Quasi-Resonant method
Isolated Output Power 100W
BM3G007MUV-EVK-001

User's Guide

＜High Voltage Safety Precautions＞

◇ Read all safety precautions before use

Please note that this document covers only the BM3G007MUV evaluation board (BM3G007MUV-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.

User's Guide

AC/DC Converter

Quasi-Resonant method
Isolated 100W 12 V 8.3 A
BM3G007MUV-EVK Evaluation Board

BM3G007MUV-EVK-001

General Description

This evaluation board outputs an isolated voltage of 12 V from an input of 90 Vac to 264 Vac,
and the maximum output current is 8.3 A.
It was developed mainly as a power supply for adapters. The average efficiency is 90.7% when VIN = 230V.
The BM3G007MUV is GaN HEMT (650 V 70 mΩ), with integrated driver and protection circuitry.
QR controllers for AC/DC power supplies use BM1Q021FJ.

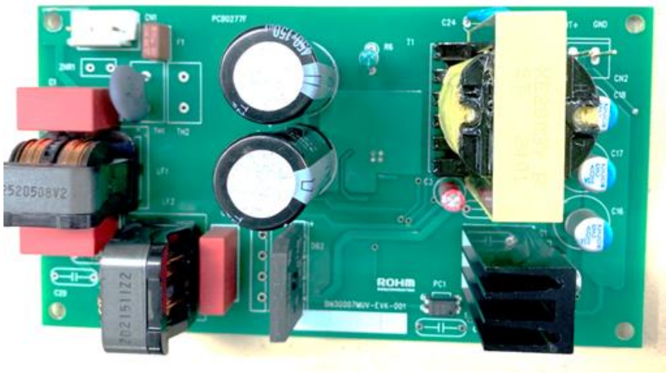


Figure 1. BM3G007MUV-EVK-001

Performance Specification

Electrical characteristic

Not guarantee the characteristics is representative value.

Unless otherwise specified V_{IN} = 230 Vac, I_{OUT} = 8.3 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	-	8.3	A	
Maximum Output Power (Note 1)	P_{OUT}			100	W	
Standby Input Power	P_{INSTBY}	-	95	-	mW	I_{OUT} = 0 A V_{IN} = 230V
Power supply efficiency	η	86	90.9	-	%	
Output Ripple Voltage (Note 2)	V_{ripple}	-	0.18	0.24	Vpp	
Opareting Temperature		-10	+25	+60	℃	

(Note 1) Adjust the operating time so that surface temperature of no component exceeds105 ° C

(Note 2) Do not consider spike noise

Derating

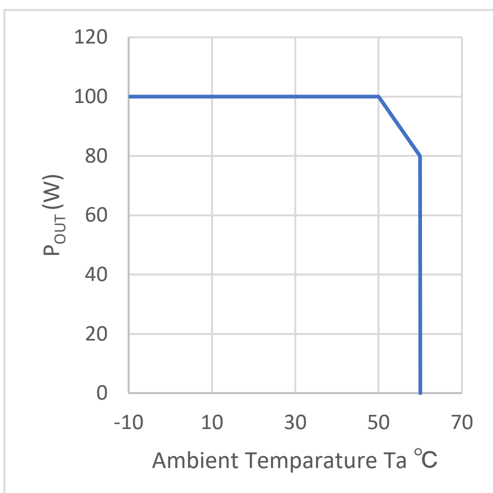


Figure 2. Temperature derating curve

Operation Procedure

1 Necessary Equipment

(1) AC power supply (90 Vac to 264 Vac, 200 W or more)

(2) Load equipment (10 A at maximum value)

(3) DC voltmeter

2 Connect to Each Equipment

(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 each output to disable the load.

(3) Connect the N terminal of the power supply to the CN1-1: AC (N) terminal and the L terminal to the CN1-2: AC (L) terminal with a pair of wires.

(4) Connect load to VOUT terminal from the positive terminal and to GND terminal 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 terminal of the DC voltmeter to VOUT terminal and the negative terminal to GND terminal 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 V).

(9) Electronic load switch is ON.

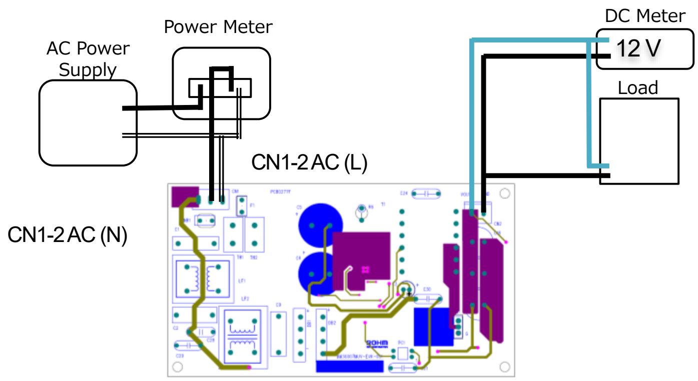


Figure 3. Diagram of How to Connect

Application Circuit

This evaluation board operates in Quasi-Resonant method.
The output (12 V) voltage is monitored by a feedback circuit and feed back to the FB pin of BM1Q021FJ through a opto - coupler.
At startup, the voltage at the VCC pin rises as the voltage is supplied from the VH 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 BM1Q021FJ starts operating.
After start of switching, the startup circuit is turned off and it cut the supply from the VH pin, in order to have low power consumption for instance in standby mode.

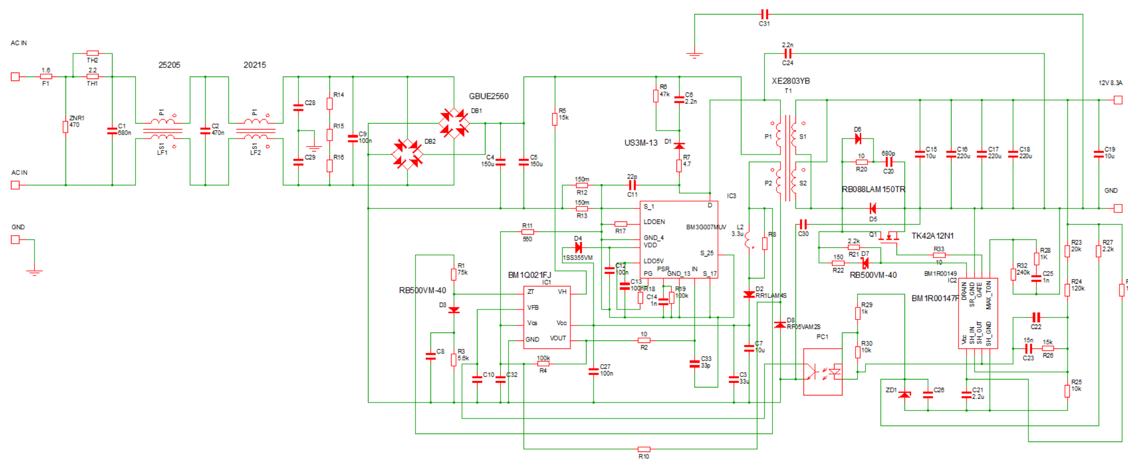


Figure 4. Application Circuit

BM3G007MUV Overview

Features

- Wide Operating Range for VDD Pin Voltage
- Wide Operating Range for IN Pin Voltage
- Low VDD Quiescent and Operating Current
- High dv/dt Immunity
- Adjustable Gate Drive Strength
- Power Good Signal Output
- VDD UVLO Protection
- Thermal Shutdown Protection

Pin Configuration

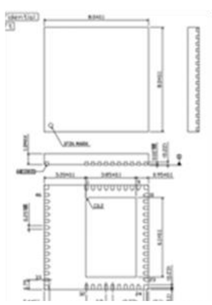
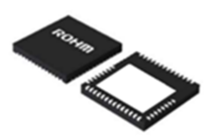


Figure 5. Pin Configuration

Key Specifications

- Operating Power Supply Voltage Range
  - VDD pin: 6.25 V to 30 V
  - D pin: 650 V(Max)
  - IN pin: -0.6 V to +30 V
- Allowable Input Switching Frequency:2 MHz (Max)
- Circuit Current 0.58 mA (Typ.)
- Turn-on Delay Time: 12 ns (Typ)
- Turn-off Delay Time: 15 ns (Typ)
- Operating Temperature Range -40 °C to +105 °C
- GaN HEMT D-S ON State Resistance: 70 mΩ (Typ)

Package	**W (Typ) x D (Typ) x H (Max)**
VQ46TV80AW	8.0 mm x 8.0 mm x 1.0 mm
	Pitch: 0.5 mm (Typ)



Pin Descriptions

Table1.BM3G007MUV Pin Configuration

Pin No.	Pin Name	I/O	Function
1,2,17-22,24-32,EXP	S	O	GaN HEMT SOURCE pin
3	LDOEN	I	LDO function enable/disable pin
4,13	GND	O	GND pin
5,7,9,10,14,16,23,24	N.C	-	Non-connection
6	VDD	I	Power supply input pin
8	LDO5V	O	5 V LDO output pin
11	PG	O	Power good signal output pin
12	RSR	I	Gate drive strength adjustment pin
15	IN	I	Non-inverting gate drive input
33-46	D	I	GaN HEMT DRAIN pin
	C.S	-	Corner pin
	C.N.C	-	Cornaer pin, non-connection

Measurement Data

1. Load Regulation

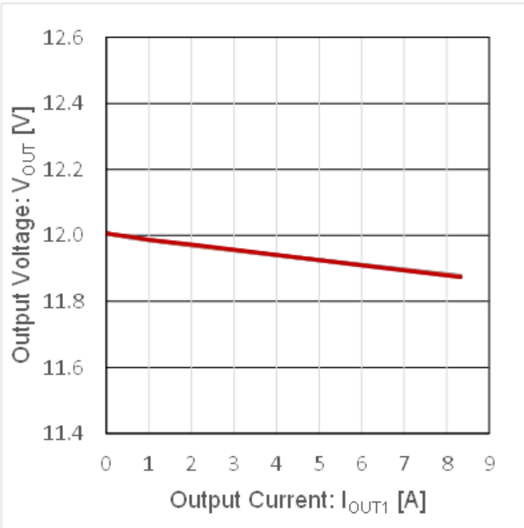


Figure 6. Load Regulation (V_{OUT} vs I_{OUT})

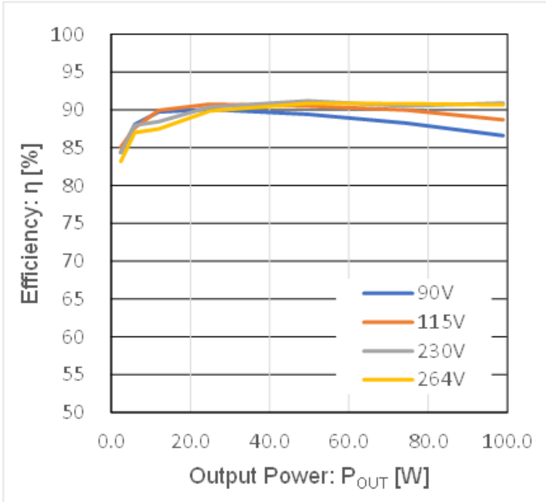


Figure 7. Efficiency vs P_{OUT}

2. Line Regulation

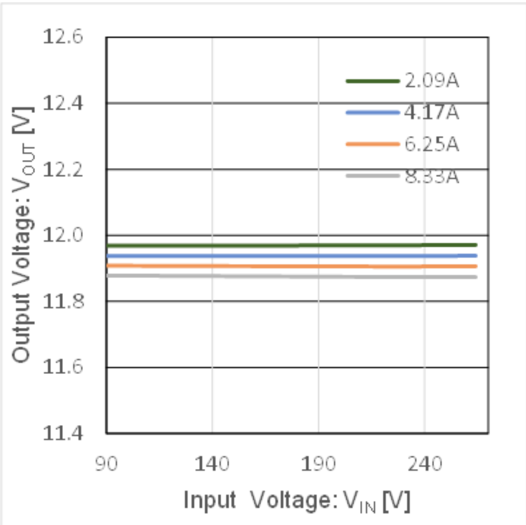


Figure 8. Line Regulation (V_{OUT} vs V_{IN})

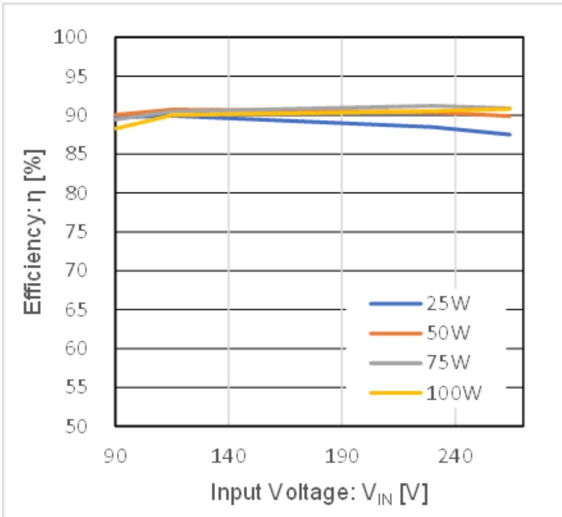


Figure 9. Efficiency vs Input Voltage

Measurement Data – continued

3 Switching Frequency

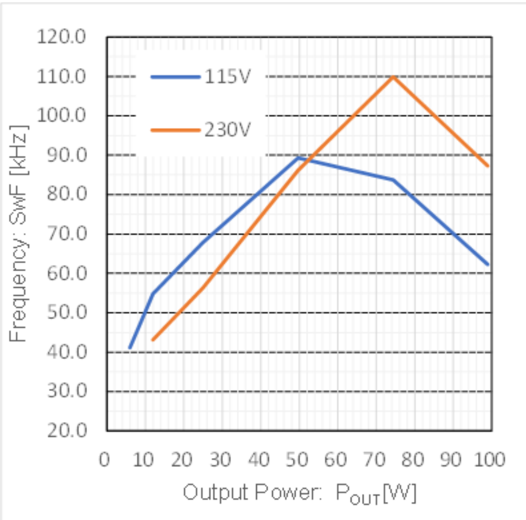


Figure 10. Switching Frequency vs P_{OUT}

4 Switching Wave Form

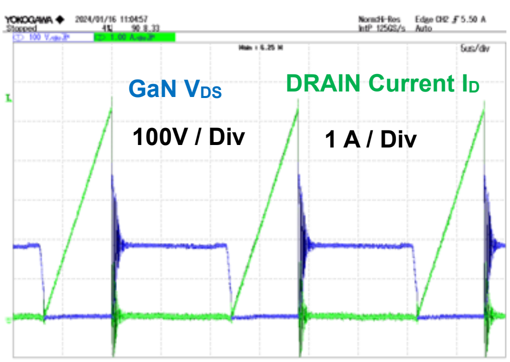


Figure 11. GaN Wave Form V_{IN} = 90 Vac, I_{OUT}=8.3 A

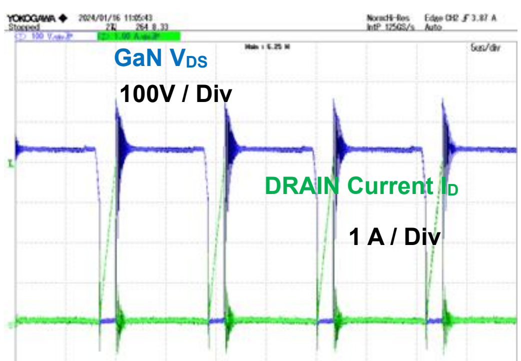


Figure 12. GaN Wave Form V_{IN} = 264 Vac, I_{OUT}=8.3 A

Measurement Data - continued

4 Switching Wave Form

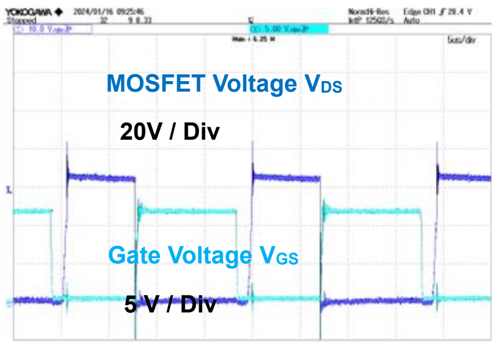


Figure 13. MOSFET Wave Form V_{IN} = 90 Vac,I_{OUT}=8.3 A

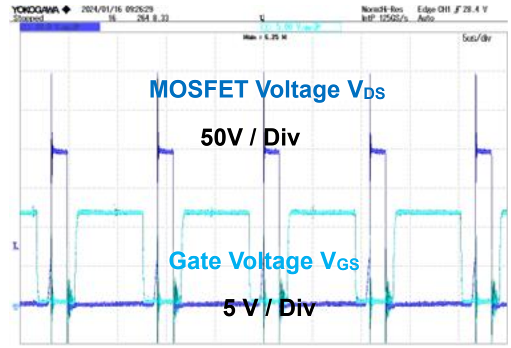


Figure 14. MOSFET Wave Form V_{IN} = 264 Vac,I_{OUT}=8.3 A

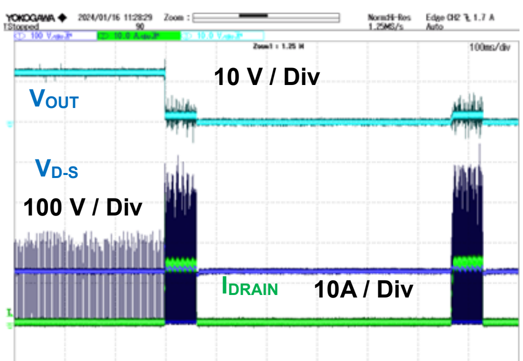


Figure 15. Drain Wave Form V_{IN}=90 Vac V_{OUT} Shorted

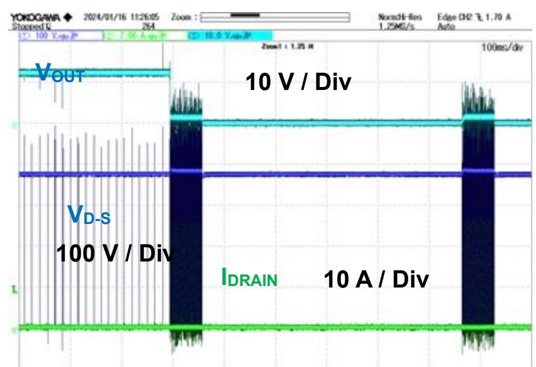


Figure 16. Drain Wave Form V_{IN}=264 Vac V_{OUT} Shorted

Measurement Data - continued

5 Startup Wave Form

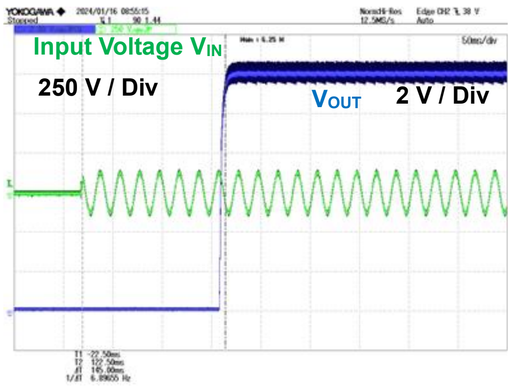


Figure 17. V_{IN} = 90 Vac, I_{OUT} = 8.3 A

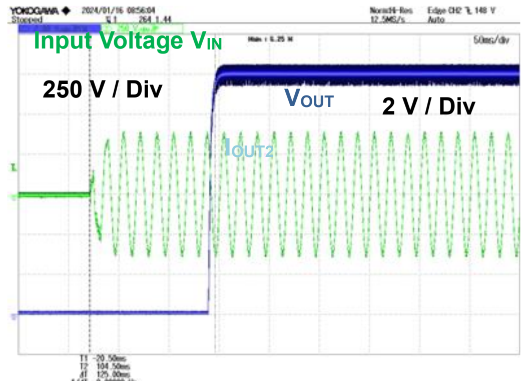


Figure 18. V_{IN} = 264 Vac, I_{OUT} =8.3 A

6 Dynamic Load Fluctuation

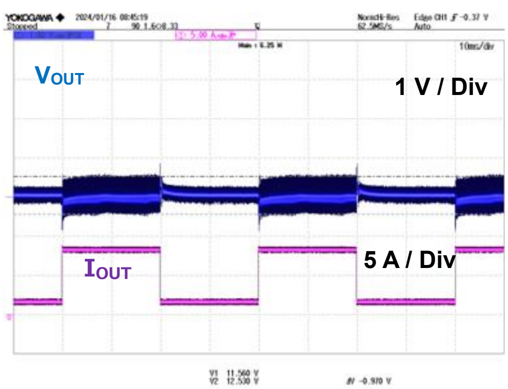


Figure 19. V_{IN} = 90 Vac, I_{OUT} = switch 1.6 A / 8.3 A

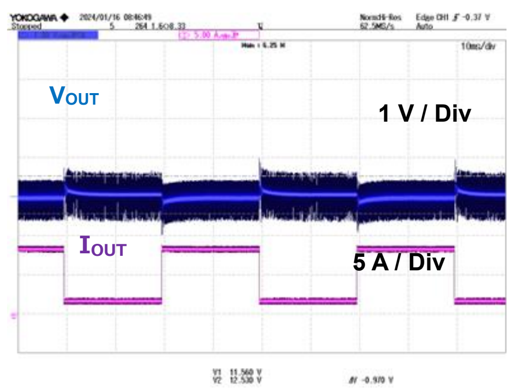


Figure 20. V_{IN} = 264 Vac, I_{OUT} = switch 1.6 A / 8.3 A

Measurement Data - continued

7 Output Voltage Ripple Wave Form

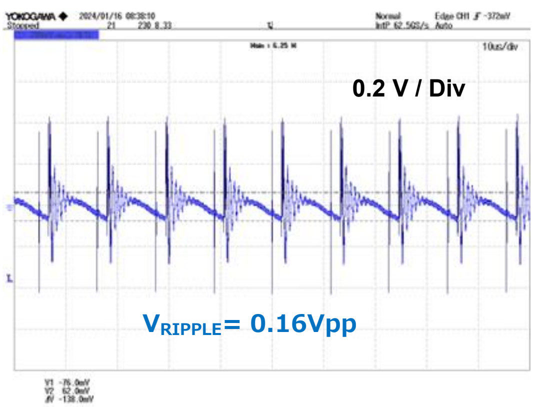


Figure 21. V_{IN} = 90 Vac, I_{OUT}=8.3 A

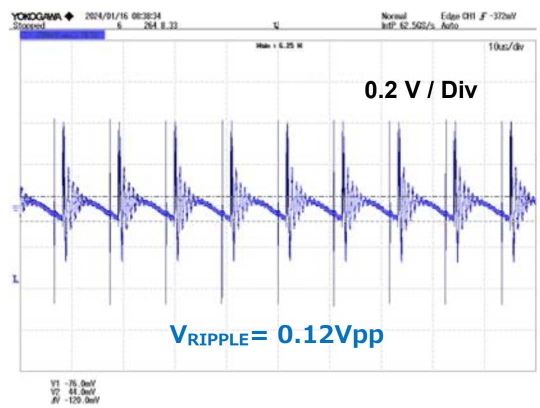


Figure 22. V_{IN} = 264 Vac, I_{OUT} = 8.3 A

8 Temperature of Parts Surface

They are measured after 20 minutes from applying a power supply.

Table 2. Surface Temperature of Parts (Ta = 24.8 °C)

VIN(V)	IOUT (A)	IC1 (℃)	DA1 (℃)
90	8.3	60.7	69.9
264	8.3	57.2	58.5

Measurement Data – continued

9 EMI

9.1 Noise Pin Voltage

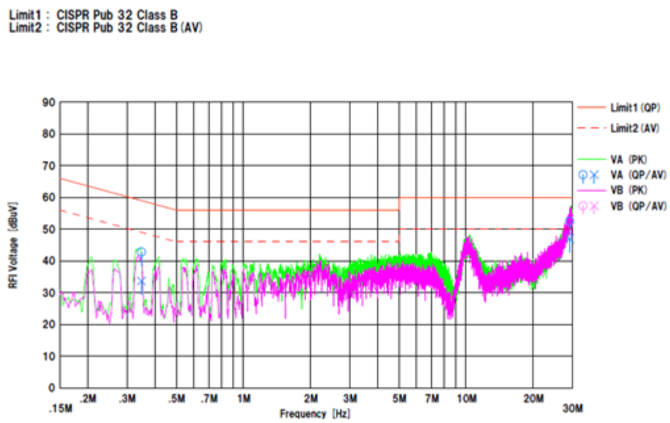


Figure 23. V_{IN}: 115 Vac / 60 Hz, I_{OUT}: 8.3 A

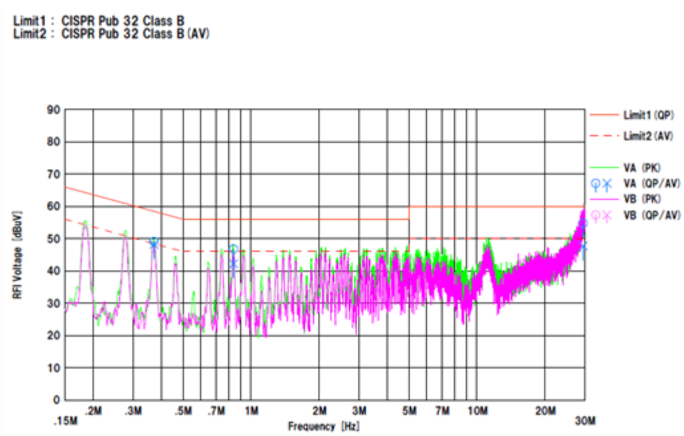


Figure 24. V_{IN}: 230 Vac / 50 Hz, I_{OUT}: 8.3 A

Schematics

V_{IN} = 90 Vac～264 Vac、V_{OUT} = 12 V 8.3 A

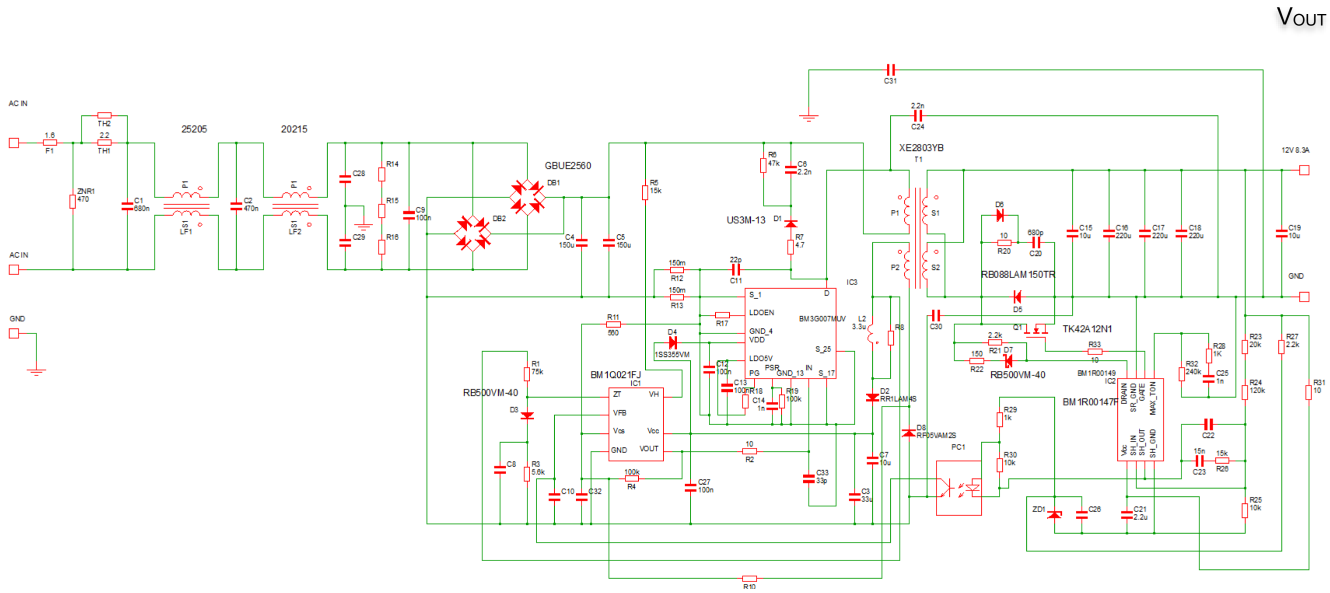


Figure 25. BM3G007MUV-EVK-001 Schematics

Parts List

Table 3. BoM of BM3G007MUV-EVK-001

Item	Specification	Parts Name	Manufacurer
C1	680 nF, 310 Vac	890334025045	WURTH ELECTRONIK
C2	470 nF, 310 Vac	890334025039CS	WURTH ELECTRONIK
C3	33μF,50V	860020672012	WURTH ELECTRONIK
C4,C5	150 μF, 450 V	450QXW150MEFR18×40	Rubycon
C6	2200 pF, 500 V	885342208007	WURTH ELECTRONIK
C7	10 μF, 35 V	GMK316AB7106ML-TR	TAIYO YUDEN
C9	100 nF, 310 Vac	890334025017CS	WURTH ELECTRONIK
C11	22pF,1kV	885342008008	WURTH ELECTRONIK
C12,C13,C27	0.1 μF,50 V	GRM188R72A104KA35D	MURATA
C14,C25	1000pF,50V	885012206083	WURTH ELECTRONIK
C15,C19	10 μF, 50 V	GRM319R6YA106KA12D	MURATA
C16,C17,C18	220 uF,25 V	APSG250ELL221MHB5S	CHEMI-CON
C20	680pF/250V	GRM31B5C2J681FW01	MURATA
C21	2.2 uF / 25V	UMK316B7225KL-T	TAIYO YUDEN
C23	15nF,50V	885012206090	WURTH ELECTRONIK
C24	2200 pF, Y1:300 Vac	DE1E3RA222MA4BP01F	MURATA
C33	33pF	GRM1885C1H330JA01J	MURATA
C8,C10,C22,C26,C28,C29,C30,C31	-	Non-Maunted	
CN1	3pin	B03P-NV(LF)(SN)	JST
CN2		CD-10-15	MAC8
D1	FRD,3 A, 1k V	US3M-13	Diodes
D2	1 A,400 V	RR1LAM4S	ROHM
D3,D7	SBD,0.1A/40V	RB500VM-40	ROHM
D4	0.1 A, 90 V	1SS355VM	ROHM
D5	SBD,5 A/150 V	RB088LAM150TR	ROHM
D8	0	MCR10EZPJ000	ROHM
DB1	600 V	GBUE2560	VISHAY
F1	310 Vac, 1.6 A	36911600000	LITTLE
L2	3.3μH 0.44A	CB2518T3R3M	TAIYO YUDEN
LF1	20.5 mH/ 2.5 A	SSRH24NV-25205	TOKIN
LF2	21.5 mH/ 2.0 A	SSRH24NVS-20215	TOKIN
HEAT1	14 ℃/W	E2A-T220-38E	OHMITE
IC1	QR	BM1Q021FJ	ROHM
IC2	SR	BM1R00147F	ROHM
IC3	Gan	BM3G007MUV	ROHM
Q1	9.4mΩ / 120V	TK42A12N1	Toshiba
R1	75 kΩ	MCR03EZPJ753	ROHM
R2	10 Ω	MCR03EZPJ100	ROHM
R3	5.6 kΩ	MCR03EZPJ562	ROHM
R4	100 kΩ	MCR03EZPJ104	ROHM
R5	15 kΩ	MCR18EZPJ153	ROHM
R6	47 kΩ / 2W	ERG2SJ473	Panasonic
R7	4.7 Ω	ESR18EZPJ4R7	ROHM
R8,R10,R17	-	Non-Maunted	
R11	560 Ω	ESR18EZPJ561	ROHM
R12,R13	150 mΩ	LTR50UZPFLR150	ROHM
R18,R28,R29	1 kΩ	MCR03EZPJ102	ROHM
R19	100 kΩ	MCR03EZPJ104	ROHM
R20	10	RK73H2ETTD10R0F	KOA
R21	2.2k	MCR03EZPJ222	ROHM
R22	150	MCR03EZPJ151	ROHM
R23	20 k	MCR03EZPF2002	ROHM
R24	120 k	MCR03EZPF1203	ROHM
R25	10 kΩ	MCR03PZFX1002	ROHM
R26	15k	MCR03EZPJ153	ROHM
R27	2.2 k	MCR03EZPFX2201	ROHM
R30	10k	MCR03EZPJ103	ROHM
R31	10	ESR18EZPJ100	ROHM
R32	240k	MCR03EZPFX2403	ROHM
R33	10	MCR10EZPJ100	ROHM
TH1	2 Ω, 4 A	2D2-13LD	SEMITEC
ZD1	-	Non-Maunted	-
PC1		LVT-817	
T1		XE2803Y B	Alpha trans
PCB		PCB0277F	

Materials may be changed without notifying.

Layout

Size: 144 mm x 80 mm

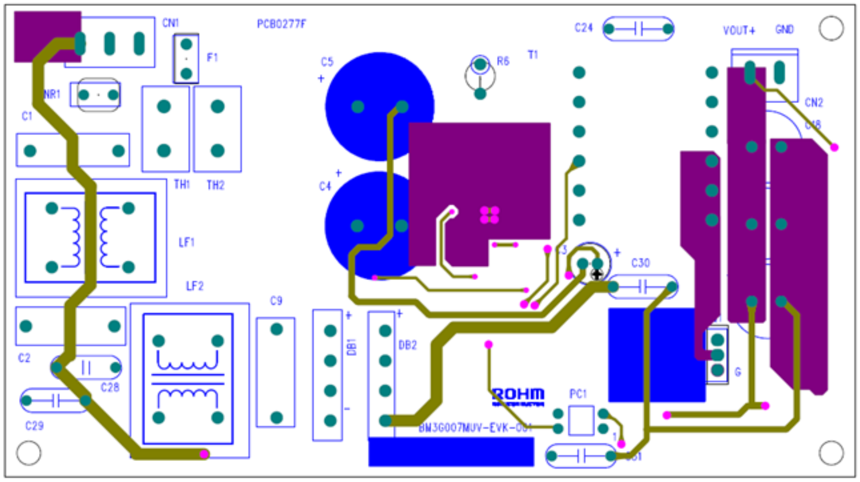


Figure 26. TOP Silkscreen (Top view)

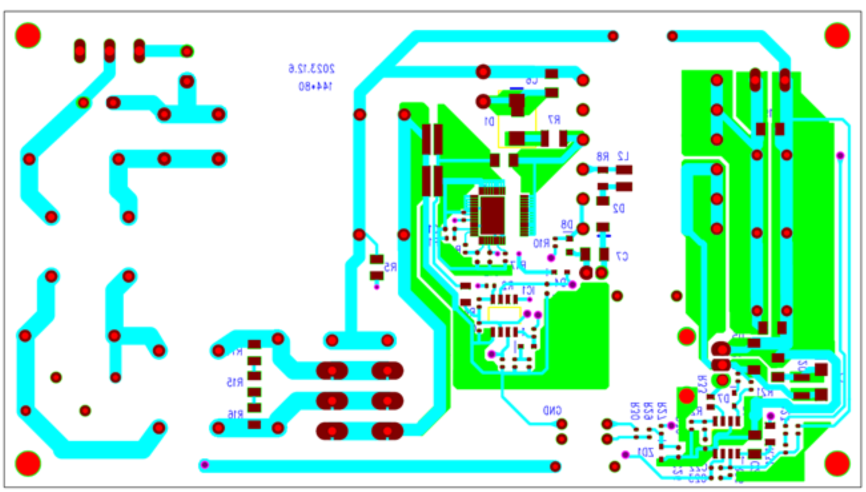


Figure 27. Bottom Layout (Top View)

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: XE2803Y_B

Bobbin: 12PIN

Core: EER35/41

- Primary Inductance: 0.152mH± 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（DC500V)

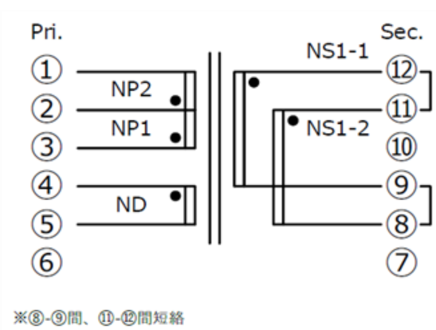


Figure 28. Circuit Diagram

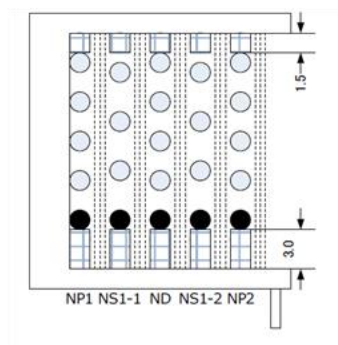


Figure 29. Structure Diagram

Table 4. Product Specification of XE2803Y_B

No.	Transformer	Winding Pin		Wire	Turn Number	Tape Layer	Wire Specification
		Start	Finish				
1	NP1	3	2	2UEW / Φ0.20 x 10	11	1	COMPACT
2	NS1	12	9	2UEW / Φ0.20 x 40	4	1	COMPACT
3	ND	4	5	2UEW / Φ0.20 x 10	6	1	COMPACT
4	NS1	11	8	2UEW / Φ0.20 x 40	4	1	COMPACT
5	NP2	2	1	2UEW / Φ0.20 x 10	11	2	COMPACT

Revision History

Date	Rev.	Changes
17.October.2024	001	New Release

Notice

1) The information contained in this document is intended to introduce ROHM Group (hereafter referred to asROHM) products. When using ROHM products, please verify the latest specifications or datasheets before use.

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