Isolation Fly-back Conveter PWM method
Output Power 12W
BM2P0363F-EVK-001

User's Guide

＜High Voltage Safety Precautions＞

◇ Read all safety precautions before use

Please note that this document covers only the BM2P0363F evaluation board (BM2P0363F-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.

AC/DC Converter

Flyback Type PWM Mode Isolated 12 V 1.0 A 12 W BM2P0363F Evaluation Board

BM2P0363F-EVK-001

General Description

The evaluation board output an isolated 12 V voltage, output from a 90 Vac to 264 Vac input,

The maximum output power can output 12 W.

BM2P0363F which is PWM method DC/DC converter IC built-in 650 V MOSFET is used.

Low on-resistance 3.0 Ω 650 V MOSFET built-in contributes to high efficiency (86.7 % typ).

PWM controller for AC / DC power supplies, the BM2P0363F provides the optimum system for all products with outlets.

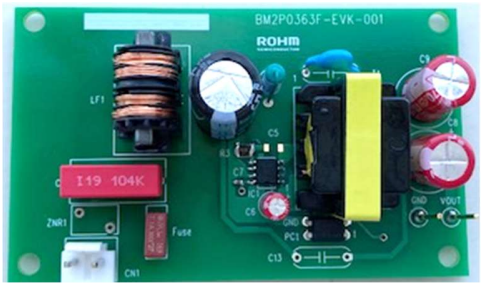


Figure 1. BM2P0363F-EVK-001

No. 66UG017E Rev.001
MAY.2023

Performance Specification

Not guarantee the characteristics is representative value.

Unless otherwise specified V_{IN} = 230 Vac , I_{OUT} = 1 A, Ta = 25 °C

Parameter	Symbol	Min	Typ	Max	Units	Conditions
Input Voltage Range	V_{IN}	90	230	264	V	
Input Frequency	f_{LINE}	47	-	63	Hz	
Output Voltage	V_{OUT}	11.4	12.0	12.6	V	
Output Current Range *(Note 1)*	I_{OUT}	0	-	1.0	A	
Maximum Output Power	P_{OUT}	-	-	12	W	
Standby Input Power	P_{INSTBY}	-	39	100	mW	I_{OUT} = 0 A V_{IN} = 230 V
Power supply efficiency	η	80.0	86.7		%	
Output Ripple Voltage *(Note21)*	V_{RIPPLE}		0.10	0.24	Vpp	
Oprating Temperature		-10	+25	+65	°C	

(Note 1) Adjust the load application time so that the component surface temperature does not exceed 105 ℃

(Note 2) Not include spikes noise.

Derating

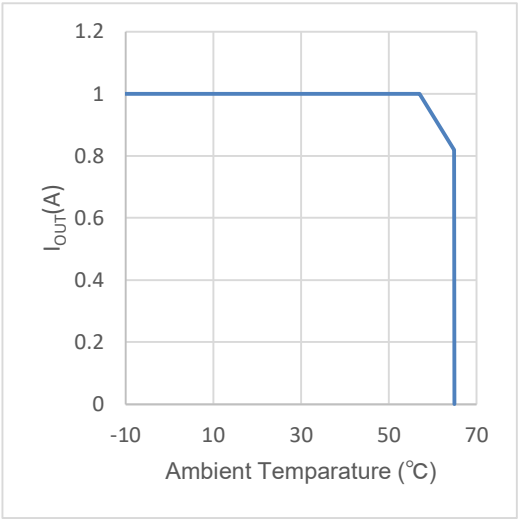


Figure 2. Temperature derating curve

Operation Procedure

1. Operation Equipment

(1) AC power supply (90 Vac to 264 Vac, 20 W or more)
(2) Load equipment (2 A at maximum value)
(3) DC voltmeter

2. Connect method

(1) Preset the AC power to 90 Vac to 264 Vac and turn off the power output.
(2) Set the load below the rated current of output to disable the load.
(3) Connect the N pin of the power supply to the CN1-1: AC (N) pin and the L pin to the CN1-2: AC (L) pin with a pair of wires.
(4) Connect the positive pin of load to VOUT pin and negative pin to the GND pin with a pair of wires.
(5) When connecting a power meter, connect as follows. (For details, refer to the User's Manual of the electricity meter you are using.)
(6) Connect the positive pin of a DC voltmeter to VOUT pin and the negative pin to GND pin for output voltage measurement.
(7) AC power supply switch is ON.
(8) Make sure that the DC voltmeter reading is at the set voltage (12.0 V).
(9) Electronic load switch is ON.

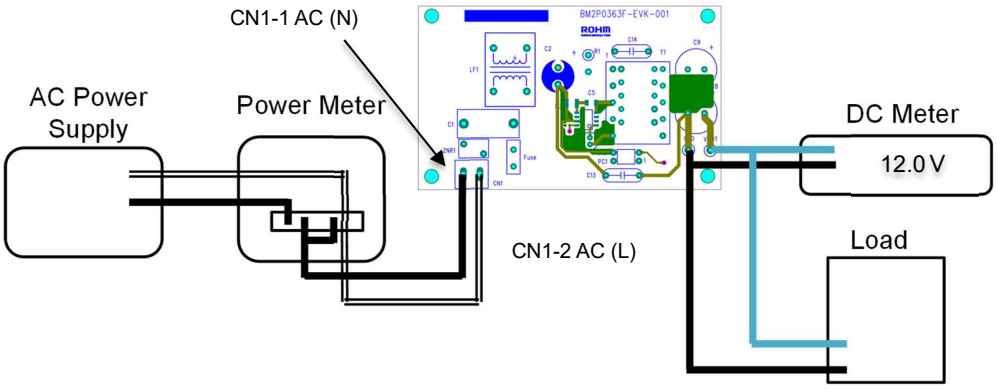


Figure 3. Diagram of How to Connect

Application Circuit

This evaluation board operates in flyback mode at a maximum frequency of around 25 kHz..
The output (12 V) voltage is monitored by a feedback circuit and fed back to the FB pin of BM2P0363F through a opto - coupler.
At startup, the voltage at the VCC pin rises as the voltage is supplied from the DRAIN pin to the VCC pin through the start circuit.
When the VCC pin voltage exceeds the UVLO release voltage of 13.5 V (Typ), the BM2P0363F starts operating.
After start of switching, the startup circuit is turned off and it cut the supply from the DRAIN pin, in order to have low power consumption for instance in standby mode.
The demo board schematic is shown in Figure below and the list of parts is tabulated on page 13.

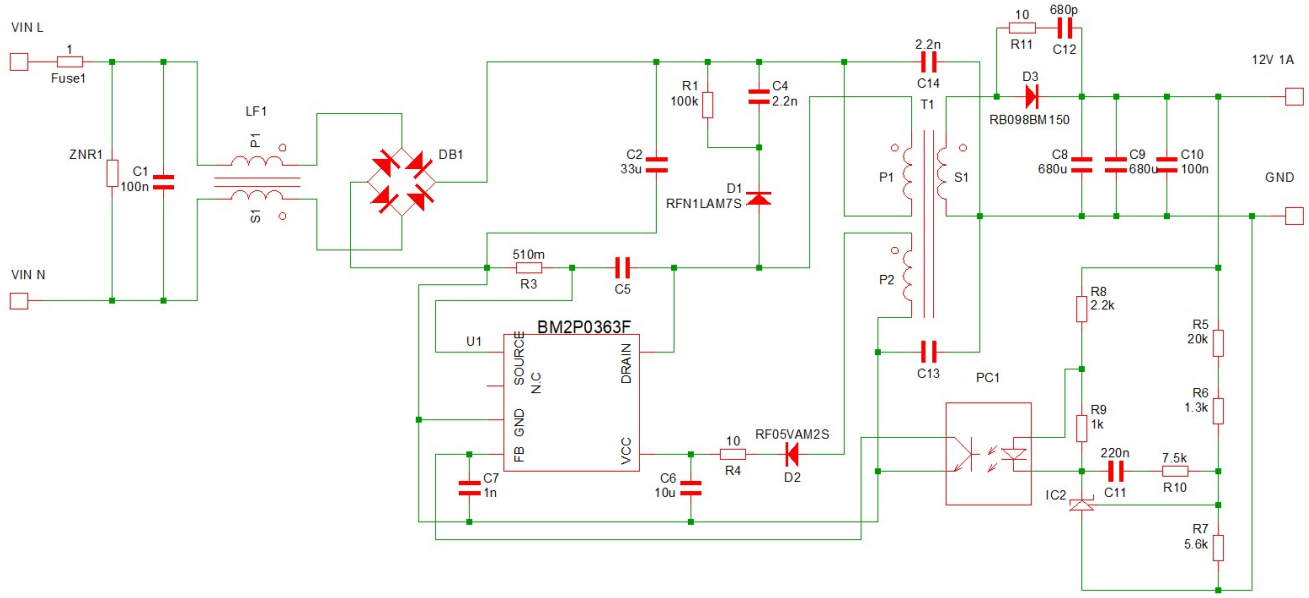


Figure 4. Schematic

BM2P0363F General Description

Features

- PWM Type Current Mode Control
- Frequency Reduction Function
- Burst Operation at Light Load
- VCC UVLO (Under Voltage Lockout)
- VCC OVP (Over Voltage Protection)
- Soft Start Function
- FB OLP (Over load Protection)
- Over Current Protection Function by cycle
- Over Current Compensation by AC voltage detection.
- SOURCE pin Open Protection
- SOURCE pin Short Protection
- SOURCE pin Leading Edge Blanking

Key Specifications

- Operation Power Supply Voltage Range
  VCC Pin Voltage: 8.9 V to 26 V
  DRAIN Pin Voltage: 650 V (Max)
- Current at Switching Operation: 0.7 mA (Typ)
- Current at Burst Operation 0.3 mA (Typ)
- Switching Frequency 65 kHz (Typ)
- MOSFET ON Resistor 3.0 Ω (Typ)
- Operation Temperature Range -40 °C to +105 °C

Package	W (Typ) x D (Typ) x H (Max)
SOP8	5.0 mm x 6.2 mm x 1.71 mm

Applications

AC Adapters, Each Household Applications ()

Pin Configuration

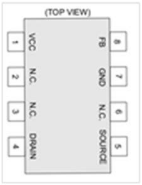


Figure 5. Pin Configuration

Pin Descriptions

No.	端子名	I / O	機能
1	VCC	I	Power supply input pin
2	N.C.	-	Non Connection
3	N.C.	-	Non Connection
4	DRAIN	I	MOSFET DRAIN pin
5	SOURCE	I	MOSFET SOURCE pin
6	N.C.	-	Non Connection
7	GND	I/O	GND pin
8	FB	I	Feedback pin

Measurement Data

1. Load Regulation

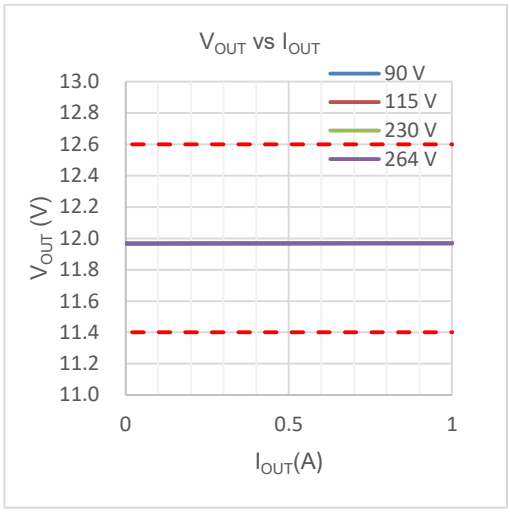


Figure 6. Output Voltage vs Output Current

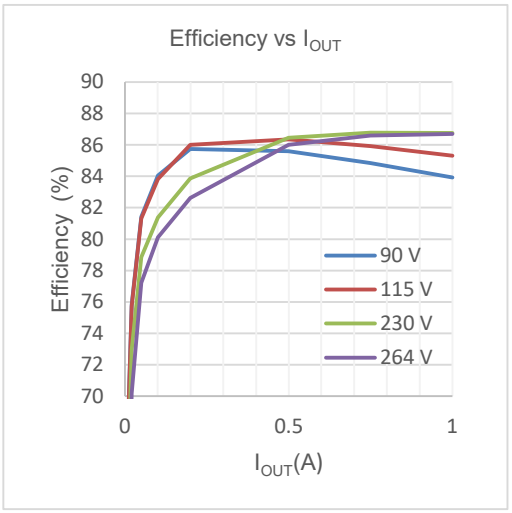


Figure 7. Efficiency vs Output Current

2. Line Regulation

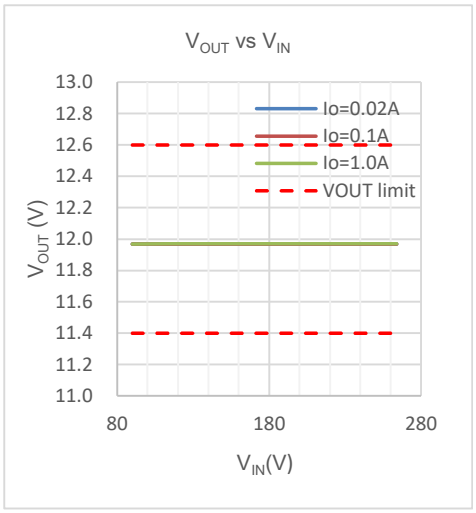


Figure 8. Output Voltage vs Input Voltage

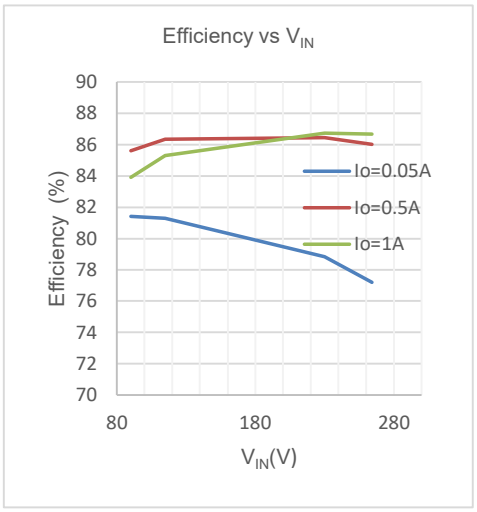


Figure 9. Efficiency vs Input Voltage

Measurement Data – continued

3. Switching Wave Form

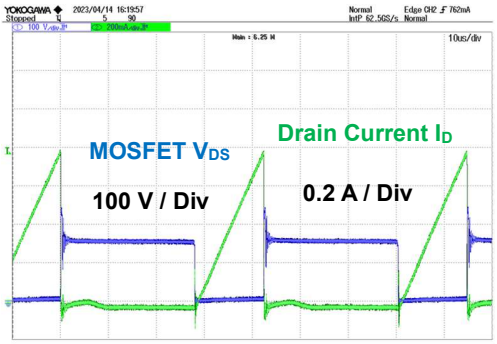


Figure 10. MOSFET Wave Form
V_{IN} = 90 Vac, I_{OUT} = 1.0 A

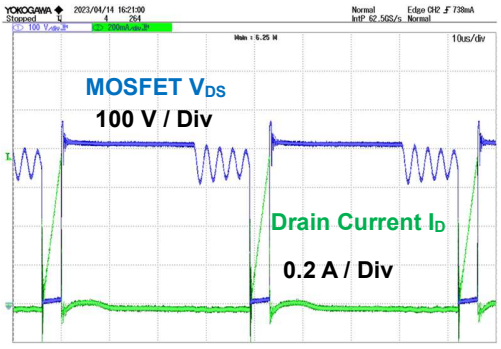


Figure 11. MOSFET Wave Form
V_{IN} = 264 Vac, I_{OUT} = 1.0 A

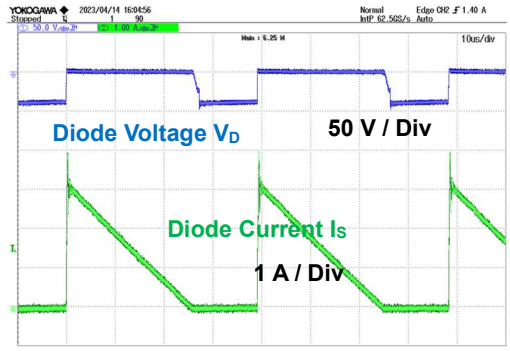


Figure 12. Diode Wave Form
V_{IN} = 90 Vac, I_{OUT} = 1.0 A

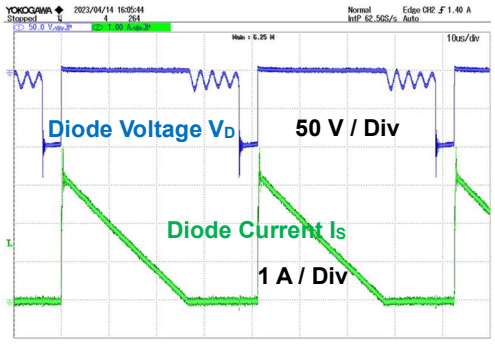


Figure 13. Diode Wave Form
V_{IN} = 264 Vac, I_{OUT} = 1.0 A

4. Switching Wave Form

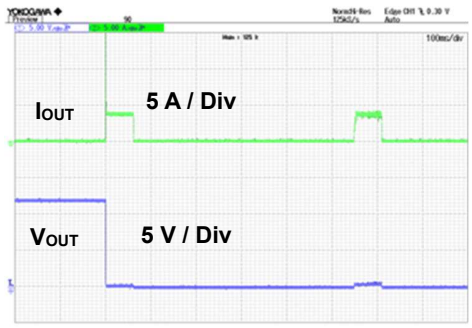


Figure 14. Drain Wave Form
V_{IN} = 90 Vac, V_{OUT1} Output Short

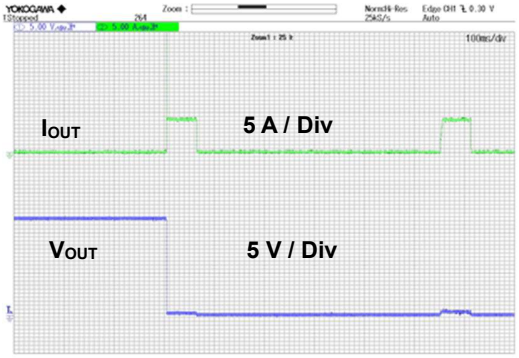


Figure 15. Drain Wave Form
V_{IN} = 264 Vac, V_{OUT1} Output Short

5. Startup Wave Form

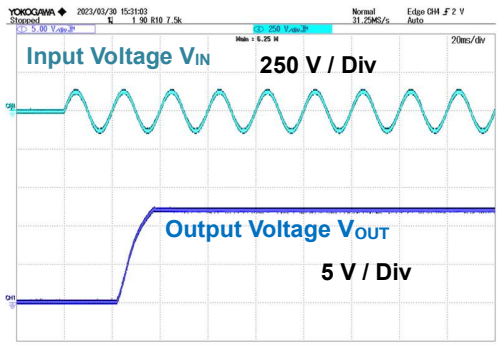


Figure 16. V_{IN} = 90 Vac, Rated load

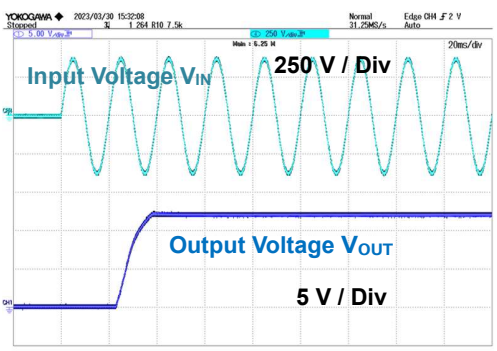


Figure 17. V_{IN} = 264 Vac, Rated load

Measurement Data – continued

8. Dynamic Load Fluctuation

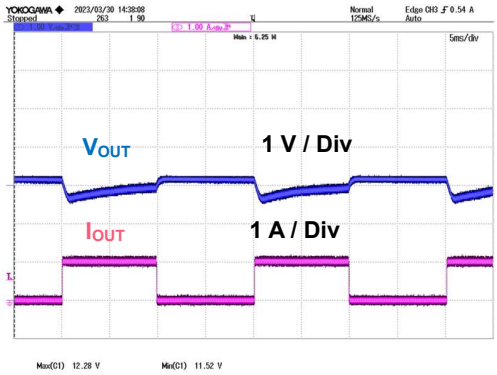


Figure 18. V_{IN} = 90 Vac, I_{OUT} = switch 0 A /1.0 A

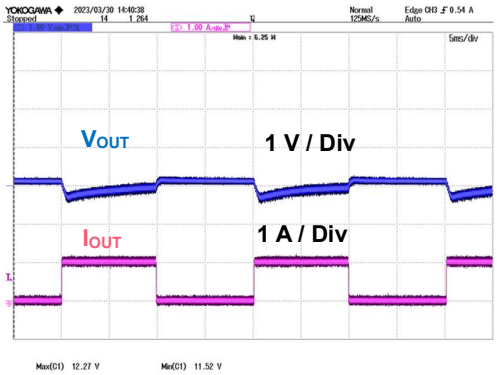


Figure 19. V_{IN} = 264 Vac, I_{OUT1} = switch 0 A / 1.0 A

Measurement Data – continued

9. Output Voltage Ripple Wave Form

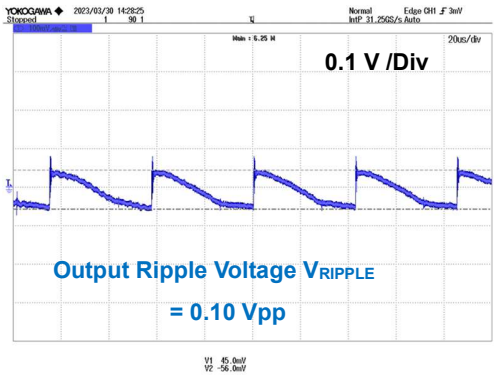


Figure 20. V_{IN} = 90 Vac, I_{OUT5} = 2.0 A

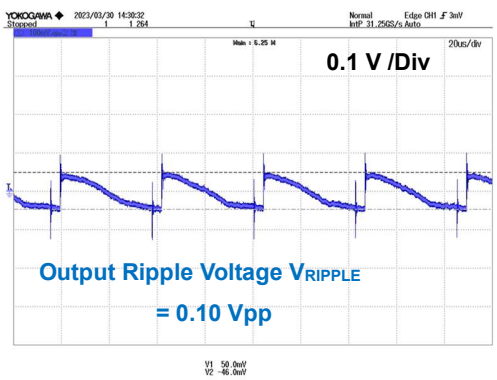


Figure 21. V_{IN} = 90 Vac, I_{OUT12} = 1.0 A

Measurement Data – continued

10. Temperature of Parts Surface

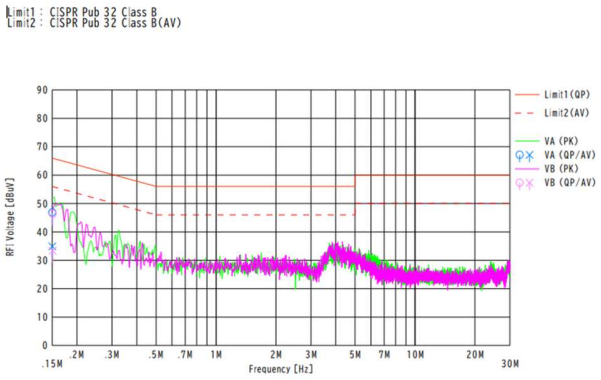
They are measured after 15 minutes from applying a power supply.

Table 1. Surface Temperature of Parts (Ta = 22.4 °C)

Part	Condition	
	V_{IN} = 90 Vac, I_{OUT}=1.0A	V_{IN} = 264 Vac, I_{OUT}=1.0A
IC1	62.1 °C	50.6 °C
Diode D3	48.7 °C	47.2 °C

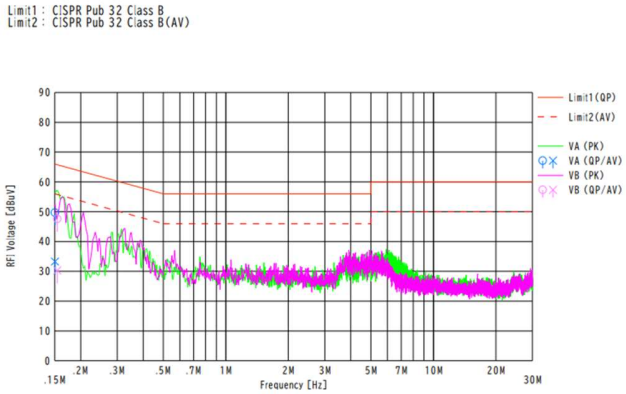
Measurement Data – continued

11. EMI Conducted Emission:CISPR22 Pub 22 Class B



QP margin: 19.1 dB
AVE margin: 21.1 dB

Figure 22. V_{IN}: 115 Vac / 60 Hz, I_{OUT}:1 A



QP margin: 16.3 dB
AVE margin: 22.7 dB

Figure 23. V_{IN}: 230 Vac / 50 Hz, I_{OUT}:1 A

Schematics

V_{IN} = 90 Vac to 264 Vac、V_{OUT}= 12 V / 1 A

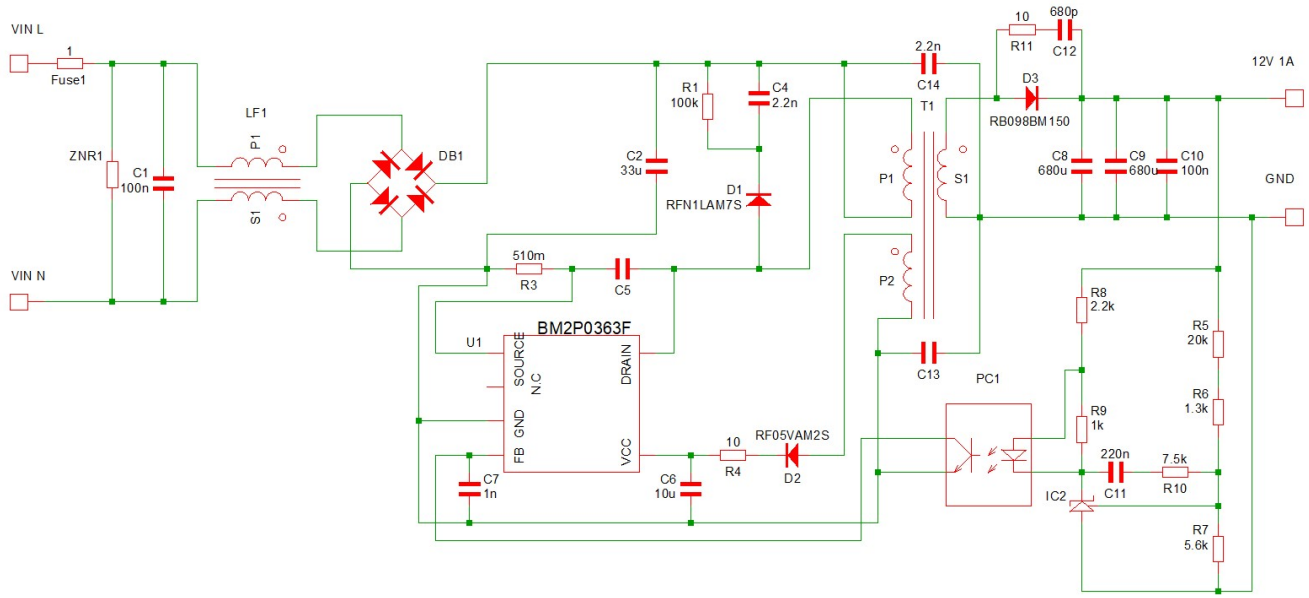


Figure 24. BM2P0363F-EVK-001 Schematics

Parts List

Items	Specifications	Parts name	Manufacture
C1	0.1uF/310V	890334025017CS	WURTH ELECTRONIK
C2	-	-	-
C3	33uF/450V	450BXW33MEFC12.5×25	
C4	2200pF/1 kV	GRM31BR73A222KW01	MURATA
C5	-	-	
C6	10μF/50V	860160672009	WURTH ELECTRONIK
C7	1000pF	HMK107B7102KA-T	TAIYO YUDEN
C8	680uF/25V	860040475009	WURTH ELECTRONIK
C9	680uF/25V	860040475009	WURTH ELECTRONIK
C10	0.1uF/100V	GRM188R72A104KA35D	MURATA
C11	0.22uF/16V	EMK107B7224KAHT	TAIYO YUDEN
C12	680pF / 630V	GRM31B5C2J681FW01L	MURATA
C13	-	-	
C14	2200 pF, Y1:300 Vac	DE1E3RA222MA4BP01F	MURATA
CN1		B02P-NV	JST
D1	FRD 700 V / 0.8 A	RFN1LAM7STR	ROHM
D2	FRD 200 V / 0.5 A	RF05VAM2STR	ROHM
D3	150 V / 5 A	RB098BM150	ROHM
DB1	800 V	D1UBA80-7062	shindengen
F 1	1A 300 V	36911000000	LITTELFUSE
FL1	0.7A 26.5mH	SSR10VS-07265	TOKIN
IC1		BM2P0363F	ROHM
IC2		TL431BIDBZTG4	T.I
PC1		LTV-817	LITE-ON
R1	100 k / 2 W	MOS2CT52R104J	KOA
R3	0.51 Ω	MCR25JZHFLR510	ROHM
R4	10Ω	MCR18EZPJ100	ROHM
R5	20k	MCR03EZPFX2002	ROHM
R6	1.3k	MCR03EZPFX1301	ROHM
R7	5.6k	MCR03EZPFX5601	ROHM
R8	2.2k	MCR03EZPJ222	ROHM
R9	1k	MCR03EZPJ102	ROHM
R10	7.5k	MCR03EZPJ752	ROHM
R11	10	MCR18EZPJ100	ROHM
T1		XE2736Y B	ALPHA TRANS
ZNR1	-	—	—
TP1		CD-10-15	MAC8
TP2		CD-10-15	MAC8
PCB		PCB0298B	SIGNUS

Materials may be changed without notifying.

Layout

Size: 91 mm x 55 mm

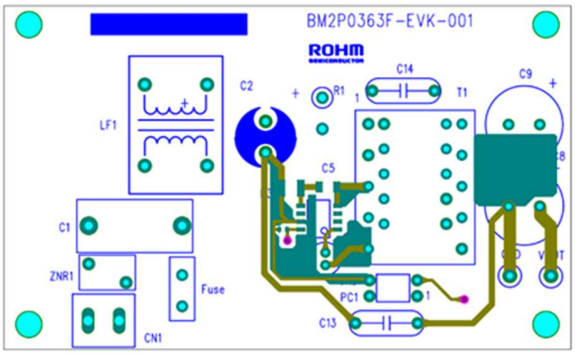


Figure 25. TOP Layout (Top view)

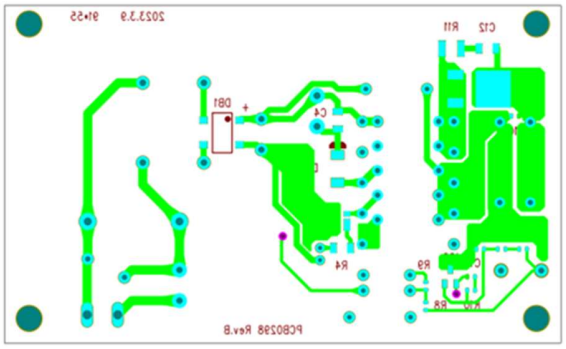


Figure 26. Bottom Layout (Top View)

Specification of the Transformer

Manufacture Alphatrans Co., Ltd. (1-7-2, Bakurou-cho, Chuo-ku, Osaka City, 541-0059, Japan)
http//www.alphatrans.jp/

Product Name: XE2736Y_B
Bobbin: 10PIN
Core: EE25/20

- Primary Inductance: 1.89 mH ±10 %
  (100 kHz, 1 V)
- Withstand Voltage
  Between Primary and Secondary: AC1500 V
  Between Primary and Core: AC1500 V
  Between Secondary and Core: AC500 V
- Insulation Resistance 100 MΩ or more (DC500 V)

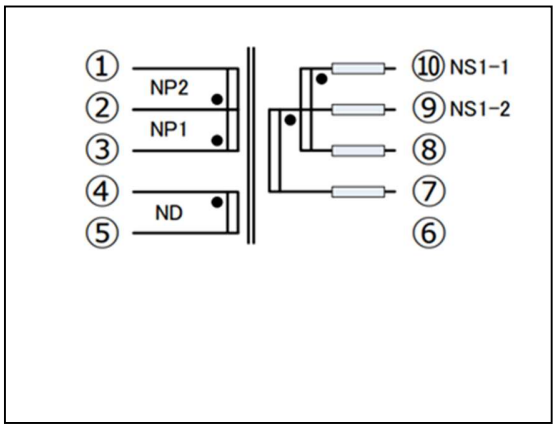


Figure 27. Circuit Diagram

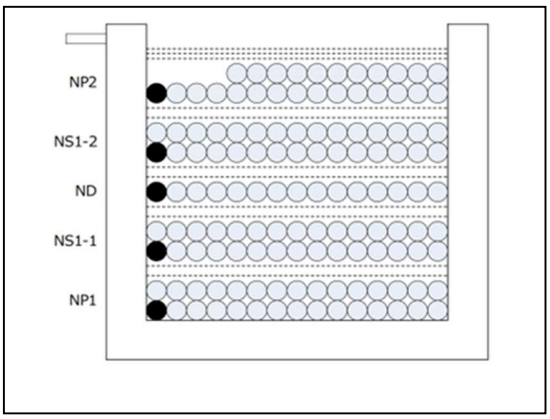


Figure 28. Structure Diagram

Table 2. Product Specification of XE2736Y_B

Transfomer	Winding Pin		Wire	Turn Number	Tape Layer	Wire Specification
	Start	Finish				
NP1	3	2	2UEW / Φ0.25	70	2	COMPACT
NS1-1	10	8	TEX / Φ0.40	31	2	COMPACT
ND	4	5	2UEW / Φ0.20	38	2	COMPACT
NS1-2	9	7	TEX / Φ0.40	31	2	COMPACT
NP2	2	1	2UEW / Φ0.25	59	3	COMPACT

Revision History

Date	Rev.	Changes
16.MAY.2023	001	New Release

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3) Electronic components, including semiconductors, can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against physical injury, and damage to any property, which a failure or malfunction of products may cause.

4) The information contained in this document, including application circuit examples and their constants, is intended to explain the standard operation and usage of ROHM products, and is not intended to guarantee, either explicitly or implicitly, the operation of the product in the actual equipment it will be used. As a result, you are solely responsible for it, and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses, or losses incurred by you or third parties arising from the use of such information.

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