

System Reference series for Automotive application

BD81A74EFV-TSB-001 Application Note

This document provides measurement test report of the BD81A74EFV-TSB-001 board, which includes electrical characteristics, EMC noise and thermal measurement results. BD81A74EFV is a white LED driver it has 4ch constant current drivers in 1-chip, where each channel can draw up to 120 mA (Max), and it is suitable for high illumination LED drive. Furthermore, a boost current mode DC/DC converter is also built to achieve stable operation during power voltage fluctuation. Dimming control (10,000: 1 @ 100 Hz) by PWM input is possible.

This document consists of following chapters.

Table of contents

Evaluation board schematic	2
Parts list.....	3
Evaluation board operating conditions.....	5
List of evaluation items.....	5
1. Efficiency	6
1.1. Measurement setup	6
1.2. Measurement result.....	6
2. Phase margin.....	7
2.1. Measurement setup	7
2.2. Measurement result.....	7
3. EMC performance	8
3.1. Measurement conditions	8
3.2. Measurement result	8
4. Thermal measurement.....	10
4.1. Measurement setup	10
4.2. Measurement result	11

Parts list

Table 1. Parts list

No	Package	Parameters	Part name(series)	Type	Manufacturer
CIN1	3225	10 μ F, X7S, 50V	GCM32EC71H106KA01	Ceramic	murata
CIN2	-	Open	-	-	-
CIN3	1005	0.01 μ F, X7R, 50V	GCM155R11H103KA40	Ceramic	murata
CIN4	3225	10 μ F, X7S, 50V	GCM32EC71H106KA01	Ceramic	murata
CIN5	-	Open	-	-	-
CIN6	1005	0.1 μ F, X7S, 50V	GCM155R71H104KE37	Ceramic	murata
CIN7	ϕ 8.0mm \times L10.5mm	220 μ F/35V	UCD1V221MNL1GS	Electrolytic	Nichicon
CM	-	Open	-	-	-
RCS1	3216	51m Ω , 1%, 1W	LTR18EZPFS051	Chip resistor	Rohm
RCS3	-	Short	-	-	-
CCS	-	Open	-	-	-
CSS	1005	0.1 μ F, X7R, 16V	GCM155R11C104KA40	Ceramic	murata
CPC1	1005	0.047 μ F, X7R, 50V	GCM155R71H473KE02	Ceramic	murata
RPC1	1608	6.2k Ω , 1%, 1/16W	MCR03EZPFL6202	Chip resistor	Rohm
CPC2	-	Open	-	-	-
RRT1	1608	20k Ω , 1%, 1/10W	MCR03EZPFL2003	Chip resistor	Rohm
RFL1	1608	100k Ω , 1%, 1/10W	MCR03EZPFL1004	Chip resistor	Rohm
RFL2	1608	100k Ω , 1%, 1/10W	MCR03EZPFL1004	Chip resistor	Rohm
CREG	3216	2.2 μ F, X7R, 50V	GCM31CR71H225KA40	Ceramic	murata
L1	W7.0 \times H4.5 \times L7.4mm	15 μ H, 4.5A	SPM7054VT-150M	Inductor	TDK
M1	W2.0 \times H1.0 \times L2.0mm	40V/12A	RF9G120BFHZG	MOSFET	Rohm
L2	W6.0 \times H4.5 \times L6.3mm	3.3 μ H	CLF6045NIT-3R3N-D	Inductor	TDK
D1	W4.7 \times H0.95 \times 2.5mm	60V/5A	RB088LAM-60	SBD	Rohm
COUT1	ϕ 6.3mm \times L7.7mm	33 μ F, \pm 20%, 50V	50HVPF33M	Hybrid	SunCon
COUT2	3225	10 μ F, X7S, 50V	GCM32EC71H106KA01	Ceramic	murata
COUT3	1005	0.1 μ F, X7R, 50V	GCM155R71H104KE37	Ceramic	murata
COUT4	1005	0.01 μ F, X7R, 50V	GCM155R11H103KA40	Ceramic	murata
COUT5	-	Open	-	-	-
COUT6	-	Open	-	-	-
ROVP1	1608	20k Ω , 1%, 1/10W	MCR03EZPFL2003	Chip resistor	Rohm
ROVP2	1608	360k Ω , 1%, 1/10W	MCR03EZPFL3604	Chip resistor	Rohm
RISET (Series)	1608	20k Ω , 1%, 1/16W	MCR03EZPFL2003	Chip resistor	Rohm
	1608	39k Ω , 1%, 1/16W	MCR03EZPFL3903	Chip resistor	Rohm
CLED1	1005	1000pF, X7R, 50V	GCM155R71H102KA37	Ceramic	murata
CLED2	1005	1000pF, X7R, 50V	GCM155R71H102KA37	Ceramic	murata
CLED3	1005	1000pF, X7R, 50V	GCM155R71H102KA37	Ceramic	murata
CLED4	1005	1000pF, X7R, 50V	GCM155R71H102KA37	Ceramic	murata
JP1	-	Open	-	-	-
JP2	-	Open	-	-	-
JP3	-	Short	-	-	-
CSSCG	1005	0.01 μ F, X7R, 50V	GCM155R11H103KA40	Ceramic	murata
EN1	1005	120k Ω , 1%, 1/16W	MCR01MZPFL1204	Chip resistor	Rohm
EN2	1005	39k Ω , 1%, 1/16W	MCR01MZPFL3903	Chip resistor	Rohm

Parts list - continued

Table 1. Parts list - continued

No	Package	Parameters	Part name(series)	Type	Manufacturer
RG	-	Short	-	-	-
CSNB2	-	Open	-	-	-
CSNB3	-	Open	-	-	-
RSNB2	-	Open	-	-	-
RSNB3	-	Open	-	-	-
FEB	-	Open	-	-	-
CFEB	-	Open	-	-	-
CVOUT	-	Open	-	-	-
COUTLED1	-	Open	-	-	-
COUTLED2	-	Open	-	-	-
COUTLED3	-	Open	-	-	-
COUTLED4	-	Open	-	-	-

Evaluation board operating conditions

Operating conditions are shown below.

Table 2. Evaluation board operating conditions

Parameter	Min	Typ	Max	Unit
Power supply voltage *1	-	13.5	-	V
LEDs in series	6	-	10	pcs
LEDs in parallel	-	4	-	ch
Output voltage *2	20	-	34	V
Output current (per channel)	-	85	-	mA
DC/DC oscillation frequency	-	400 *3	-	kHz
Over voltage limit	-	38	-	V
Over current limit	-	3.9	-	A

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

*2 Output voltage is determined by the Vf value of the connected LED and the number of series. Since this evaluation board has a boost-configuration, output voltage should be higher than input voltage. Also, output voltage should be lower than OVP voltage.

*3 The default frequency is set to 400kHz so that it is higher than the EMC standard (LW: 150kHz to 300kHz) even if variations and SSCG functions are considered.

List of evaluation items

List of evaluation items are shown below.

Table 3. List of evaluation items

Chapter No.	Items	X-axis	Y-axis	Condition
1	Efficiency	Input voltage	Efficiency	VCC=7V to 18V,
2	Phase margin	Frequency	Gain, Phase	VCC=13.5V
3	EMC performance	Frequency	Noise level	CISPR25 standard (Conducted, Radiated)
4	Thermal measurement	-	-	Tc at each device in operation

1. Efficiency

1.1. Measurement setup

Measurement setup of efficiency is shown below.

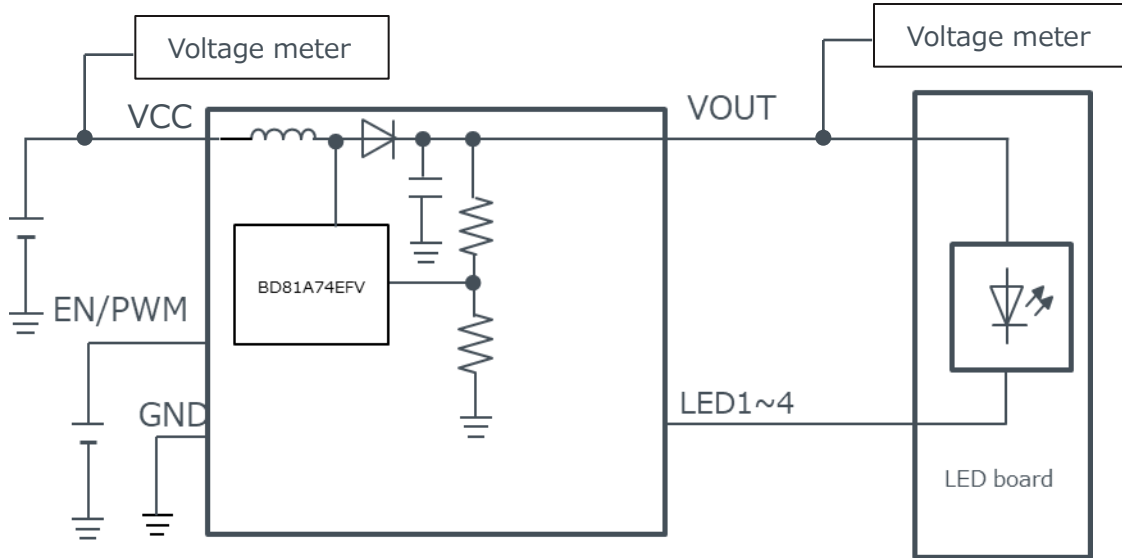


Figure 2. Measurement setup of efficiency

1.2. Measurement result

Measurement result of efficiency is shown below.

(Ta=25°C, LEDs in series =10pcs, Output voltage=34V)

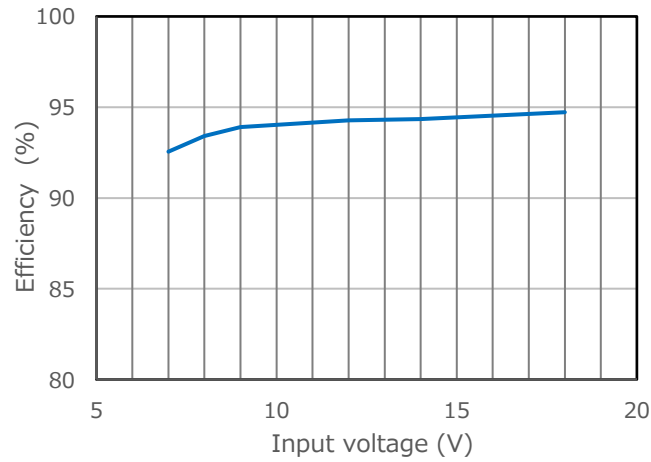


Figure 3. Efficiency vs Input voltage

2. Phase margin

2.1 Measurement setup

Measurement setup of phase margin is shown below.

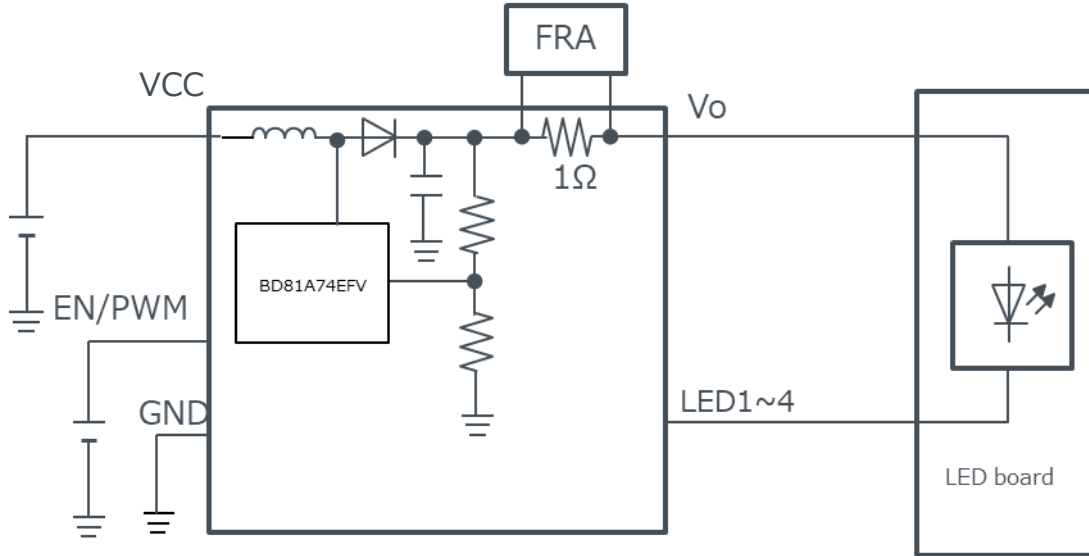


Figure 4. Measurement setup of phase margin

2.2. Measurement result

Measurement results of phase margin is shown below.

(Ta=25°C, LEDs in series =10pcs, Output voltage=34V)

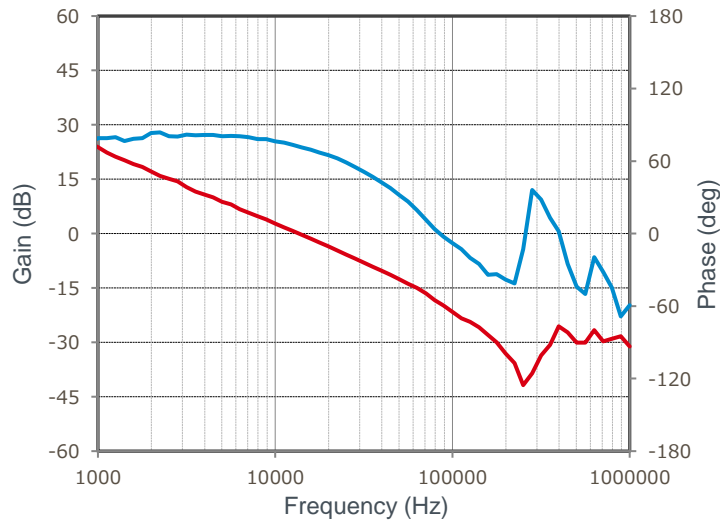


Figure 5. Gain, Phase vs Frequency (VCC=13.5V)

3. EMC performance

BD8A74EFV-TSB-001 is able to meet CISPR25 Class5 EMC test standard. In testing, CISPR standard is cleared without a common mode noise filter.

3.1. Measurement conditions

Measurement conditions are shown below.

Table 4. Measurement conditions

Item	Condition
Temperature	Room temp (Ta=25°C)
Input Voltage	12V Battery
LEDs in series (Output voltage)	10LEDs (about 34V)
Load current	85mA×4ch
Switching Frequency	405kHz(Spread Spectrum :ON)
PWM pin	High (100%duty)

3.2. Measurement result

3.2.1 Conducted noise measurement result

Conducted noise measurement result is shown below.

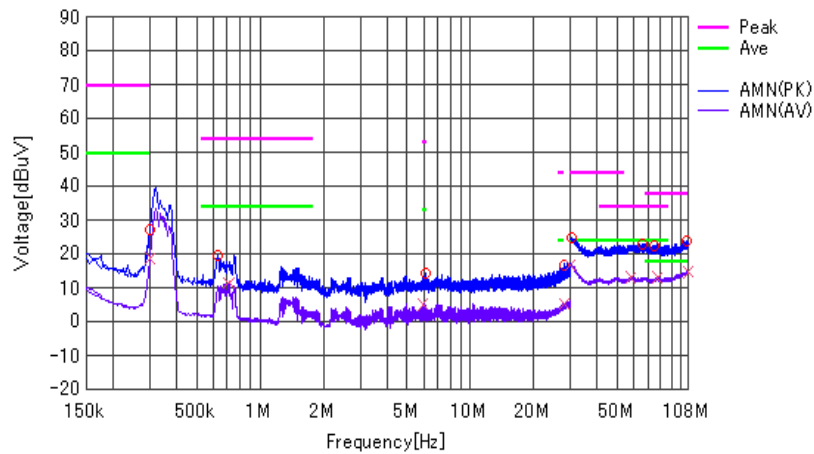


Figure 6. Conducted noise emission

3.2.2 Radiated noise (Antenna face in horizontal direction) measurement result

Radiated noise with antenna face in horizontal direction measurement result is shown below.

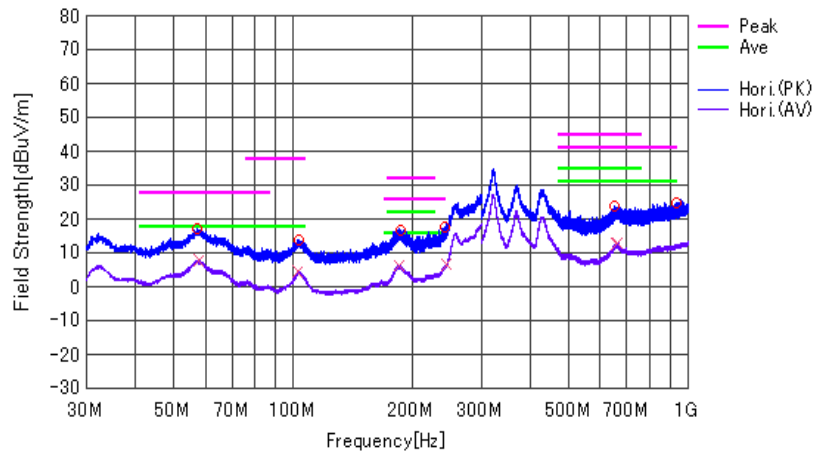


Figure 7. Radiated noise emission (antenna horizontal)

3.2.3 Radiated noise (Antenna face in vertical direction) measurement result

Radiated noise with antenna face in vertical direction measurement result is shown below.

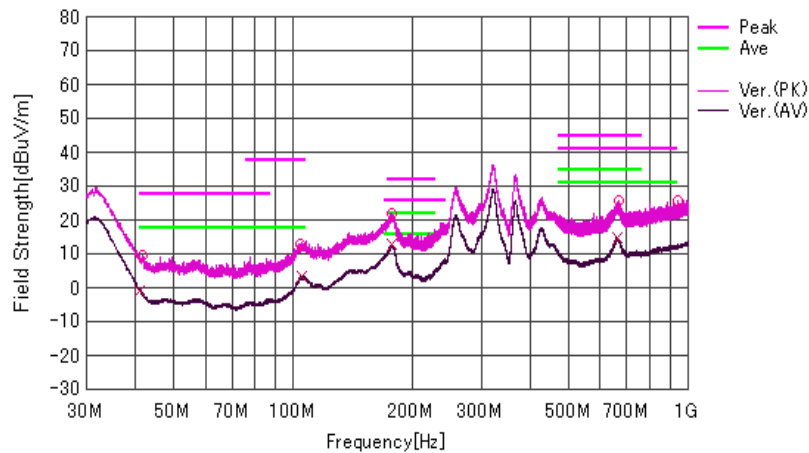


Figure 8. Radiated noise emission (antenna vertical)

4. Thermal measurement

4.1. Measurement setup

Measurement setup of thermal measurement is shown below.

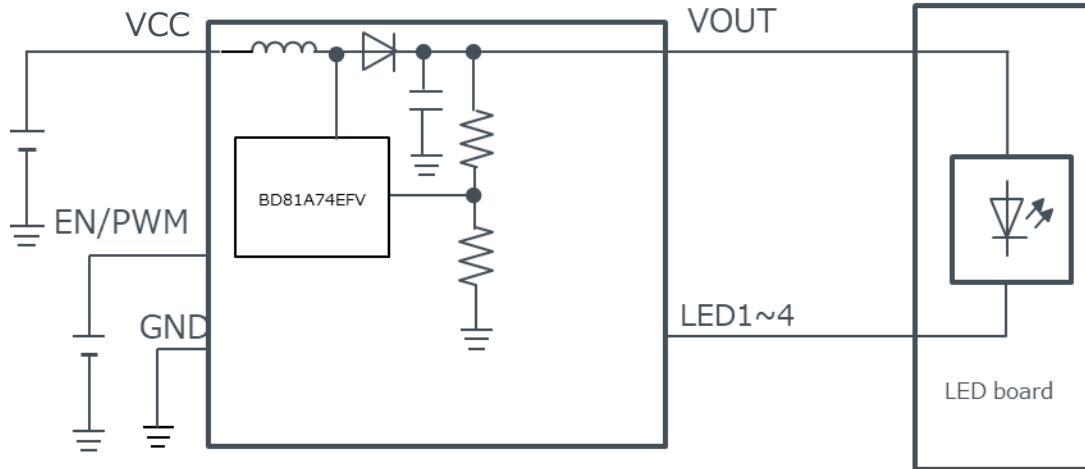


Figure 9. Measurement setup of thermal measurement

Table 5. Measurement conditions

Item	Condition
Temperature	Room temp (Ta=25°C)
Input Voltage	13.5V
LEDs in series (Output voltage)	10LEDs (about 34V)
Load current	85mA×4ch
Switching Frequency	405kHz(Spread Spectrum :ON)
PWM pin	High (100%duty)

4.2. Measurement result

Thermal measurement results are shown below as the difference from room temperature.

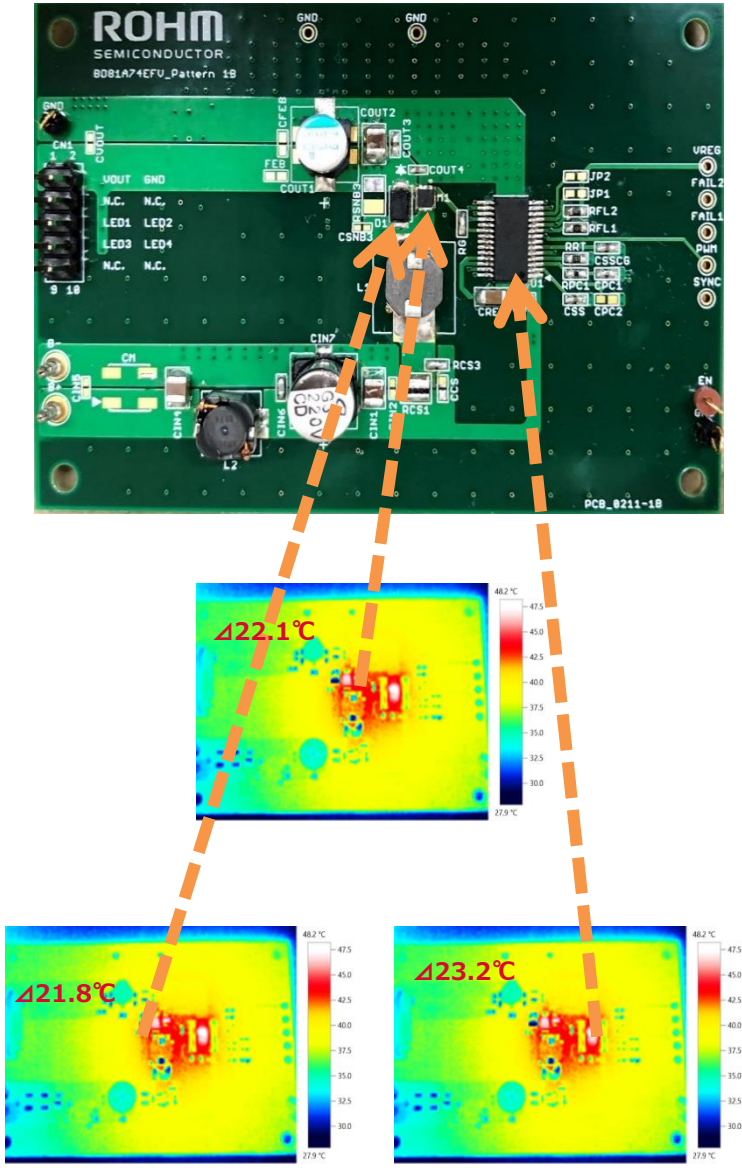


Figure 10. Thermal measurement result

Notes

- 1) The information contained herein is subject to change without notice.
- 2) Before you use our Products, please contact our sales representative and verify the latest specifications :
- 3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors.
Therefore, in order to prevent personal injury or fire arising from failure, please take safety measures such as complying with the derating characteristics, implementing redundant and fire prevention designs, and utilizing backups and fail-safe procedures. ROHM shall have no responsibility for any damages arising out of the use of our Products beyond the rating specified by ROHM.
- 4) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.
- 5) The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM or any other parties. ROHM shall have no responsibility whatsoever for any dispute arising out of the use of such technical information.
- 6) The Products specified in this document are not designed to be radiation tolerant.
- 7) For use of our Products in applications requiring a high degree of reliability (as exemplified below), please contact and consult with a ROHM representative : transportation equipment (i.e. cars, ships, trains), primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, servers, solar cells, and power transmission systems.
- 8) Do not use our Products in applications requiring extremely high reliability, such as aerospace equipment, nuclear power control systems, and submarine repeaters.
- 9) ROHM shall have no responsibility for any damages or injury arising from non-compliance with the recommended usage conditions and specifications contained herein.
- 10) ROHM has used reasonable care to ensure the accuracy of the information contained in this document. However, ROHM does not warrants that such information is error-free, and ROHM shall have no responsibility for any damages arising from any inaccuracy or misprint of such information.
- 11) Please use the Products in accordance with any applicable environmental laws and regulations, such as the RoHS Directive. For more details, including RoHS compatibility, please contact a ROHM sales office. ROHM shall have no responsibility for any damages or losses resulting non-compliance with any applicable laws or regulations.
- 12) When providing our Products and technologies contained in this document to other countries, you must abide by the procedures and provisions stipulated in all applicable export laws and regulations, including without limitation the US Export Administration Regulations and the Foreign Exchange and Foreign Trade Act.
- 13) This document, in part or in whole, may not be reprinted or reproduced without prior consent of ROHM.



Thank you for your accessing to ROHM product informations.
More detail product informations and catalogs are available, please contact us.

ROHM Customer Support System

<https://www.rohm.com/contact/>