



# **AC Voltage Zero Cross Detection IC BM1Z102FJ Evaluation Board**

**User's Guide**

## <High Voltage Safety Precautions>

◇ Read all safety precautions before use

Please note that this document covers only the **BM1Z102FJ** evaluation board (BM1Z102FJ-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 be 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.

AC/DC Converter

# Zero Cross Output

## BM1Z102FJ Evaluation Board

### BM1Z102FJ-EVK-001

#### General Description

This evaluation board outputs a zero cross signal from 90 Vac to 264 Vac input.

This evaluation board is mounted with BM1Z102FJ which outputs high precision zero cross timing of targeted AC voltage and the DC voltage after diode rectification with high accuracy.

The evaluation board is also mounted with power supply for the IC.



Figure 1. BM1Z102FJ-EVK-001

#### Performance Specification

Not guarantee the characteristics is representative value. Ta = 25 °C

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage Range	90	230	264	V	
Input Frequency	47	-	63	Hz	
Output Voltage (High Level)	4.75	5.00	5.25	V	
Output Voltage (Low Level)	0.0	-	0.1	V	
Delay Time	-	0.0	-	μs	
DCOUT Pin Voltage	0.915	0.99	1.07	V	V <sub>VH,DC</sub> = 100 V
Operating Temperature Range	-10	+25	+65	°C	

## Operation Procedure

### 1 Necessary Equipment

- (1) AC power supply (90 Vac to 264 Vac, 10 W or more)
- (2) Oscilloscope

### 2 Connect to Each Equipment

- (1) Set the AC power supply to 90 Vac to 264 Vac power supply off.
- (2) Connect the output pin (ACOUT-pin, COMMON pin) to Oscilloscope (Insulation isolated).
- (3) Connect the pin of the power supply (CN1) to AC power supply output with pair of wires.
- (4) Connect the Multi-meter to DCOUT-pin and GND-pin
- (5) AC power supply turn on.
- (6) Confirm the output waveform synchronized with the AC voltage.
- (7) The DCOUT terminal outputs about 1/100 voltage with the DC voltage after the diode rectification.

**Caution :** To avoid the electrical shock , please keep Oscilloscope probes being isolated.

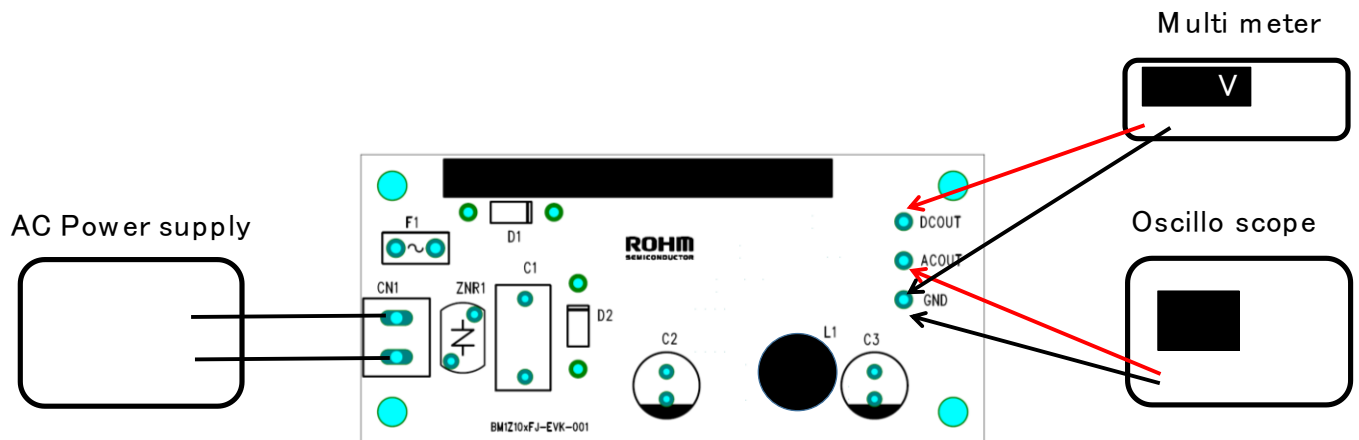


Figure 2. Diagram of How to Connect

### Application Circuit

This evaluation board outputs a zero cross signal.

This evaluation board (BM1Z102FJ) output a zero cross point of the AC voltage from ACOUT pins by monitoring the voltage between VH\_AC1 pins and the VH\_AC2 pins of IC1.

600V withstand monitor circuit is integrated at VH\_AC1 pin and VH\_AC2 pin to realize high reliability and low power consumption. ACOUT pin output 5V as high level and 0V as low level.

The DCOUT terminal outputs about 1/100 voltage with the DC voltage after the diode rectification.

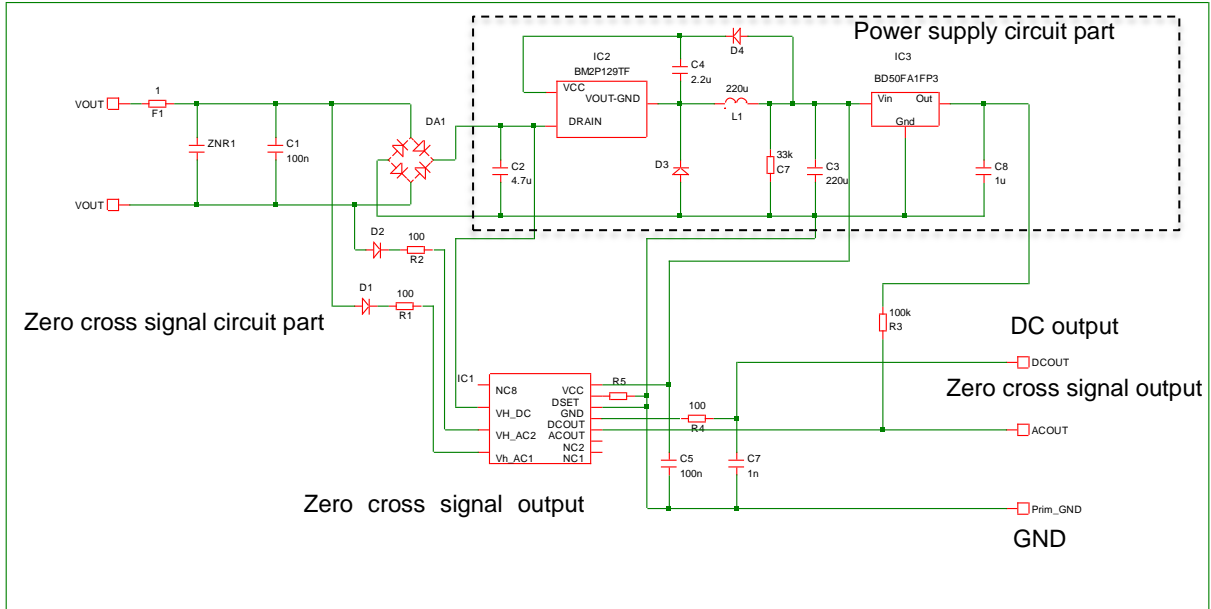


Figure 3. Application Circuit

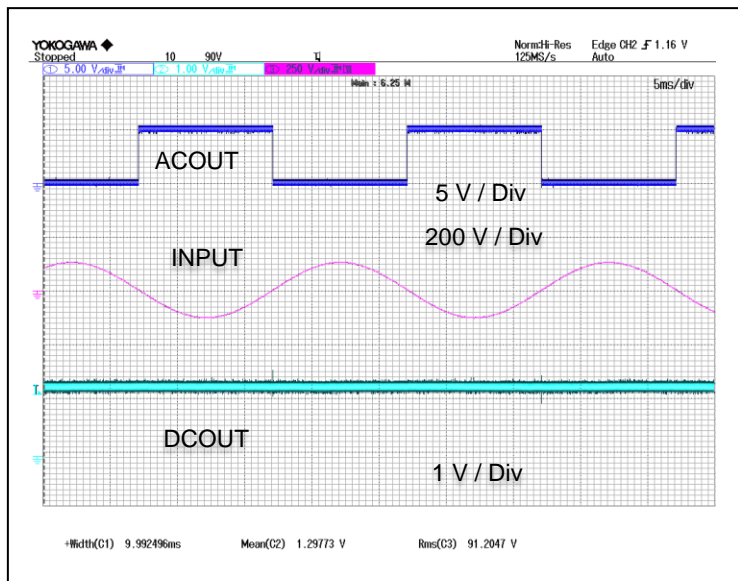


Figure 4. Wave form of the input output voltage

## BM1Z102FJ • General Description

### Features

This IC outputs the AC voltage zero cross timing detection and the DC voltage after diode rectification with high accuracy.

By eliminating the need for opto-coupler and external components required in conventional applications, it is possible to reduce the number of parts drastically and realize compact and highly reliable power supply applications. In addition, this IC can reduce standby power largely in comparison with an existing opto-coupler control.

### Key Specifications

- VCC Input Power Supply Voltage Range: -0.3 V to +29.0 V
- VH\_AC1 and VH\_AC2 Pins Operation Voltage: 600 V (Max)
- VH\_DC Pin Operation Voltage: 600 V (Max)
- Circuit Current at Standby: 50  $\mu$ A (Typ)
- Circuit Current at Operation: 160  $\mu$ A (Typ)
- Operating Temperature Range: -40 °C to +105 °C

### Pin Configuration

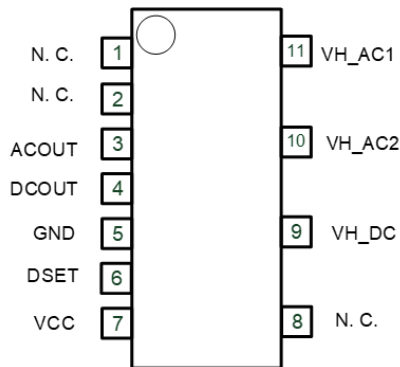


Figure 5. Pin Configuration

### Package

SOP-J11

W (Typ) x D (Typ) x H (Max)

8.65 mm x 6.0 mm x 1.65 mm

Pitch (Typ): 1.27 mm

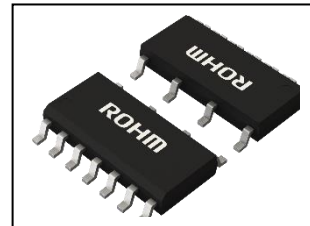


Figure 6. SOP-J11 Package

### Pin Descriptions

No.	Pin Name	I/O	Function
1	N.C	-	Non Connection (Do not connect to any pins.)
2	N.C	-	Non Connection (Do not connect to any pins.)
3	ACOUT	O	AC voltage zero cross timing output pin
4	DCOUT	O	DC voltage output pin
5	GND	-	GND pin
6	DSET	I	AC voltage zero cross timing output pin
7	VCC	I	Power supply pin
8	N.C	-	Non Connection (Do not connect to any pins.)
9	VH_DC	I	DC voltage input pin
10	VH_AC2	I	AC voltage input 2 pin
11	VH_AC1	I	AC voltage input 1 pin

## 1 Important Parameter

Parameter	Symbol	Min	Typ	Max	Units	Conditions
Input Voltage Range	$V_{IN}$	90	230	264	V	
Output Voltage (High Level)	$V_{OUT}$	4.75	5.00	5.25	V	
Output Voltage (Low Level)	$I_{OUT}$	0.0	0.0	0.1	V	
Delay Time	$T_{DELAY}$	-	0	-	$\mu s$	
DC Output Voltage	$V_{DCOUT}$	0.915	0.990	1.070	V	$V_{VH\_DC} = 100 V$

Zero cross delay time is adjustable by the external (R5) between DSET pins and GND pins.

R5	Setting delay time
OPEN	0 $\mu s$
330 k $\Omega$	200 $\mu s$
68 k $\Omega$	-200 $\mu s$
0 $\Omega$	-480 $\mu s$

This evaluation board, R5 assumes it OPEN. Thus, the delay time works in 0  $\mu s$ .

Measurement Data

1 Input output waveform

R5: OPEN

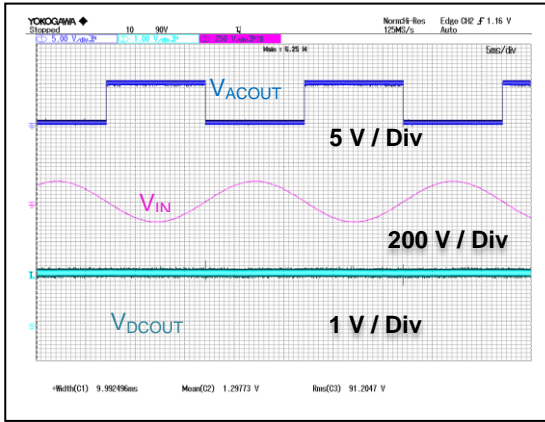


Figure 7. Input output waveform  $V_{IN} = 90$  Vac

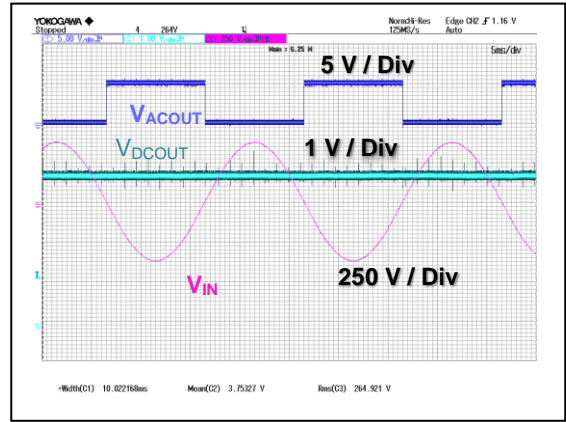


Figure 8. Input output waveform  $V_{IN} = 264$  Vac

R5 : 330 k $\Omega$

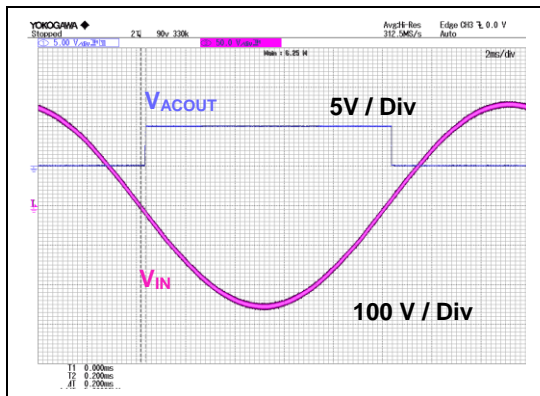


Figure 9. Input output waveform  $V_{IN} = 90$  Vac

R5 : 8 k $\Omega$

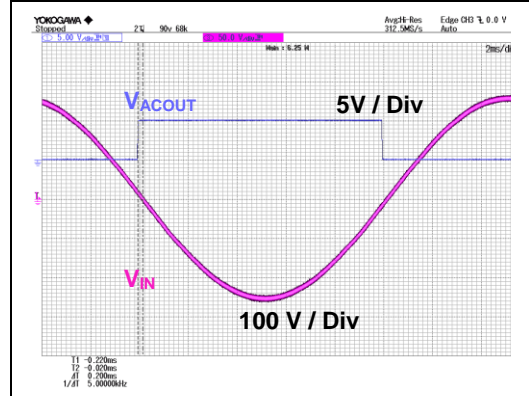


Figure 10. Input output waveform  $V_{IN} = 90$  Vac

R5 : 0  $\Omega$

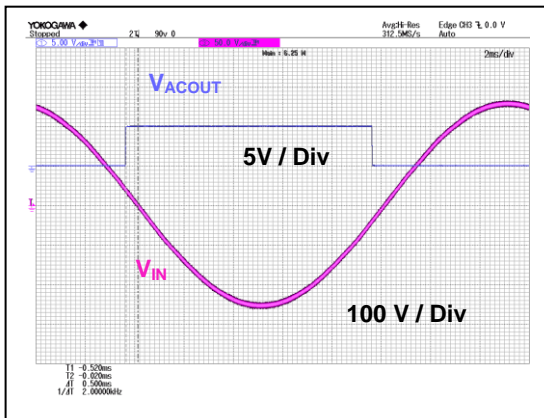


Figure 11. Input output waveform  $V_{IN} = 90$  Vac



Measurement Data - continued

2 DCOUT Pin Voltage

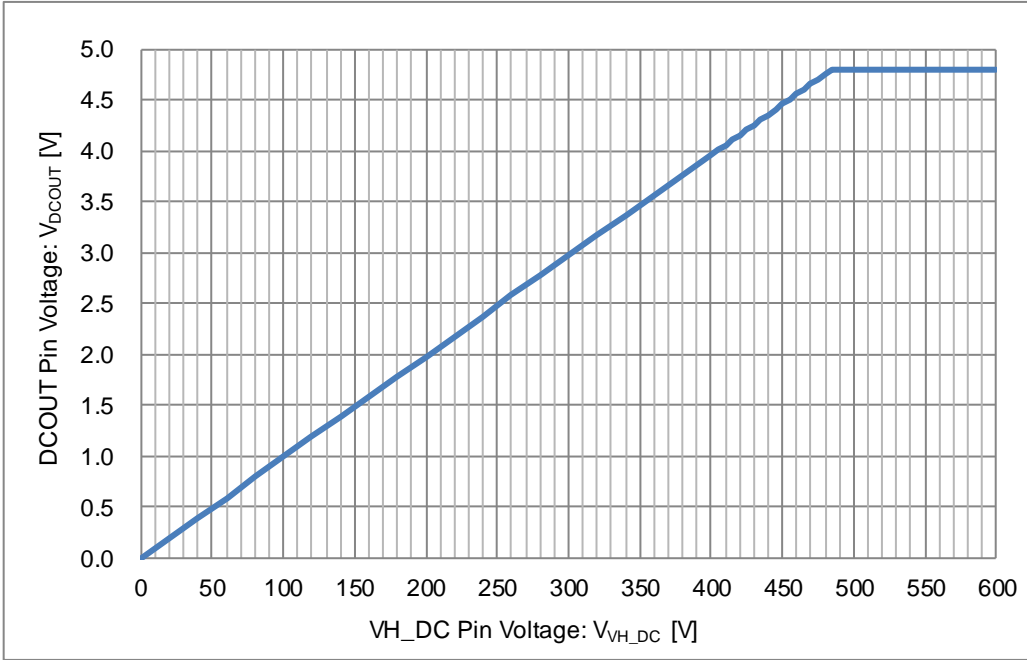


Figure 12. DCOUT Pin Voltage vs VH\_DC Pin Voltage

### Application Circuit

(Condition)  $V_{IN} = 90 \text{ Vac}$  to  $264 \text{ Vac}$

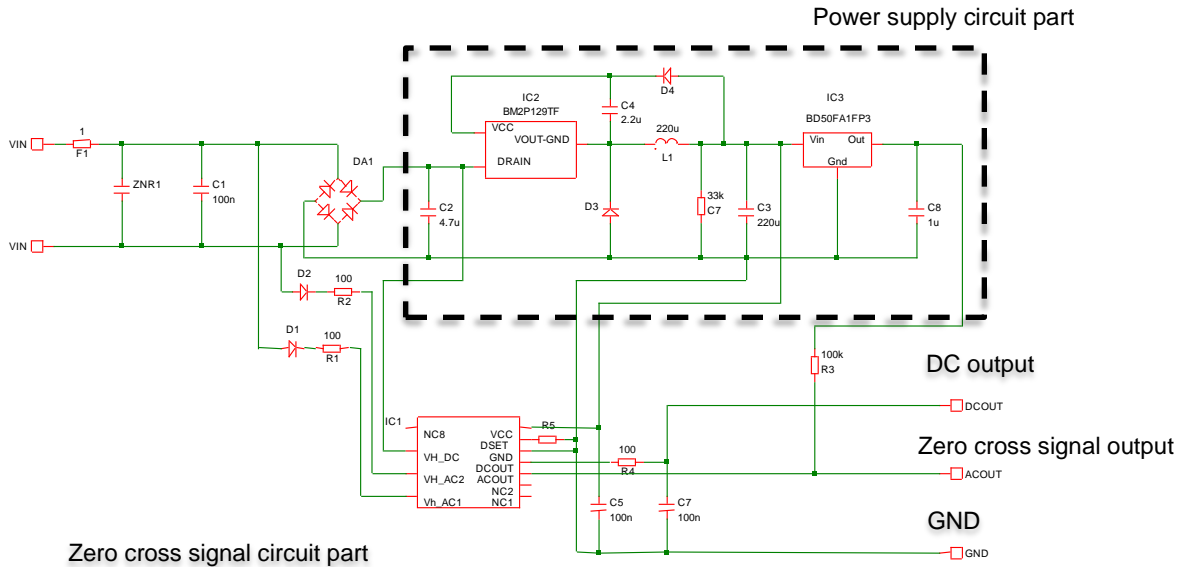


Figure 13. BM1Z002FJ-EVK-001 Application Circuit

## Parts List

Item		Specifications	Parts name	Manufacture
Connector	CN1		B02P-NV	JST
Capacitor	C1	0.1 $\mu$ F, 275 V	890324023023CS	WURTH ELECTRONIK
	C2	4.7 $\mu$ F, 400 V	860021374008	WURTH ELECTRONIK
	C3	220 $\mu$ F, 25 V	860080474010	WURTH ELECTRONIK
	C4	2.2 $\mu$ F, 35 V	UMK212BB7225KG-T	TAIYO YUDEN
	C5	0.1 $\mu$ F, 100 V	HMK107B7104MA-T	TAIYO YUDEN
	C7	0.1 $\mu$ F, 100 V	HMK107B7104MA-T	TAIYO YUDEN
	C8	1 $\mu$ F, 50 V	UMK212BJ105KG-T	TAIYO YUDEN
Diode-Bridge	DA1	1 A, 800 V	D1UBA80-7062	SHINDENGEN
Diode	D1	1 A, 1000 V	1N4007	MCCSEMI
	D2	1 A, 1000 V	1N4007	MCCSEMI
	D3	FRD, 0.8 A, 600 V	RFN1LAM6S	ROHM
	D4	0.2 A, 600 V	RRE02VSM6S	ROHM
Fuse	F1	1 A, 300 V	36911000000	LITTELFUSE
IC	IC1		BM1Z102FJ	ROHM
	IC2		BM2P129TF	ROHM
	IC3		BD50FA1FP3-ZTL	ROHM
Coil	L1	220 $\mu$ H	7447471221	WURTH ELECTRONIK
Resistor	R1	100 $\Omega$	MCR18EZPJ101	ROHM
	R2	100 $\Omega$	MCR18EZPJ101	ROHM
	R3	100 k $\Omega$	MCR03EZPJ104	ROHM
	R4	100 $\Omega$	MCR03EZPJ101	ROHM
	C6	33 k $\Omega$	MCR03EZPJ333	ROHM
Pin	TP	Red	LC-2-G	
	TP	Orange	LC-2-G	
	TP	Black	LC-2-G	

(Note 1) Materials may be changed without notifying.

### Layout

Size: 36 mm x 90 mm

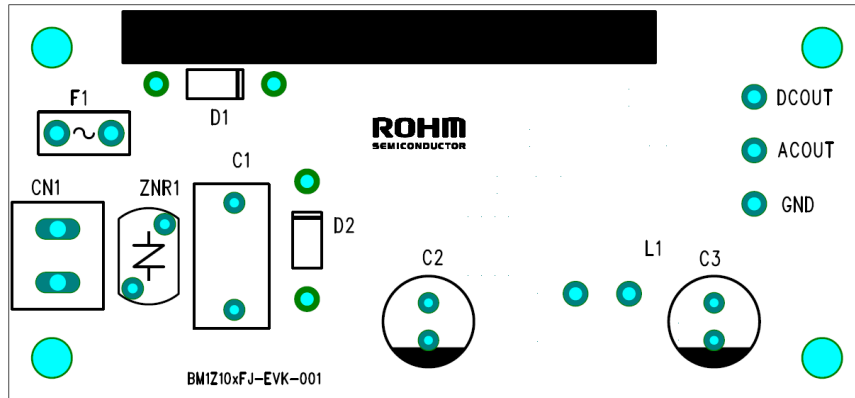


Figure 14. TOP Silkscreen (Top view)

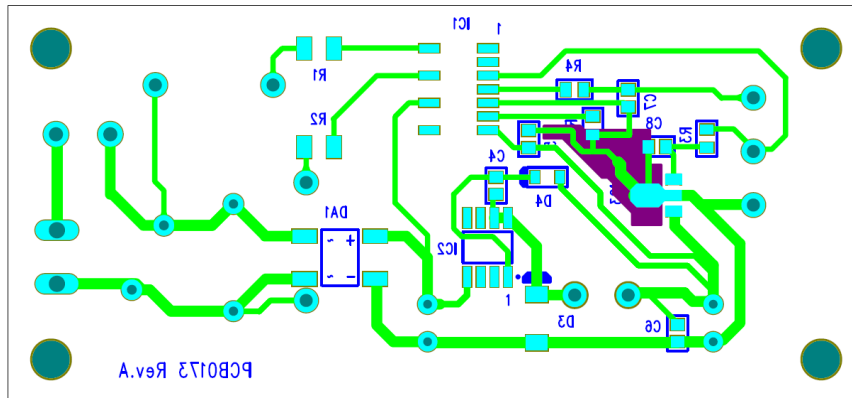


Figure 15. Bottom Layout (Top View)

### Revision History

Date	Rev.	Changes
6.April.2020	001	New Release

## 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.  
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- 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.
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