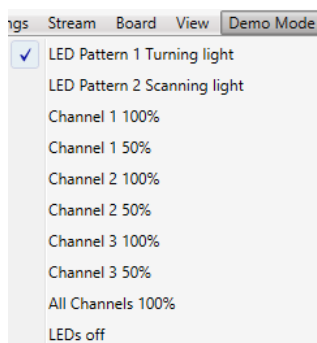
- Device registry editor for R/W commands.

- Demo mode including turning and scanning LED patterns.

- Digital / Analog PWM, signal monitoring and status register polling.

As example the Demo mode drop-down menu is implemented as shown with a range of selection possibilities.

Here Turning light is selected.



Furthermore, registers can be adapted individually using write command and verified with read command.

All registers can be written and read using the Write all and Read all commands.

Polling is implemented to check status registers. For example, by selecting error status the different status registers can be monitored. The status registers are automatically updated during polling using auto stop. Polling stops when auto stop is not automatic after an error status occurs, for example during open/short LED conditions.

The GUI BD18398 registry is shown in Figure 13.

Different subsets are selected with select set drop-down menu.

For example, all registry entries are shown when “Show all” is selected.

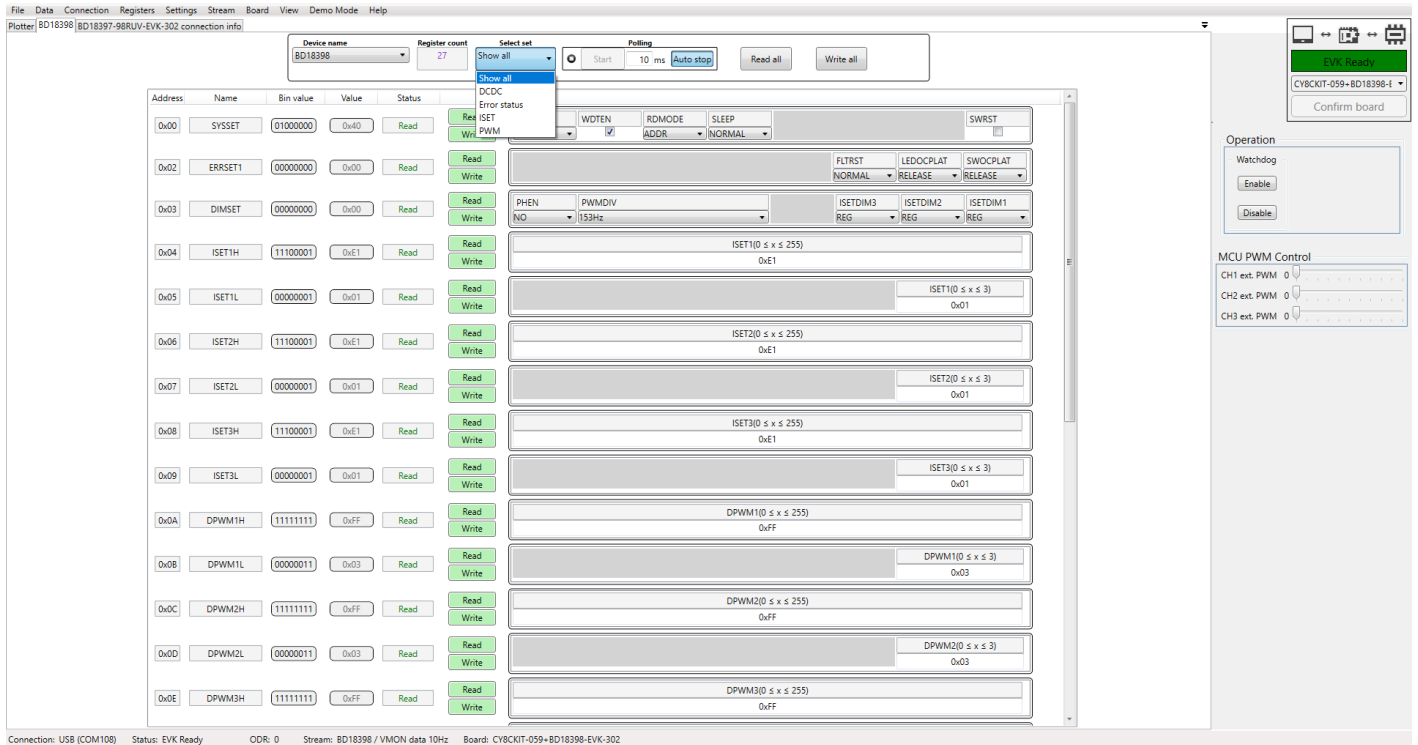
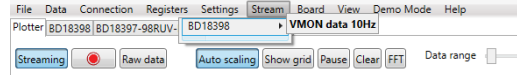


Figure 13: GUI BD18398 Registry

The plotter function displays different selected signals for monitoring.



Before enabling streaming select VMON data 10Hz

The board tab shows the different board selections that are implemented.



Figure 14: Plotter Function

6. ROHM EVK GUI USER INTERFACE AND DROP-DOWN MENUS

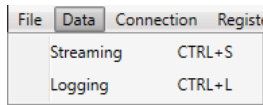
6.1. User Interface and drop-down menus

6.1.1. File Menu



The File menu contains only the option to exit the application. Selecting "Exit" will exit from the application.

6.1.2. Data Menu



The Data menu contains the options related to acquiring the data.

The streaming menu is used for enabling / disabling device data streaming. Shortcut: CTRL + S

The logging menu is used for enabling / disabling device data logging. Shortcut: CTRL + L

The status bar will show the log file name.

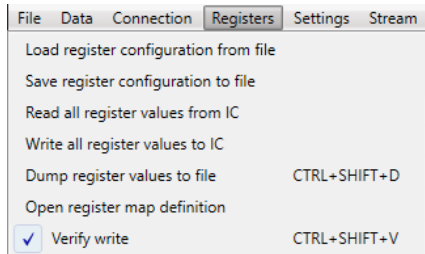
6.1.3. Connection Menu



The ROHM EVK GUI connects to the via USB COM port. The Bluetooth connection (Windows BLE) is not supported by the BD18397/98RUV-EVK-302 Evaluation Kit. The ROHM EVK GUI uses USB COM connection by default. When auto-connect is enabled, the USB connection is established automatically when the BD18397/98RUV-EVK-302 Evaluation Kit is connected.

If you are having connection problems, "CTRL + R" can be used to refresh current connection.

6.1.4. Registers Menu



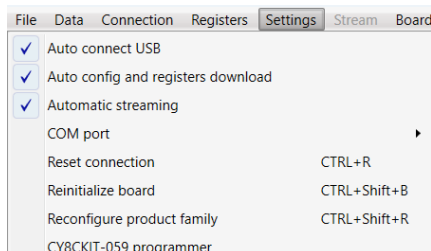
The device's register configuration file can be loaded and saved in json file format.

Reading/Writing all register values from and to IC is possible.

Register Dump allows users to save the current value of all the registry to a text file.

When writing register entries and with "Verify write" enabled the registry data values are verified.

6.1.5. Settings Menu



When "Auto connect" is enabled, the ROHM EVK GUI will automatically select the USB COM port for the connected device and connect to it.

When "Auto config download" is enabled, the ROHM EVK GUI will automatically check and download the latest board and stream

configurations. The user will be notified when there are new configurations available for download.

When “Automatic streaming” is enabled, the ROHM EVK GUI will automatically start data streaming when the device stream is changed.

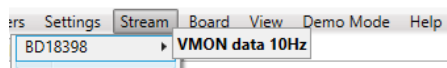
When there are multiple devices connected or there is some problem with the USB COM port selection, the COM port can be selected from the dropdown list. Before doing this the “Auto-connect” feature must be disabled.

If having any connection problems, “Reset connection” can be used for refreshing the current connection. It also initializes the current data stream again. Shortcut: CTRL + R.

In case board needs to be initialized then “Reinitialize board” can be selected. Shortcut: CTRL + Shift + B

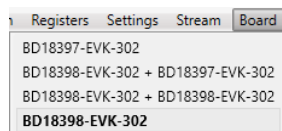
When required to reconfigure the product family, selected the relevant product family. Shortcut: CTRL + Shift + R

6.1.6. Stream Menu



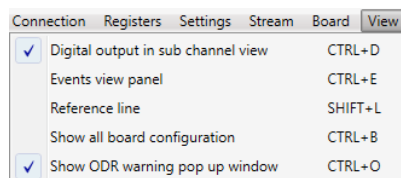
The stream menu allows the monitoring of data at 10Hz repetition. Select VMON data 10Hz before enabling streaming under the stream tab

6.1.7. Board Menu



The ROHM EVK GUI support multiple boards. Here 4 board configurations are possible.

6.1.8. View Menu



The View menu item provides different features that can be shown or hidden in the ROHM EVK GUI as shown in the View drop-down Menu

The Register Write Events are shown in the Events panel located below the plot window.

This example shows write events during LED Pattern 1 Turning Light and also showing the status (bottom part of the window).

Also, as the Turning light in Demo mode progresses the dynamic behavior of internal temperature is monitored and plotted.



Figure 15: Write events during LED Pattern 1 Turning Light

When the "Reference line" is enabled, the plotter shows an additional horizontal line that can help to compare the real time signal value against the referenced value. The line can be dragged up/down the plotter view by pressing and holding the left button mouse. The present value of the Reference line position (0 in this case) is shown in the Status bar (lower right corner of the window). To achieve a higher resolution / granularity when setting the reference line position, use the mouse scroll wheel to zoom into and out of the plotter window.

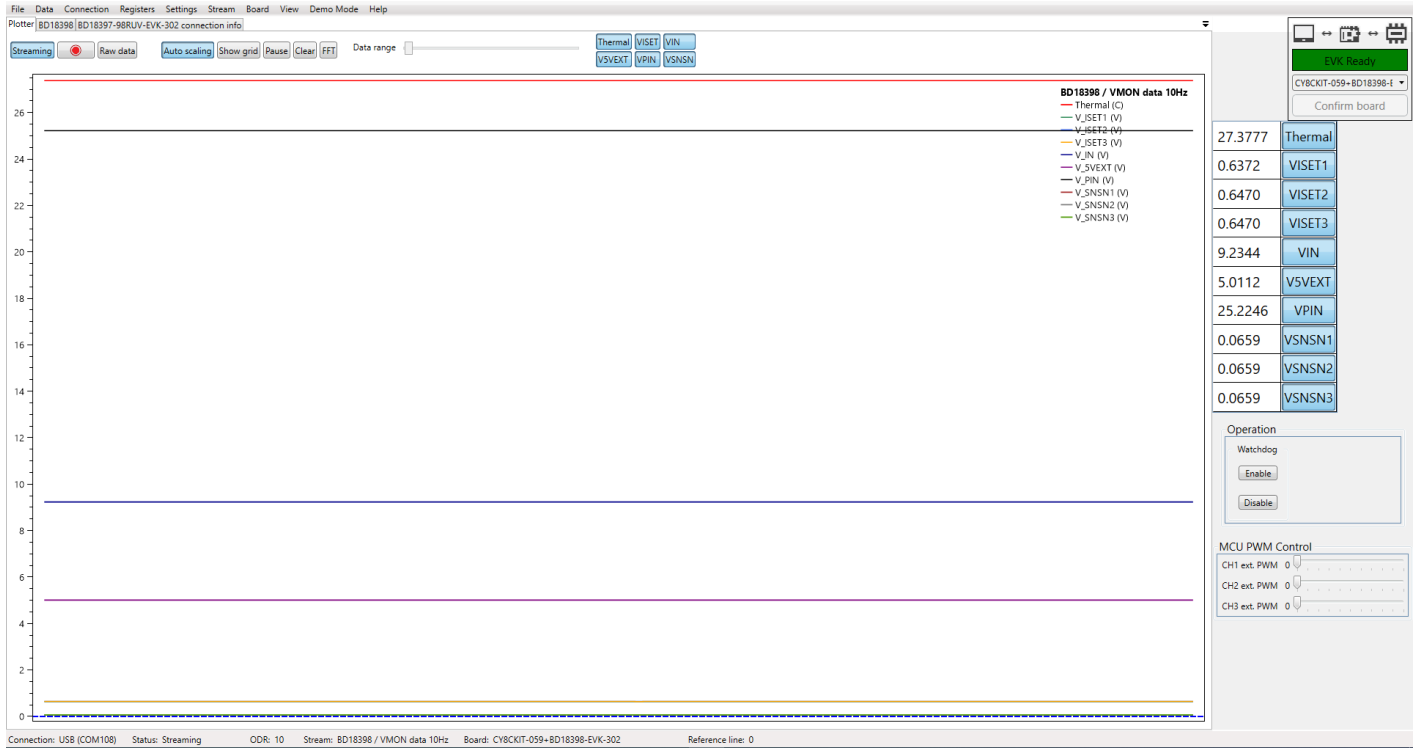
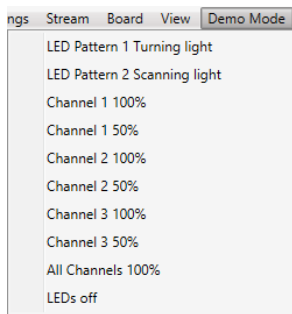


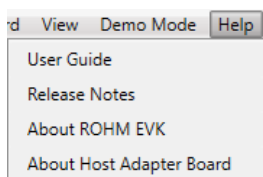
Figure 16: Reference Line (dotted line at 0)

6.1.9. Demo Mode Menu



The View menu item provides different features that can be shown or hidden in the ROHM EVK GUI as shown in the View. In Demo Mode different LED patterns (Turning Light, Scanning Light) and different channel settings can be selected.

6.2.0. Help Menu



Information is provided regarding User Guides, Release Notes, ROHM EVK GUI Version and Host Adapter Board.

The About Host Adapter Board help menu is enabled when a host adapter board is connected. The provided information includes its firmware information (ROHM EVK Protocol Version, ROHM EVK Firmware Version), as well as the hardware information such as Board ID and Board Unique ID (UID) when available.

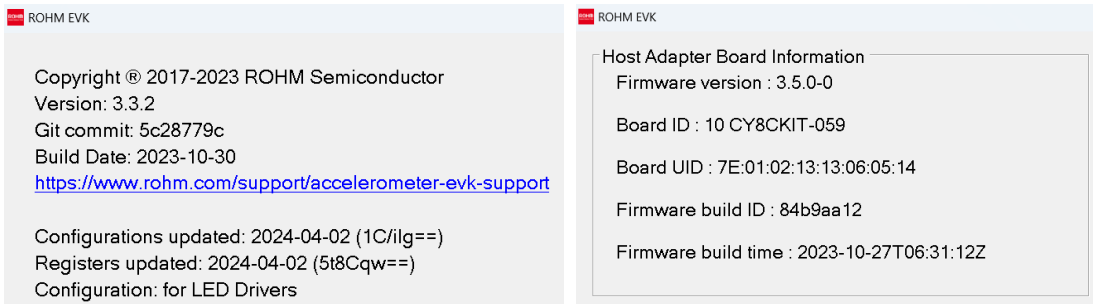


Figure 17: ROHM EVK GUI version and Host Adapter Board Information.

7. USER INTERFACE TABS

The functionalities of the ROHM EVK Windows GUI are divided between separate tabs.

7.1. Plotter - Tab

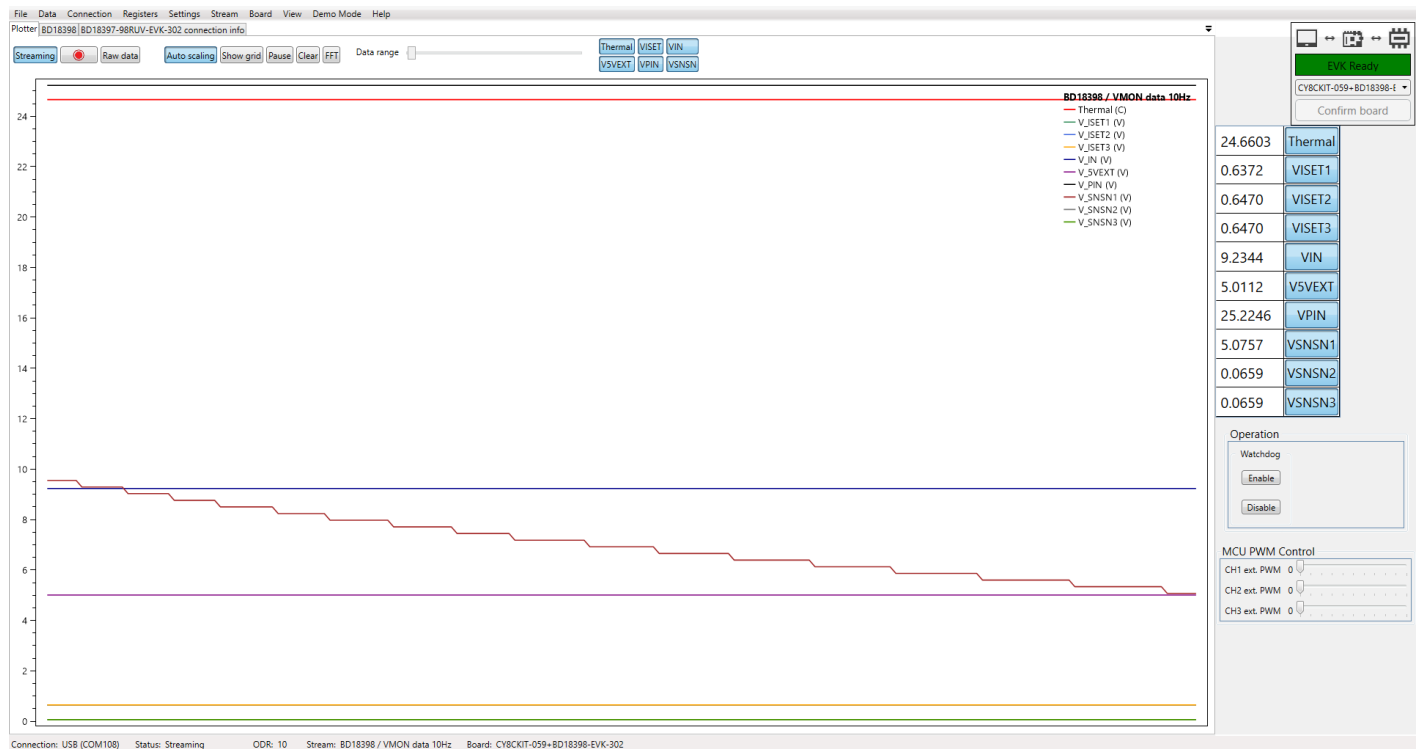


Figure 18: Plotter Tab

The Plotter shows device data from the current stream.

The Plotter has its own Streaming and Raw data buttons to change them quickly.



Data logging can be enabled/disabled easily with the button with the red circle icon.

Auto scaling – when enabled, plotter will auto scale the min. and max. values in the y-axis according to the device data.

Scaling can be adapted by zooming in/out by using the mouse wheel.

Show grid – enables data grid lines. The shortcut "G" can also be used for this.

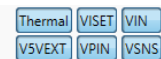
Pause – pauses the plotter. The shortcut "P" can also be used for this.

Clear – clears all data points from the plotter. The shortcut "C" can also be used for this.

FFT – turns on the Fast Fourier Transform (FFT) functionality of the plotter.

Data range – this slider bar adjusts the amount of data points shown in the plotter.

The Plotter has dynamic buttons to show/hide data channels within the used device stream.



7.2. BD18398 - Tab

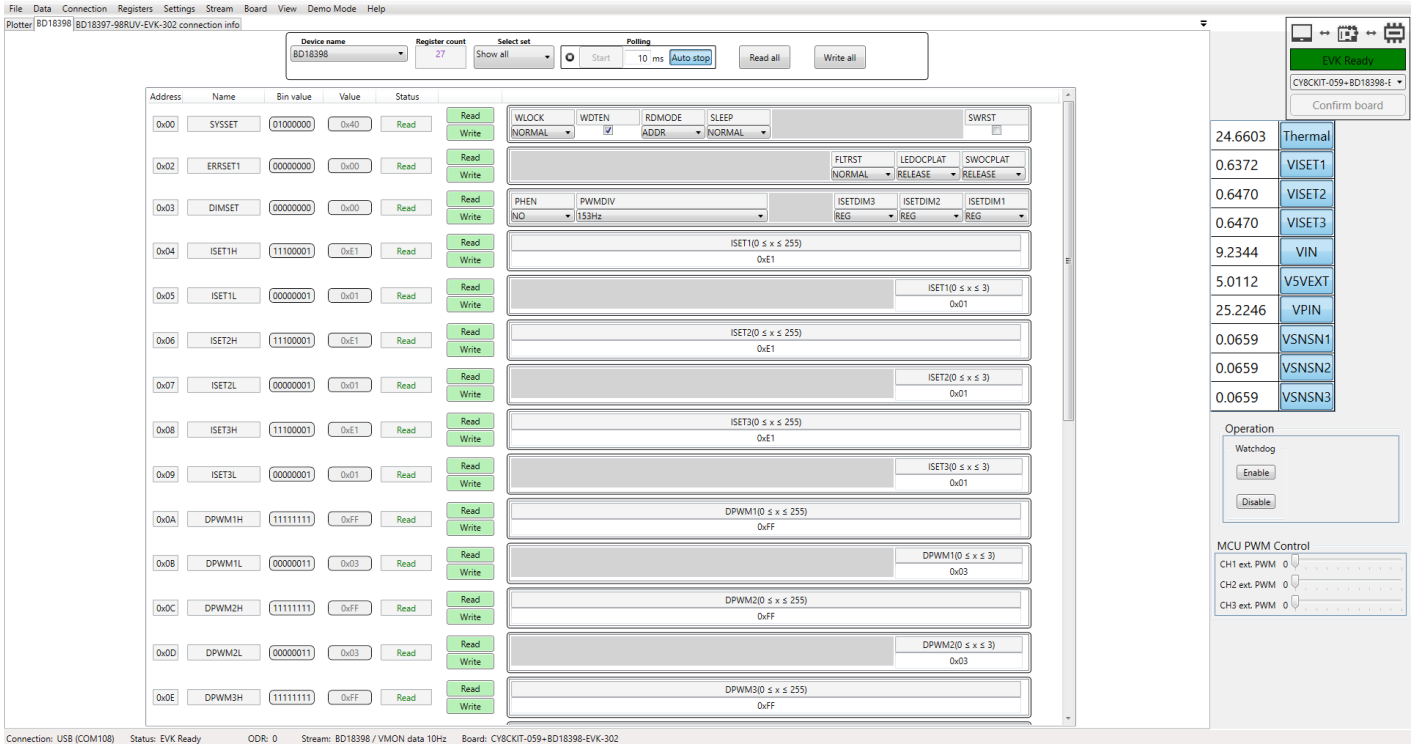
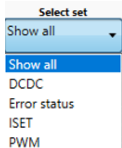


Figure 19: BD18398 Registry Tab

The BD18398 registry is adapted separately by R/W commands or complete update by Read all / Write all commands.

During start-up of the ROHM EVK GUI the BD18398 registry default values are loaded. Also, the default file can be loaded by selecting the load button.

A subset of the BD18398 registry can be selected with the Select set drop-down menu.



For example, if Error status is selected, polling can be started, and Error status is continuously updated with the auto function.

7.3. BD18397/98RUV-EVK-302 connection info – Tab

Board reference	BD18397/98RUV-EVK-302 Connector/Jumper	Connector/Jumper Setting
CN1	CY8CKIT-059 board	Populated
CN9	VBATT input	13V DC
CN10	PIN input	13V DC (4 LED series)
CN6	LED1 output channel	LED Load 1
CN8	LED3 output channel	LED Load 3
CN7	LED2 output channel	LED Load 2
CN17	SPI Secondary I/O	Open
CN18	CAN bus	Open
CN20	SPI Primary I/O	Open
CN3	CAN driver ON/OFF	GND (enabled)
CN4	5VEXT	Vreg (Vreg/5VLDO)
CN5	Vspi	Vreg (Vreg/VIO)
CN11	GND for CSB1	Open
CN16	Ext 5VLDO	Open
CN26	CAN bus High	Closed
CN27	CAN bus Low	Closed
CN28	GND for CN20	Closed
CN29	GND for CN20	Open
TSW1	LED1 output control	Out (Out/Open/GND)
TSW3	LED3 output control	Out (Out/Open/GND)
TSW2	LED2 output control	Out (Out/Open/GND)

Figure 20: THE BD18397/98RUV-EVK-302

The BD18397/98RUV-EVK-302 board connection shows the connection of supply signals VBATT, PIN, 3 LED output channels, USB for EVK data.

For flashing firmware if required, the CY8CKIT-059 plug in board is removed from the BD18397/98RUV-EVK-302 evaluation board and inserted into PC/laptop USB receptacle using the “USB for firmware flashing” connection.

In addition if CANBUS interfacing is required to the CANBUS, connector CN19 is available.

The header and default settings is indicated for the different connector/jumpers on the board.

8. SHORTCUTS

The ROHM EVK Windows GUI has the following defined keyboard shortcuts:

CTRL + L	Enable/disable logging
CTRL + S	Enable/disable streaming
ALT + R + L	Load register definition file
CTRL + R	Reset used connection and data streaming (disconnect and connect when having connection problem). Re-enable the Streaming when connection is established.
CTRL + E	Show events view
CTRL + V	Show subchannel view
CTRL + D	Show digital output in sub channel view (works only if subchannel view is enabled)
CTRL + C	Clears the current points in plotter view
G	Shows the grid in the plotter
P	Pause plotter
CTRL + W	Hide/show wake up interrupt pop up window
SHIFT + L	Hide/show reference line
CTRL + SHIFT + B	Reinitialize board
CTRL + SHIFT + D	Register Dump
CTRL + SHIFT + R	Reconfigure product family
CTRL + SHIFT + V	Verify write
CTRL + B	Not used
CTRL + O	Not used

Table 4: Short Key Functions

9. MCU-ONLY MODE

The BD18397/98RUV-EVK-302 MCU-only mode demonstrates features of the BD18397/98RUV-M device.

For MCU-only mode operation, different firmware needs to be flashed into the CY8CKIT-059 MCU plug-in board.

This firmware is available on request from ROHM.

The ROHM EVK GUI will not function in MCU-only mode and the demo sequence is controlled with the SW1 button

The 5V supply to the MCU is either provided by the BD450M2EFJ-C linear regulator or USB cable from the PC/laptop

Connect LED module to the 3 output channels.

Connect VBATT = 12 V to BD18397/98-EVK-302, VREG LED lights green.

When CN16 is open, there is no 5V supply to MCU.

PROTECTION LED (orange LED) and FAULT_B LED (red LED) are turned on

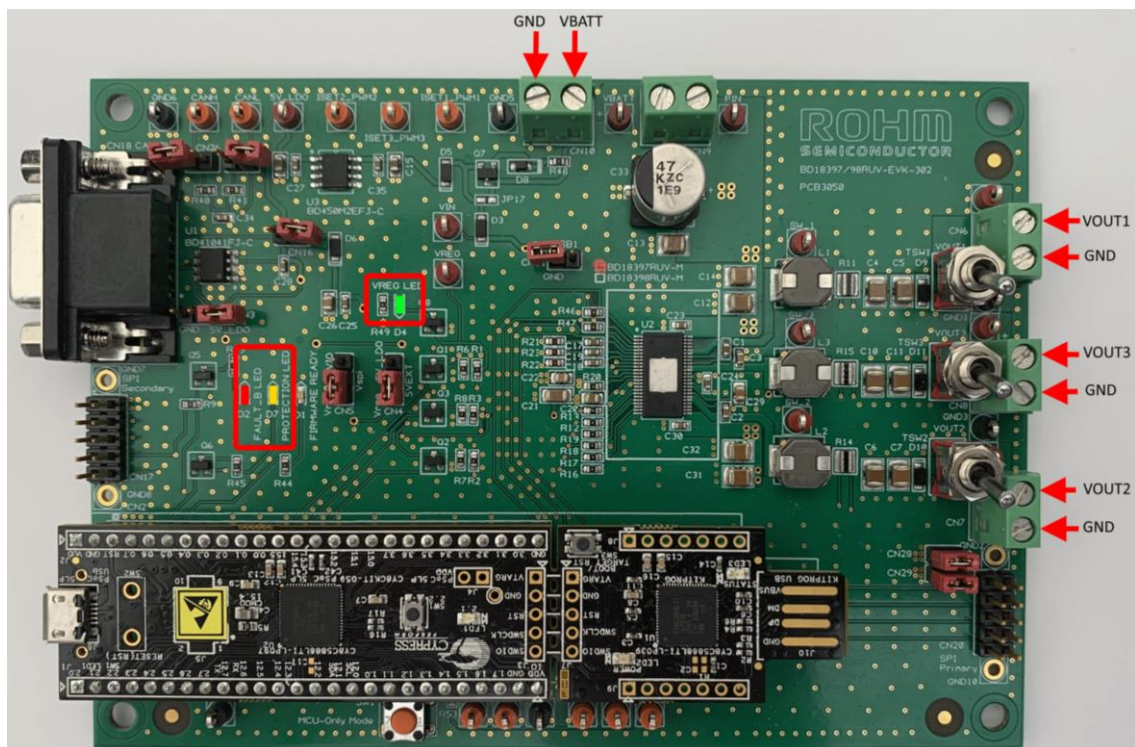


Figure 21: BD18397/98RUV-EVK-302

Connect CN16 to supply the 5V to the MCU plug-in board from the BD450M2EFJ-C linear regulator.

The blue light turns on the MCU plug-in board, the FAULT_B LED (red LED) turns off on the evaluation board.

Also, the FIRMWARE READY (green LED) turns on and PROTECTION LED (orange LED) flashes slowly since PIN UVLO is detected as PIN is not yet supplied.

Connect PIN = 20V and PROTECTION LED (orange LED) stops flashing and LED CH1 VOUT1 LED string turns on.

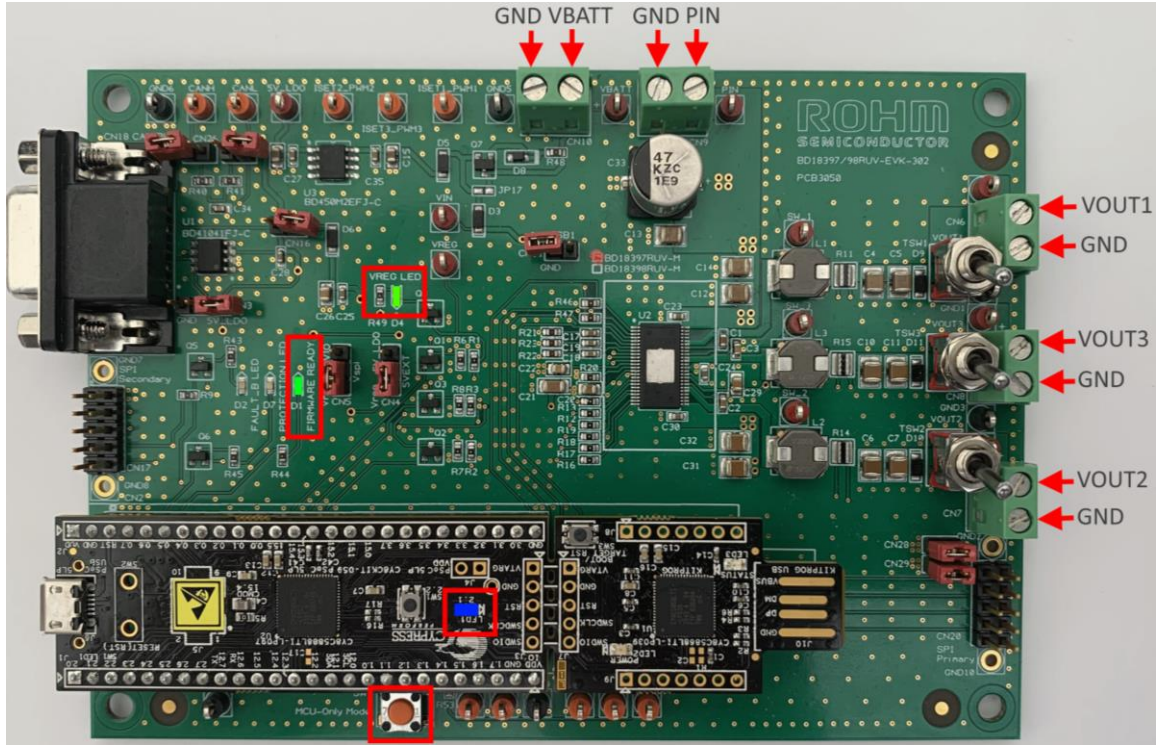


Figure 22: BD18397/98RUV-EVK-302

The demo sequence can be progressed in steps ever instant the SW1 button is released after been pressed.

The demo sequence is as follows:

VOUT1 LED string turns on (this is the starting point of the sequence).

VOUT2 LED string turns on and 2 channels are now on.

VOUT3 LED string lights up and 3 channels are now on.

3 channels zoomed down together in intensity with digital PWM dimming.

3 channels zoomed down individually in intensity with digital PWM dimming.

Enter LIMP HOME mode.

LEDs off.

VOUT1 LED string turns on.

Protection features namely LED open or LED short to GND can be validated.

The internal protection status bits are checked when channels are active.

For a LED SHORT condition on any channel the orange LED will turn on continuously.

The LED short condition is activated when the TSW1, TSW2 or TSW3 switches are in the up position.

For LED short to GND, the BD18397/98RUV-M device protection disables that particular output channel.

For a LED Open condition on any channel, the orange LED will blink fast.

The LED open condition is activated when the TSW1, TSW2 or TSW3 switches are in the mid position.

For LED open, the BD18397/98RUV-M device protection results in switching signal at VSW pin at maximum duty cycle and VOUTx rises to the PIN voltage.

Other status errors like UVLO or PIN UVLO results in the orange LED blink slowly.

Protection status will not be shown in LIMP HOME mode

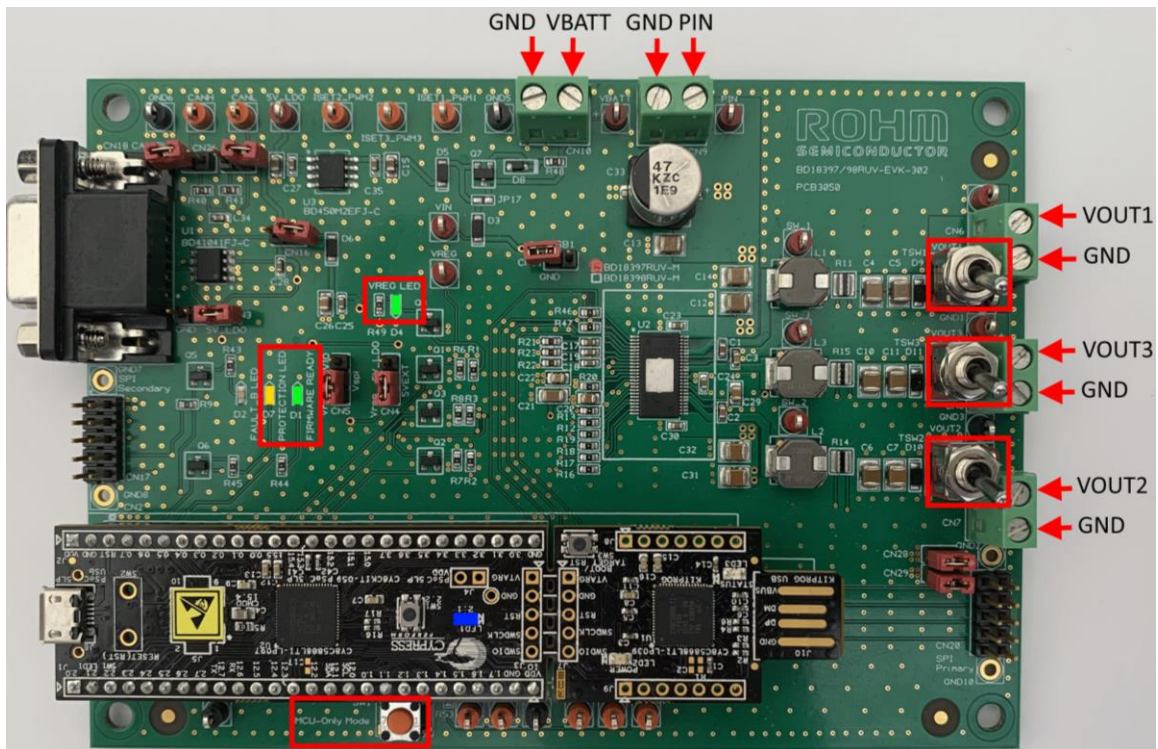


Figure 23: BD18397/98RUV-EVK-302 in MCU only mode during demo sequence

10. SPI PARALLEL CONNECTION MODE

SPI parallel connection mode is where two boards are connected together via CN20 (SPI primary) and CN17 (SPI secondary) to loop the SPI signals and GND between the two boards.

The application set up for a 5-channel application is shown in Figure 24.

The BD18398RUV-M device (3-channel) device is used in the evaluation board where the MCU plug-in board is mounted.

The BD18397RUV-M device (2-channel) is used in the evaluation board where the MCU plug-in board is not mounted.

SPI control of both evaluation boards is performed with one MCU plug-in board.

The ROHM EVK GUI board selection is BD18398-EVK-302 + BD18397-EVK-302.

Demo mode is valid for 5 channels where registry values and status of both devices is accessible.

In addition, MCU-only mode for 5 channel is also implemented.

For MCU-only mode operation, different firmware needs to be flashed into the CY8CKIT-059 MCU plug-in board.

This firmware is available on request from ROHM.

The ROHM EVK GUI will not function in MCU-only mode and the demo sequence is controlled with the SW1 button

The 5V supply to the MCU is either provided by the BD450M2EFJ-C linear regulator or USB cable from the PC/laptop.

The demo sequence and protection features are similar to already described in Chapter 10 but now for 5-channel sequencing.

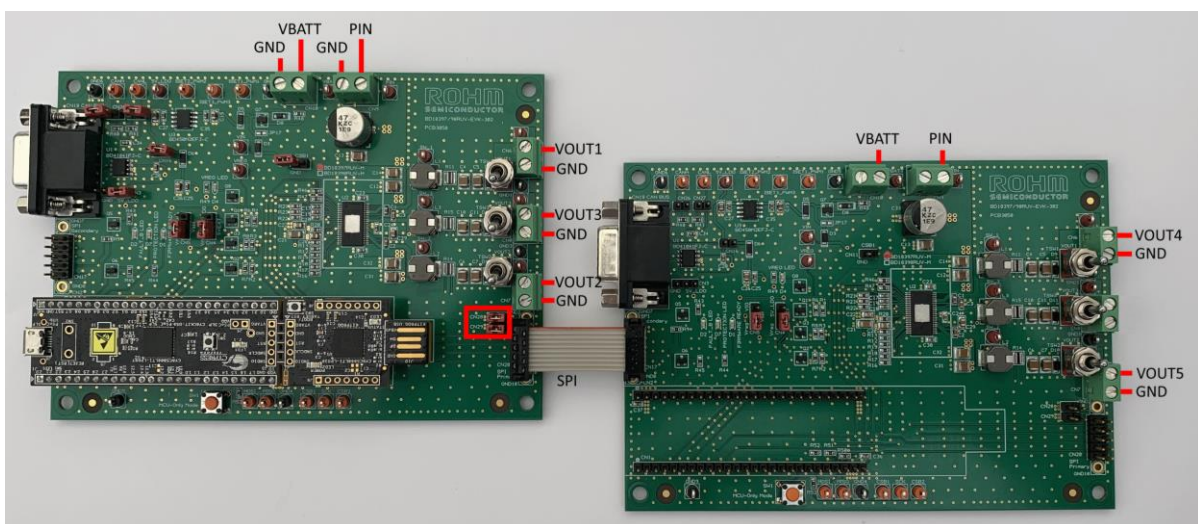


Figure 24: SPI Parallel connection mode using the BD18398RUV-M and BD18397RUV-M devices

11. MEASUREMENTS

11.1. BD18397RUV-M and BD18398RUV-M efficiency measurements.

Efficiency measurements were carried out for both BD18397RUV-M and BD18398RUV-M devices in the evaluation board BD18397/98RUV-EVK-302 with heatsink mounted

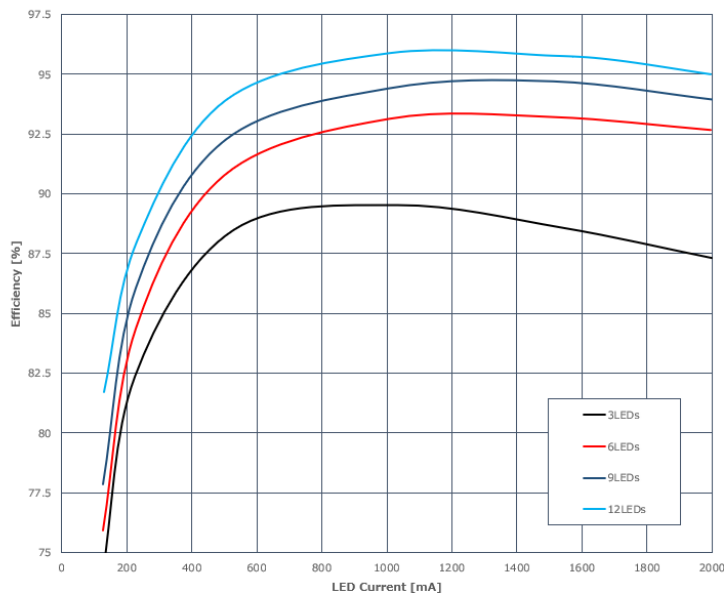
Conditions:

$V_{BATT} = 13V$, $PIN = 60V$, $R_{TON} = 51k\Omega$ [Default setting for $f_{sw} = 400kHz$]

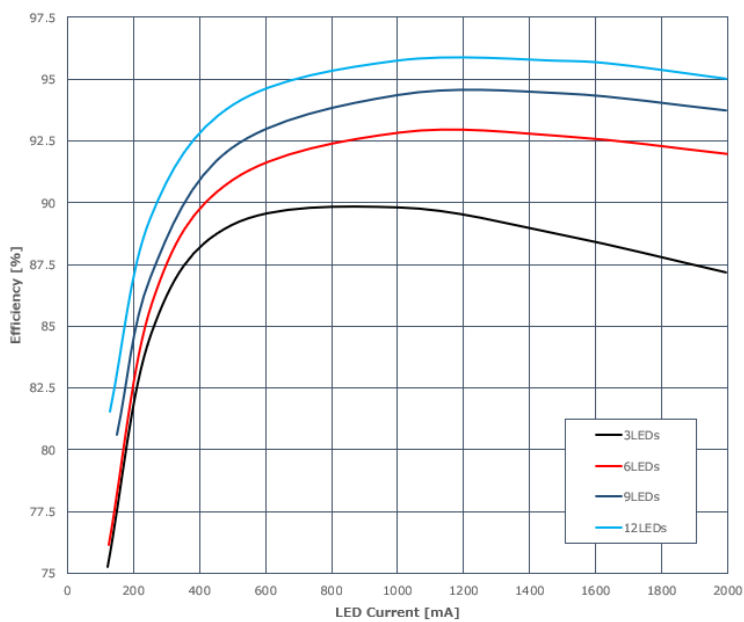
$L=22\mu H$, $C_{OUT} = 2 \times 4.7\mu F$ $C_{COMP} = 100nF$, $R_{COMP} = 1k\Omega$

Results:

BD18397RUV-M Efficiency vs LED current



BD18398RUV-M Efficiency vs LED current



11.2. BD18398RUV-M thermal measurements in the BD18398RUV-EVK-302 board

Temperature measurements of heatsink on BD18398RUV-EVK-302 board using thermal camera.

The 3 channels were enabled with ISET = 500mA and 1000mA per channel in MCU only mode or with GUI

The ambient temperature is 27°C.

Conditions: VBATT =12V, PIN = 20V, ISET = 500mA

Results: Temperature Heatsink = 42.5°C

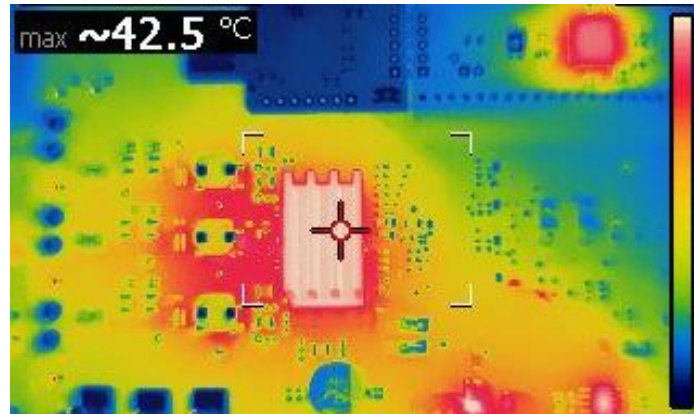


Figure 25: ISET = 500mA, 3 channels enabled

Conditions: VBATT =12V, PIN = 20V, ISET = 1000mA.

Results: Temperature heatsink = 62.7°C

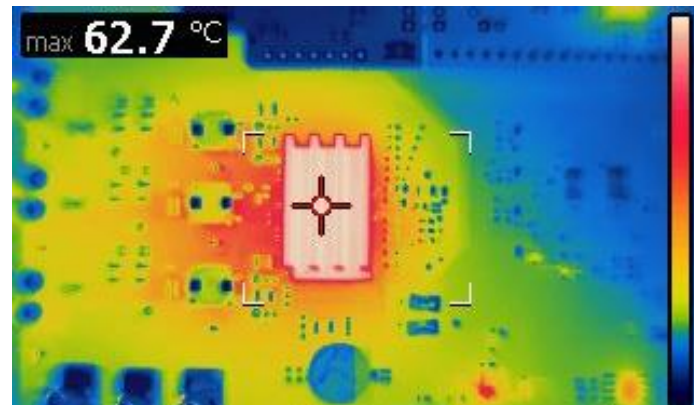


Figure 26: ISET = 1000mA, 3 channels enabled

11.3. BD18398RUV-M LED Open and LED Short to GND in the BD18398RUV-EVK-302 board

Conditions:

VOUTx SHORT to GND and VOUTx OPEN were tested in MCU only mode with ISET = 500mA, VOUT1 is enabled. VIN = 12V, PVIN = 20V and ISET = 500mA

Result:

When VOUTx is shorted GND, VSW stops switching as shown in Figure 34

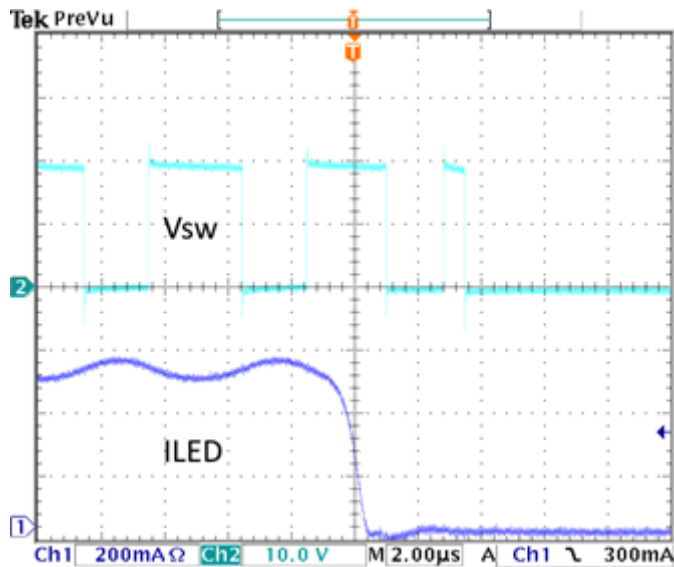


Figure 27: VSW and ILED Waveforms for VOUTx shorted to GND

Result:

When VOUTx is open, VSW goes to maximum duty cycle as shown in Figure 35

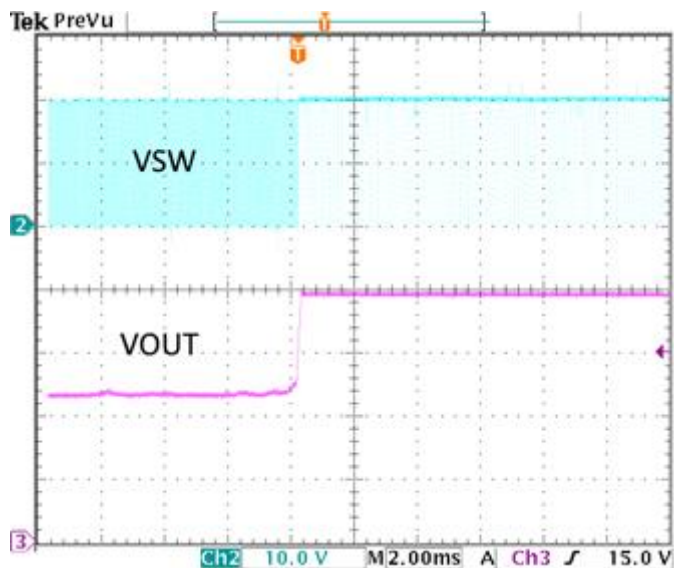


Figure 28: VSW and ILED Waveforms for VOUTx open

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