5-Channel LED Control Unit for Headlamp Solution Evaluation Board

User's Guide

＜High Voltage Safety Precautions＞

◇ Read all safety precautions before use

Please note that this document covers only the 5-Channel LED Control Unit for Headlamp Solution evaluation board (REF67012-EVK-001) and its functions. For additional information, please refer to the datasheet.

To ensure safe operation, please carefully read all precautions before handling the evaluation board

Depending on the configuration of the board and voltages used,

Potentially lethal voltages may be generated.

Therefore, please make sure to read and observe all safety precautions described in the red box below.

Before Use

[1] Verify that the parts/components are not damaged or missing (i.e. due to the drops).
[2] Check that there are no conductive foreign objects on the board.
[3] Be careful when performing soldering on the module and/or evaluation board to ensure that solder splash does not occur.
[4] Check that there is no condensation or water droplets on the circuit board.

During Use

[5] Be careful to not allow conductive objects to come into contact with the board.
[6] **Brief accidental contact or even bringing your hand close to the board may result in discharge and lead to severe injury or death.**

Therefore, DO NOT touch the board with your bare hands or bring them too close to the board.
In addition, as mentioned above please exercise extreme caution when using conductive tools such as tweezers and screwdrivers.

[7] If used under conditions beyond its rated voltage, it may cause defects such as short-circuit or, depending on the circumstances, explosion or other permanent damages.
[8] Be sure to wear insulated gloves when handling is required during operation.

After Use

[9] The ROHM Evaluation Board contains the circuits which store the high voltage. Since it stores the charges even after the connected power circuits are cut, please discharge the electricity after using it, and please deal with it after confirming such electric discharge.
[10] Protect against electric shocks by wearing insulated gloves when handling.

This evaluation board is intended for use only in research and development facilities and should by handled **only by qualified personnel familiar with all safety and operating procedures.**
We recommend carrying out operation in a safe environment that includes the use of high voltage signage at all entrances, safety interlocks, and protective glasses.

LED Driver for Automotive Exterior lamps

5-Channel LED Control Unit for Headlamp Solution Evaluation Board

This User's Guide describes the steps necessary to operate the ROHM Solution Evaluation Board for Head Lamps.
It includes information on the LED Dr, microcontroller, and other products, as well as operating instructions and application data.

Description

This LED control unit (LCU) is designed for versatility and seamless integration. It features a multi-channel LED control system for enhanced lighting performance, along with 4V DCDC converter and 5V LDO to provide external electronics (e.g., for animations). Communication with the vehicle is simplified through a single CAN_FD interface, and the local CAN network can be accessed via UART over CAN. Additionally, a LIN interface is included. The LCU also has analog inputs for two temperature sensors (NTC) and binning resistors, all of which are read from the MCU's GPIO pins. Furthermore, 21 GPIO pins are available, offering flexibility for various automotive headlamp applications.

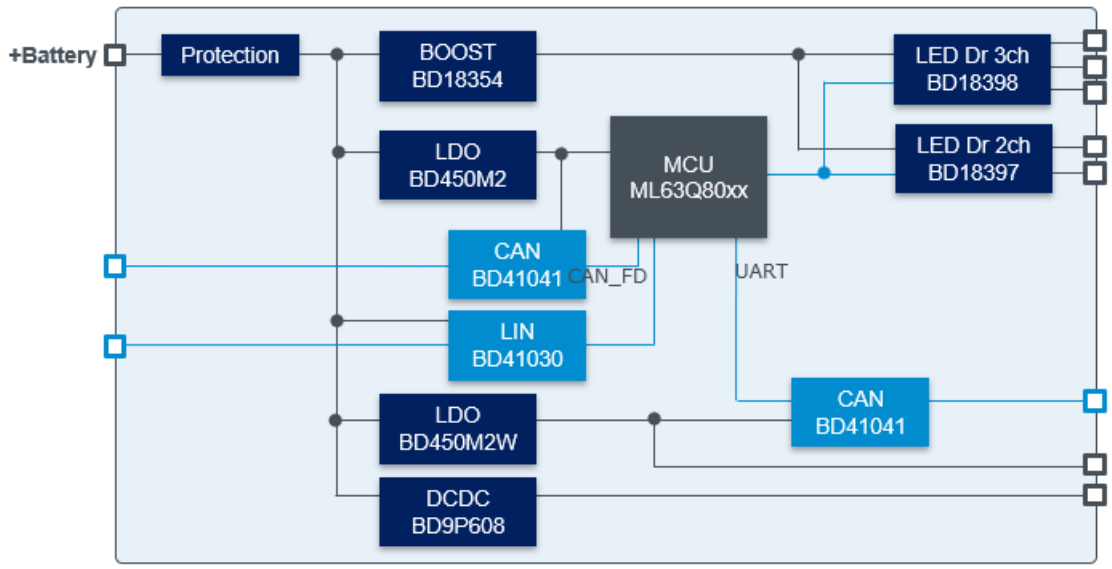


Figure1: Block diagram

Application

Automotive application for Head Lamps.

No. 67UG120E Rev.001
January 2025

Evaluation board operating condition (default setting)

Table 1. Evaluation board operating condition (default setting)

Parameter	Min	Typ	Max	Unit
Power supply voltage(J1 pin) *1	9	13.5	16	V
LEDs in series	-	-	12	pcs
Number of LED Channels	-	5	-	ch
BOOST output voltage *2	-	48	-	V
Buck DCDC Converter for P1_2 pin	-	4.0	-	V
Buck DCDC Converter max current	-	-	6.0	A
LDO for CAN FD / P1_6 pin	-	5.0	-	V
LDO max current	-	-	0.2	A

*1 This indicates the voltage near the J1 pin. Be careful of voltage drop by the impedance of power line.s

*2 Since this evaluation board has a Boost configuration, BOOST output voltage is for the Buck LED Dr.

Table 2. LED Driver Pin Description

Pin Name		Function	Parameter	Min	Typ	Max	Unit
J2	1	Ground	-	-	-	-	-
	2	BD18397 LED1+ anode	Continuous Average LED Current *	-	-	1.6	A
J3	1	Ground	-	-	-	-	-
	2	BD18397 LED2+ anode	Continuous Average LED Current *	-	-	1.6	A
J4	1	Ground	-	-	-	-	-
	2	BD18398 LED3+ anode	Continuous Average LED Current *	-	-	1.6	A
J5	1	Ground	-	-	-	-	-
	2	BD18398 LED4+ anode	Continuous Average LED Current *	-	-	1.6	A
J6	1	Ground	-	-	-	-	-
	2	BD18398 LED5+ anode	Continuous Average LED Current *	-	-	1.6	A

*Note : Tj max for BD18397 and BD18398 is 150°C. To avoid exceeding this temperature, ensure heat dissipation by the PCB board or by the shield case.

Operating procedure

By applying a voltage (typ. 13.5V) to the J1 terminal, the system will operate and the voltage will be supplied to the LEDs via terminals J2 to J6 according to the CC mode. Additionally, the DCDC converter BD9P608MUF (4V output / Max 6A) will output voltage to the P1_2 terminal, and the LDO BD450S2WEFV (5V output / Max 0.2A) will output voltage to the P1_6 terminal.
The EVK is shipped with a pre-programmed microcontroller. For detailed information regarding the following files, please contact us via the homepage.

・Sample Software Documentation ・Demo Source Code (C Language) ・Microcontroller Device Information File

Evaluation board

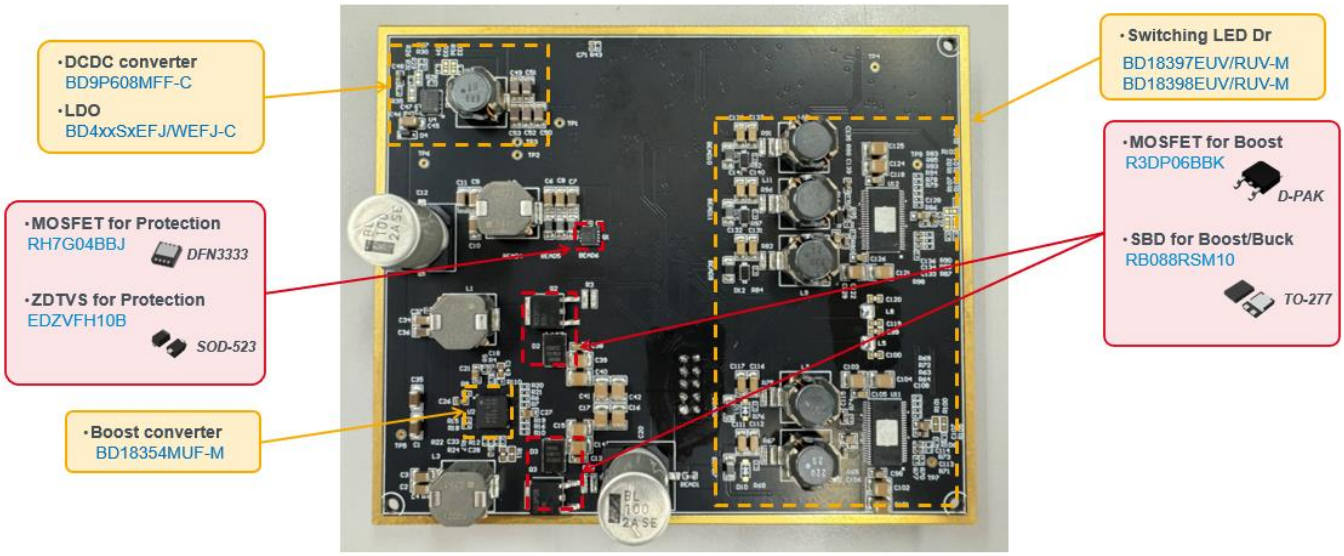


Figure 2.Parts Placement (TOP View)

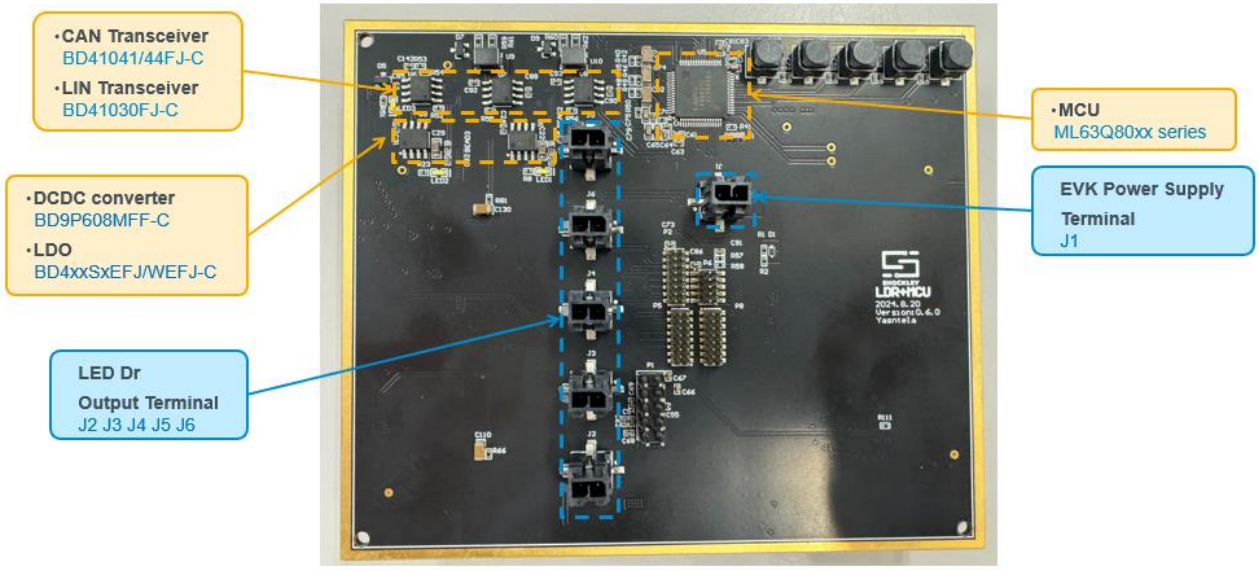


Figure 3. Parts Placement (Bottom View)

Evaluation board Connections example

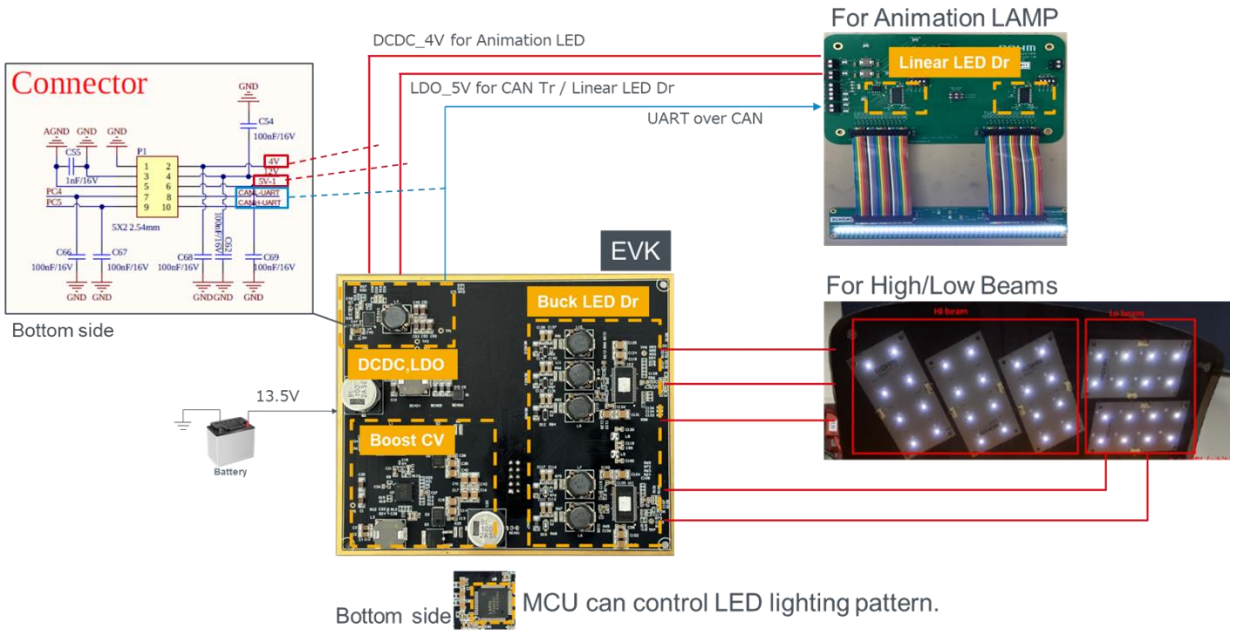


Figure 4. Evaluation board Connections example

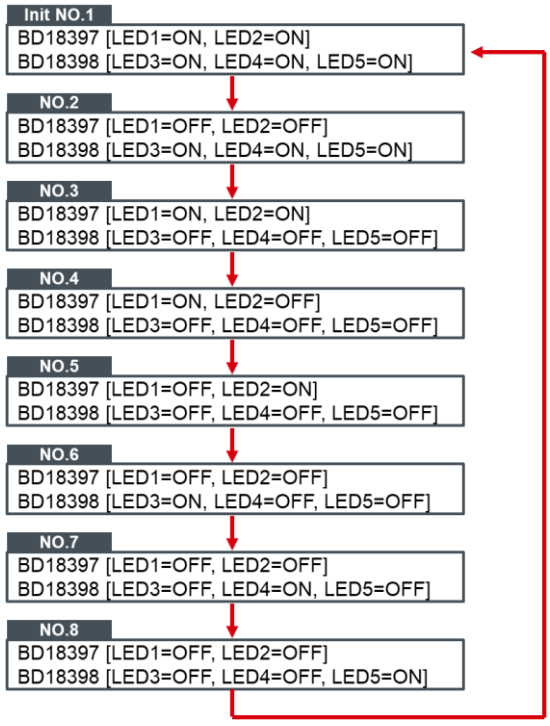
Button SW setting definition(DEMO code)

Table 4. Button SW setting

SW Button Name	SW Function	MCU ML63Q805 Connecting Port Name
RST	The demo code has not been used	-
B5	BD18397/BD18398 Lighting pattern settings	PA6(10PIN)
B2	The demo code has not been used	-
B1	BD18397/BD18398 Brightness adjustment	PA4(8PIN)
B3	The demo code has not been used	-

●Brightness adjustment buttons (B1 button)

●Pattern setting buttons (B5 button)

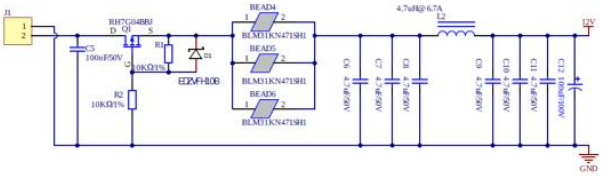


※ When the SW button is pressed " LONG " : Return to No.1 in any state.

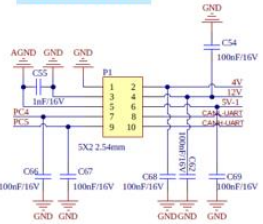
In the demo code, the reset of the state is performed by fully discharging the power supply (J1 terminal).

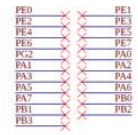
Evaluation board schematic

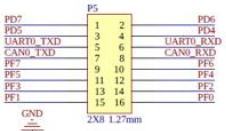
INPUT

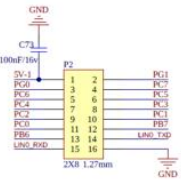


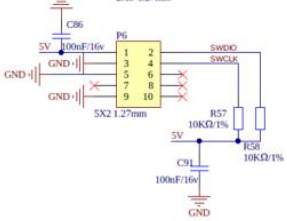
Connector



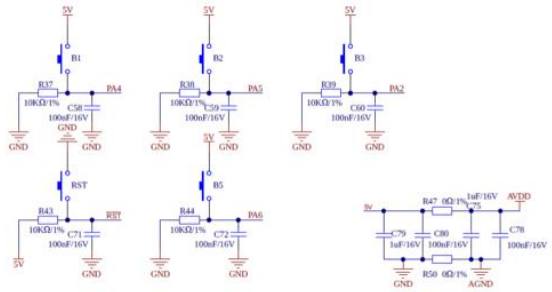




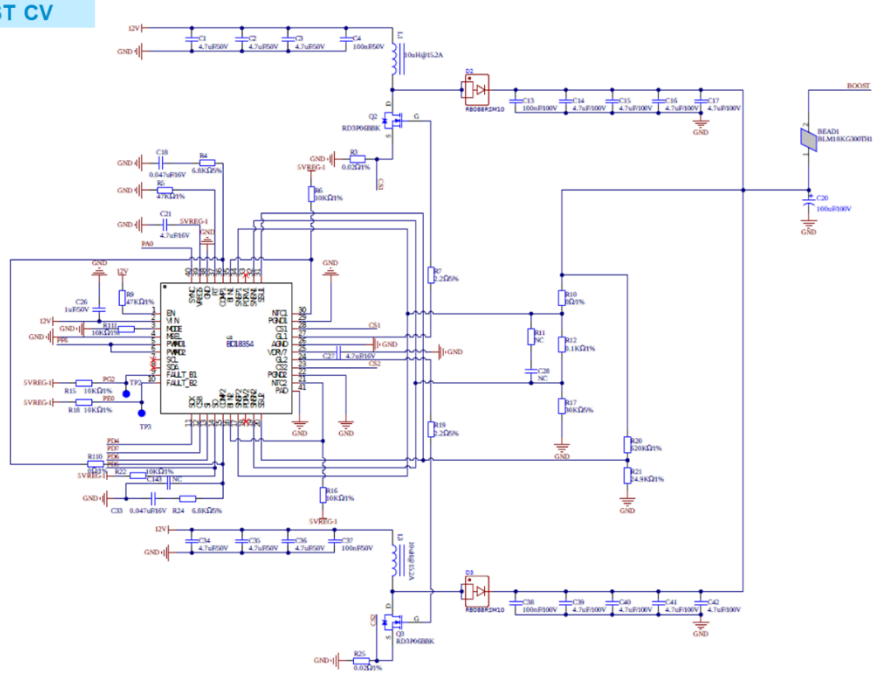


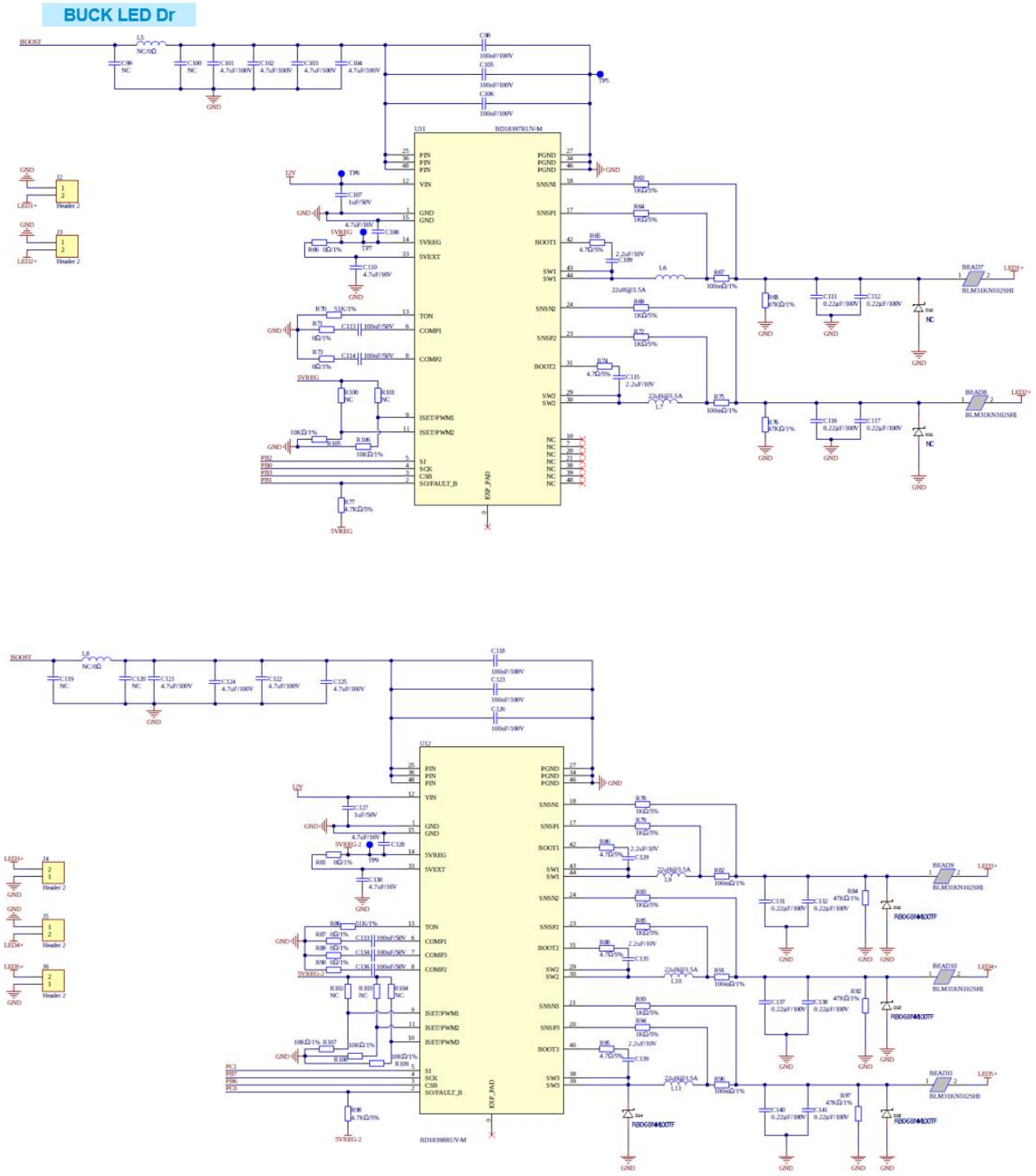


Button



BOOST CV




BUCK LED Dr
BOOST
U11
BD18397RUV-M
U12
BD18398RUV-M
EXP_PAD
Header 2
BLM31KN102SH1
RBQ68NM100TF

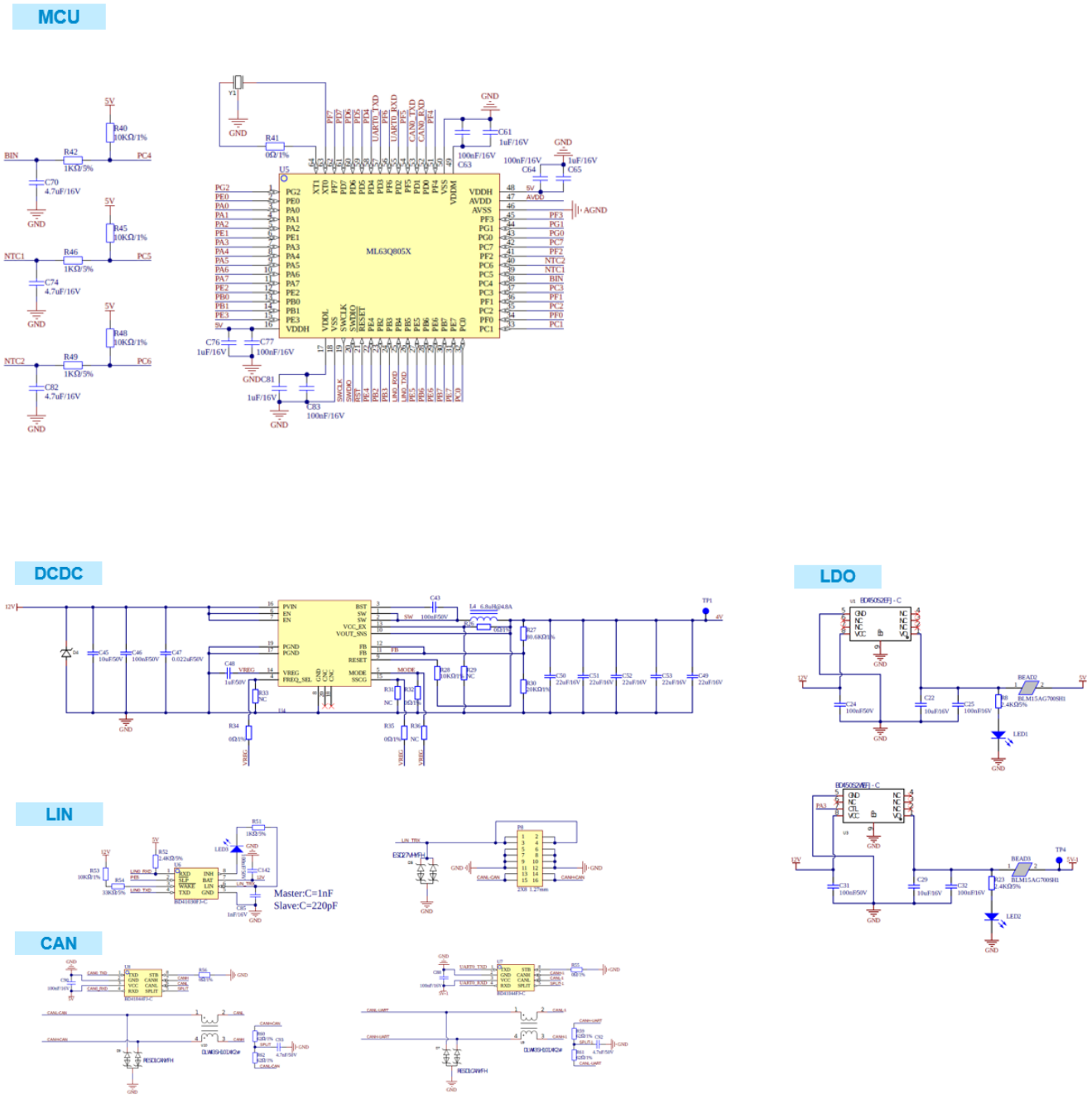


Figure 5. Evaluation board schematic

Parts list

Table 4. EVK Parts list

Parts Type		Part Number	
IC	BOOST CV	BD18354MUF-M	U2
	Buck LED driver/2ch	BD18397RUV-M	U11
	Buck LED driver/3ch	BD18398RUV-M	U12
	MCU/64PIN	ML63Q805X	U5
	LIN Transceiver	BD41030FJ-C	U6
	CAN Transceiver	BD41044FJ-C	U7, U8
	DCDC Converter	BD9P608MFF-C	U4
	LDO	BD450S2EFJ-C	U1
	LDO	BD450S2WEFJ-C	U3
Transistor	Pch MOSFET/VDSS -40V ID 40A	RH7G04BBJ	Q1
	Nch MOSFET/VDSS 100V ID 59A	RD3P06BBK	Q2, Q3
Diode	Zener Diodes/VZ 10V IR0.1μA	EDZVFH10B	D1
	Bidirectional TVS/VRWM 24V IR0.1μA	RESD1CANYFH	D7, D9
	Bidirectional TVS/VRWM 24V IR0.1μA	ESD27VHYFH	D5
	TVS/VRWM 13V IR0.1μA	VS13VUA1VWMTF	D4
	Schottky diode100V 10A	RB088RSM10	D2, D3
	Schottky diode/100V 2A	NC/RB068MM100TF	D10, D11
	Schottky diode/100V 2A	RB068MM100TF	D12, D13, D14, D15
Inductor	6.8μH@4.8A	MDH10060C-6R8NB=P3	L4
	22μH@3.5A	MDH10060C-220MB	L6,L7, L9, L10, L11
	Common mode choke/100μH(at 1MHz)□	DLW43SH101XK2	U10, U9
	10μH@15.2A	SPM10065VT-100M-D	L1,L3
	4.7μH@6.7A	SPM10065VT-4R7	L2
Capacitor	4.7μF/50V	GCM31CC71H475KA03	C1, C2, C3, C6, C7, C8, C9, C10, C11, C34, C35, C36
	100nF/50V	GCM155L8EH104KE07	C4, C5, C24, C31, C37, C43, C46, C113, C114, C133, C134, C136, C142
	100nF/100V	GCM21BR72A104KA37	C13, C38, C98, C105, C106, C118, C123, C126
	4.7μF/100V	GCM32DC72A475KE02L	C14, C15, C16, C17, C39, C40, C41, C42, C101, C102, C103, C104, C121, C122, C124, C125
	0.047μF/16V	GCM155L81C473KA37	C18, C33
	4.7μF/16V	GCM21BR71C475KA67L	C21, C27, C70, C74, C82, C108, C110, C128, C130
	10μF/16V	GCM21BC71C106KE36	C22, C29
	100nF/16V	GCM155R71C104KA55	C25, C32, C54, C58, C59, C60, C62, C63, C64, C66, C67, C68, C69, C71, C72, C73, C77, C78, C80, C83, C86, C88, C90, C91
	1μF/50V	GCM188D71H105KE36	C26, C48, C107, C127
	10μF/50V	GCM31CD71H106KE36	C45
	0.022μF/50V	GCM155R71H223KA55J	C47
	22μF/16V	GCM31CC71C226ME36	C49, C50, C51, C52, C53
	1nF/16V	GCM033R71E102KA03	C55, C85
	1μF/16V	GCM188R71C105KA64	C61, C65, C75, C76, C79, C81
	4.7nF/50V	GCM155L81H472KA37#	C92, C93
	2.2μF/10V	GCM188C71A225KE02	C109, C115, C129, C135, C139
	0.22μF/100V	GCM31MR72A224KA37	C111, C112, C116, C117, C131, C132, C137, C138, C140, C141
	NC		C28, C99, C100, C119, C120, C143
	100μF/100V	100SEV100M12.5X16	C12, C20
Resistor	10KΩ/1%	MCR01MZPF1002	R1, R2, R6, R15, R16, R18, R22, R28, R37, R38, R39, R40, R43, R44, R45, R48, R53, R57, R58, R105, R106, R107, R108, R109, R111
	0.02Ω/1%	LTR18EZPFSR020	R3, R25
	6.8KΩ/5%	MCR01SMQPJ682	R4, R24
	47KΩ/1%	MCR01SMQPF4702	R5, R9, R68, R76, R84, R92, R97
	2.2Ω/5%	MCR01SMQPJ2R2	R7, R19
	2.4KΩ/5%	MCR01SMQPJ243	R8, R23, R52
	0Ω/1%	MCR01MZPJ000	R10, R26, R32, R34, R35, R41, R47, R50, R55, R56, R66, R71, R73, R81, R87, R89, R90, R110
	NC		R11, R29, R31, R33, R36, R100, R101, R102, R103, R104
	0.1KΩ/1%	MCR01SMQPF1000	R12
	30KΩ/5%	MCR01SMQPJ303	R17
	620KΩ/1%	MCR01SMQPF6203	R20
	24.9KΩ/1%	MCR01SMQPF2492	R21
	80.6KΩ/1%	MCR01SMQPF8062	R27
	20KΩ/1%	MCR01SMQPF2002	R30
	1KΩ/5%	MCR01SMQPF1001	R42, R46, R49, R51, R63, R64, R69, R72, R78, R79, R83, R85, R93, R94
	33KΩ/5%	MCR01SMQPJ333	R54
	62Ω/1%	MCR03SEQPF62R0	R59, R60, R61, R62
	4.7Ω/5%	MCR01SMQPJ4R7	R65, R74, R80, R88, R95
	100mΩ/1%	LTR18EZPFLR100	R67, R75, R82, R91, R96
	51K/1%	MCR01SMQPF5102	R70, R86
	4.7KΩ/5%	MCR01SMQPJ472	R77, R98
Bead	30Ω@at 100MHz/5A	BLM18KG300TH1	BEAD1
	240Ω@at 100MHz/350mA	BLM15AG700SH1	BEAD2, BEAD3
Crystal	8MHz	CSTNE8M00G52A000R0	Y1
Connector	2X1/Board to board connector	2182160220	J1, J2, J3, J4, J5, J6
	5X2 2.54mm/ Pin header	NC	P1
	8X2 1.27mm/ Pin header	NC	P2,P5,P8
	5X2 1.27mm/ Pin header	NC	P6

Board layout

Evaluation board PCB information

Material	FR-4
Board thickness	1.6mm
Copper thickness	1 oz.
Number of layers	6
Board size	120X100mm
Minimum copper width	5mil
Minimum air gap	5mil
Minimum hole size	0.3mm

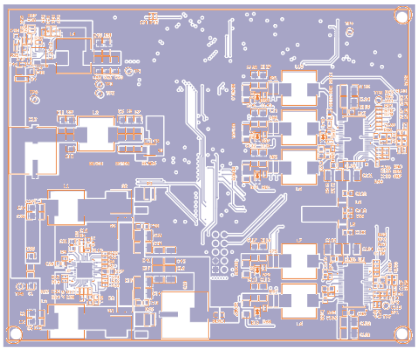


Figure 6. Top layer layout
(Top view)

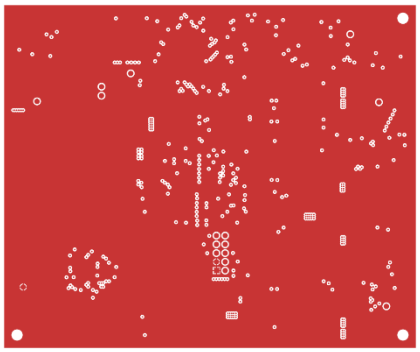


Figure 7. Mid1 layer layout
(Top view)

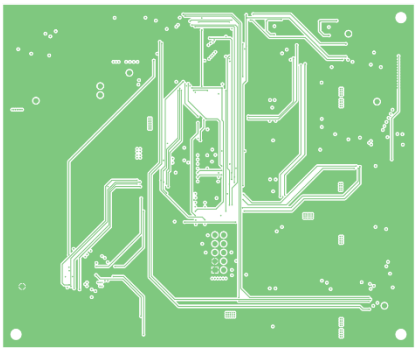


Figure 8. Mid2 layer layout
(Top view)

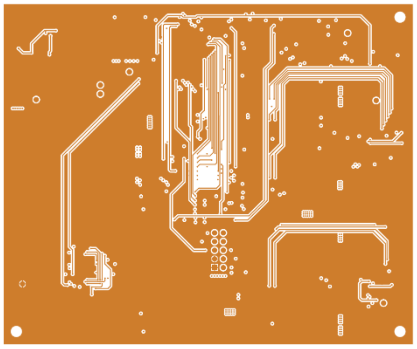


Figure 9. Mid3 layer layout
(Top view)

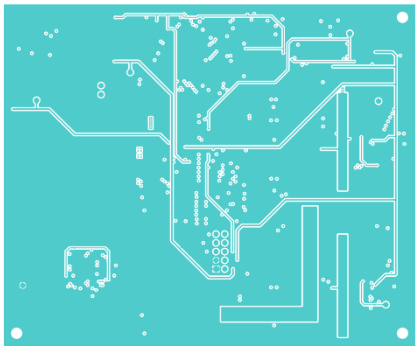


Figure 10. Mid4 layer layout
(Top view)

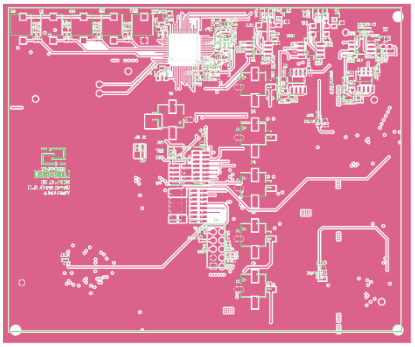
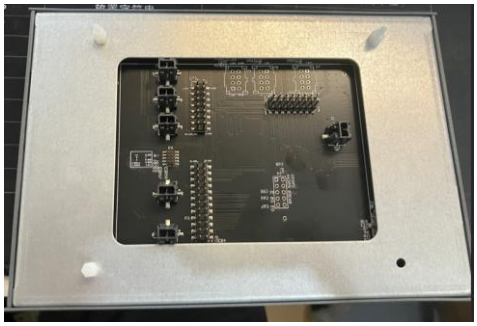


Figure 11. Bottom layer layout
(Top view)

Reference EMC data

This recommended layout meets the EMC standard CISPR25 Class 5 with Shield case.



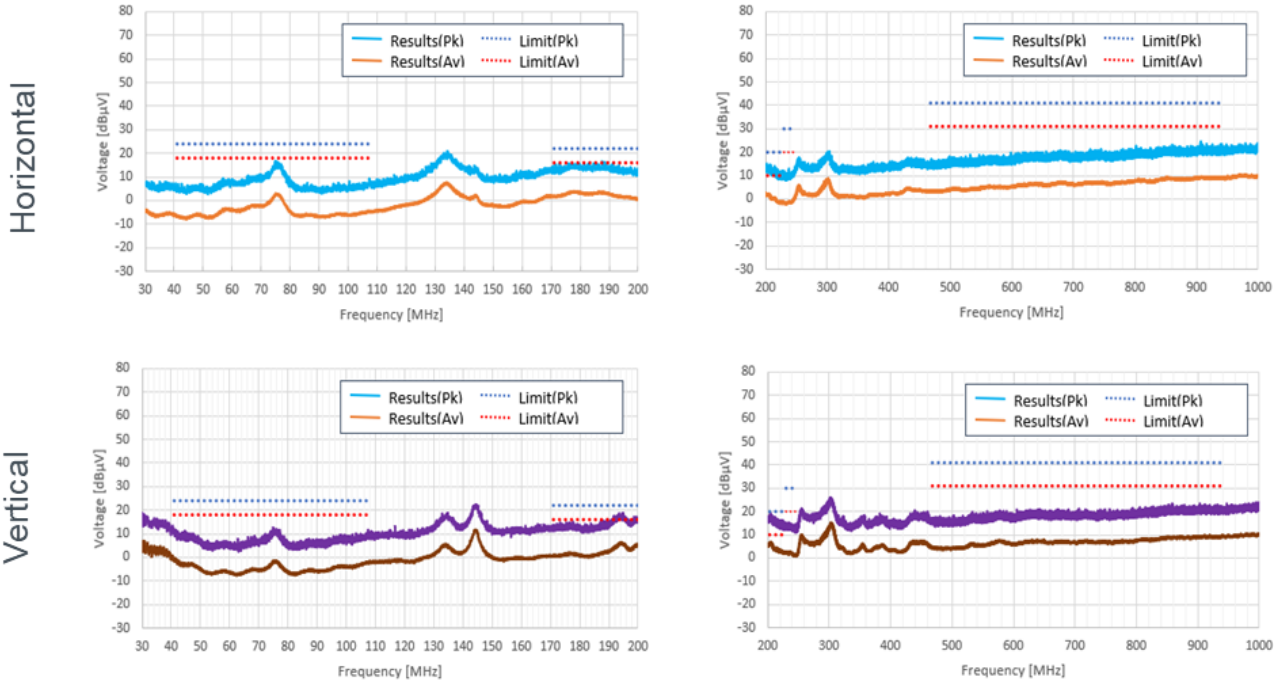


Figure 12. Radiated noise (CISPR25 Class5)

Reference Efficiency data for BD18354 +BD18398

Vout=30V, Io=3A(BD18398/Combine the 3 output channels) Ta=Room temp.,

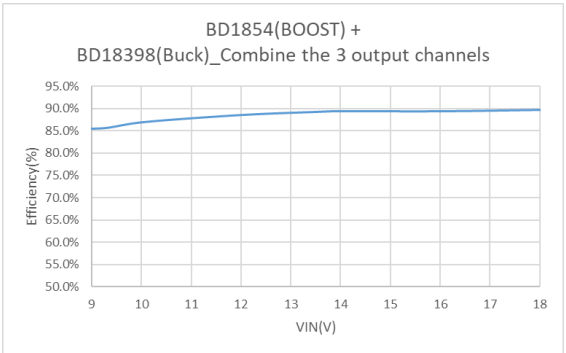


Figure 13. Efficiency

Revision history

Date	Revision number	Description
21. Jan. 2025	001	Initial release

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ROHM SEMICONDUCTOR

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