AC/DC Converter
Non-Isolation Buck Converter PWM method
2.6 W 13 V
BM2P139TF Reference Board

User's Guide

Downloaded from Arrow.com.

＜High Voltage Safety Precautions＞

◇ Read all safety precautions before use

Please note that this document covers only the BM2P139TF evaluation board (BM2P139TF-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.

© 2018 ROHM Co., Ltd. All rights reserved.

Downloaded from Arrow.com.

AC/DC Converter
Non-Isolation Buck Converter PWM method Output 2.6 W 13 V

BM2P139TF Reference Board

BM2P139TF-EVK-001

The BM2P139TF-EVK-001 evaluation board outputs 13 V voltage from the input of 90 Vac to 264 Vac. The output current supplies up to 0.2 A. BM2P139TF which is PWM method DC/DC converter IC built-in 650 V MOSFET is used.
The BM2P139TF contributes to low power consumption by built-in a 650 V starting circuit. Built-in current detection resistor realizes compact power supply design.
Current mode control imposes current limitation on every cycle, providing superior performance in bandwidth and transient response. The switching frequency is 100 kHz in fixed mode. At light load, frequency is reduced and high efficiency is realized. Built-in frequency hopping function contributes to low EMI. Low on-resistance 9.5 Ω 650 V MOSFET built-in contributes to low power consumption and easy design.



Figure 1. BM2P139TF-EVK-001

Electronics Characteristics

Not guarantee the characteristics, is representative value.

Unless otherwise noted :V_{IN} = 230 Vac, I_{OUT} = 150 mA, Ta:25 ℃

Parameter	Min	Typ	Max	Units	Conditions
Input Voltage Range	90	230	264	Vac	
Input Frequency	47	50/60	63	Hz	
Output Voltage	11.7	13.0	14.3	V	
Maximum Output Power	-	-	2.6	W	I_{OUT} = 200 mA
Output Current Range (NOTE1)	2	150	200	mA	
Stand-by Power	-	33	-	mW	I_{OUT} = 0 A
Efficiency	-	79.1	-	%	
Output Ripple Voltage (NOTE2)	-	34	-	mVpp	
Operating Temperature Range	-10	+25	+65	℃	

(NOTE1) Please adjust operating time, within any parts surface temperature under 105 ℃

(NOTE2) Not include spike noise

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Operation Procedure

1. Operation Equipment

(1) AC Power supply 90 Vac～264 Vac, over 10W

(2) Electronic Load capacity 0.20 A

(3) Multi meter

2. Connect method

(1) AC power supply presetting range 90~264 Vac, Output switch is off.

(2) Load setting under 0.20 A. Load switch is off.

(3) AC power supply N terminal connect to the board AC (N) of CN1, and L terminal connect to AC(L).

(4) Load + terminal connect to VOUT, GND terminal connect to GND terminal

(5) AC power meter connect between AC power supply and board.

(6) Output test equipment connects to output terminal

(7) AC power supply switch ON.

(8) Check that output voltage is 13 V.

(9) Electronic load switch ON

(10) Check output voltage drop by load connect wire resistance



CN1: from the top AC (L), AC (N)

Figure 2. Connection Circuit

Deleting

Maximum Output Power Po of this reference board is 2.6 W. The derating curve is shown on the right. If ambient temperature is over 40 ℃, Please adjust load continuous time by o ver 105 ℃ of any parts surface temperature.

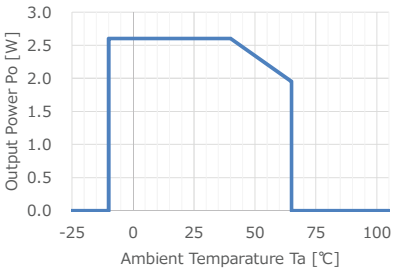


Figure 3. Temperature Deleting curve

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Application Circuit

V_{IN} = 90 ~ 264 Vac, V_{OUT} = 13 V

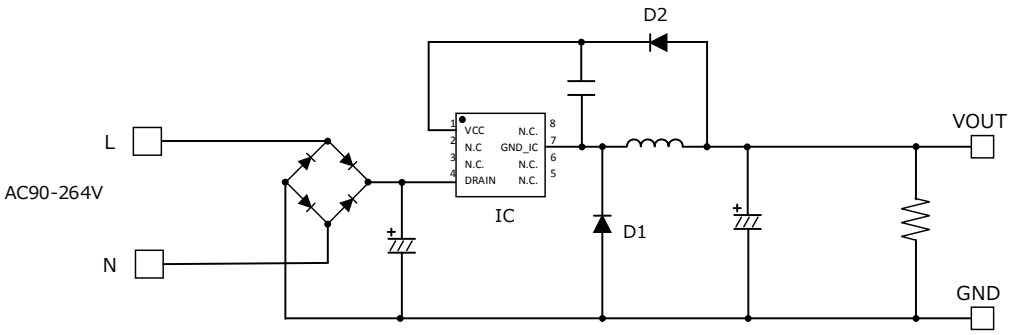


Figure 4. BM2P129TF-EVK-001 Application Circuit

The BM2P139TF is non-insulation method without opto-coupler and feeds back the VCC voltage to 13.0 V typ. This VCC voltage is the voltage between the VCC pin and the GND_IC pin.
The output voltage VOUT is defined by the following equation.

$$\mathrm{VOUT} = V_{CNT} + V_{FD2} - V_{FD1}$$

V_{CNT}: VCC Control Voltage
V_{FD1}: Forward Voltage of diode D1
V_{FD2}: Forward Voltage of diode D2

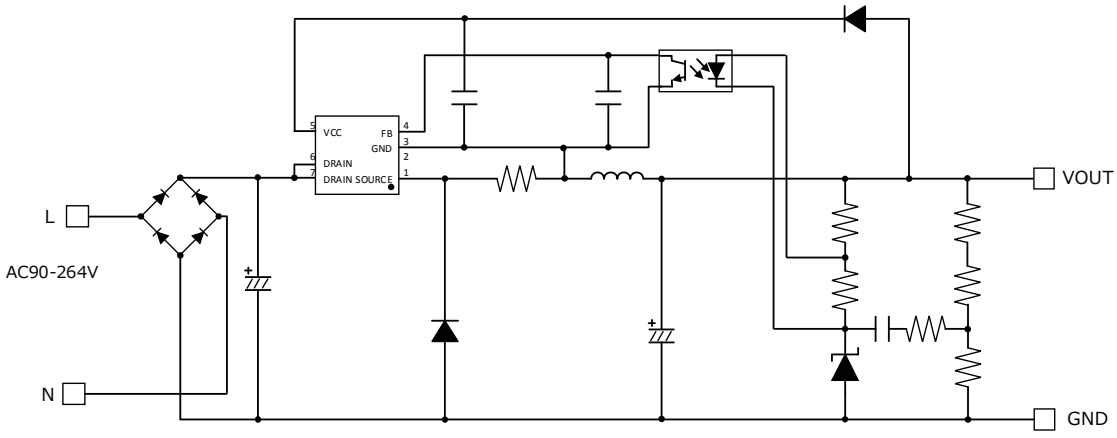


Figure 5. General Buck converter application circuit

Compared to the general Buck converter as shown above, the number of parts is reduced because the feedback circuit is not required. However, the output voltage may rise at light load because the VCC voltage and the output voltage that are fed back are different. In that case, please put a resistance on the output terminal and lower the output voltage.

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

BM2P139TF Overview

Feature

- PWM Frequency =100kHz
- PWM current mode method
- Frequency hopping function
- Burst operation at light load
- Built-in 650 start circuit
- Built-in 650V switching MOSFET
- VCC pin under voltage protection
- VCC pin over voltage protection
- Over current limiter function per cycle
- Soft start function

Key specifications

- Power Supply Voltage Operation Range:
  VCC: 10.60 V to 14.05 V
  DRAIN: to 650 V
- Normal Operation Current: 0.85 mA(Typ)
- Burst Operation Current: 0.45 mA(Typ)
- Oscillation Frequency: 100 kHz(Typ)
- Operation Temperature Range: -40 ℃ ~ +105 ℃
- MOSFET Ron: 9.5 Ω (Typ.)

Application

LED lights, air conditioners, and cleaners, (etc.).

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

SOP-J8 5.00 mm x 6.20 mm x 1.71 mm
Pitch 1.27 mm



Figure 6. SOP8 Package

(*) Product structure：Silicon monolithic integrated circuit This product has no designed protection against radioactive rays
(*) Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.

Table 1. BM2P139TF Pin description

No.	Name	I/O	Function	ESD Diode	
				VCC	GND
1	VCC	I	Power Supply input pin	-	✓
2	-	-	-	-	-
3	-	-	-	-	-
4	DRAIN	I/O	MOSFET DRAIN pin	-	✓
5	-	-	-	-	-
6	-.	-	-	-	-
7	GND_IC	I/O	GND pin	✓	-
8	-.	-	-	-	–

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Design Overview

1 Important Parameter

- V_{IN} : Input Voltage Range AC 90 V ~ 264 Vac (DC 100 V ~ 380 V)
- V_{OUT} : Output Voltage DC 13 V
- I_{OUT}(Typ) : Constant Output Current 0.15 A
- I_{OUT}(Max) : Max Output Current 0.20 A
- f_{SW} : Switching Frequency Min:94 kHz, Typ:100 kHz, Max:106 kHz
- Ipeak(Min) : Over Current Limit Min:0.395 A, Typ:0.450 A, Max:0.505A

2 Coil Selection

2.1 Determining coil inductance

The switching operation mode determines the L value so that it becomes as discontinuous mode (DCM) as possible. In the continuous mode (CCM), reverse current in trr of the diode flows, which leads to an increase in power loss of diode. Furthermore, this reverse current becomes the peak current when the MOSFET is ON, and the power loss of the MOSFET also increases. The constant load current I_{OUT} (Typ): 0.15 A, the peak current I_L flowing through the inductor is:

$$I_P(BCM) = I_{OUT}(Typ) \times 2 = 0.3 \quad [A]$$

It tends to be in continuous mode (CCM) when the input voltage drops. Calculate with input voltage minimum voltage 100 Vdc. From the output voltage V_{OUT}: 13 V and the diode V_F: 1 V, Calculate the maximum value of Duty: Duty (Max).

$$\mathrm{Duty}(max) = \frac{V_{OUT} + VF}{V_{IN}(Min)}$$

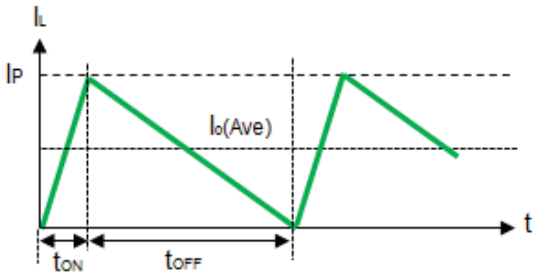


Figure 7. Coil current waveform in BCM

From the minimum switching frequency f_{SW} (Min) = 94 kHz, Calculate on time ton (Max)

$$\mathrm{ton}(Max) = \frac{Duty(Max)}{f_{SW}(Min)} = 1.49 \quad [\mu sec]$$

Calculate L value to operate in discontinuous mode.

$$\mathrm{L} < \mathrm{ton}(Max) \times \frac{V_{IN}(Min) - V_{OUT}}{I_P} = 431.9 \quad [\mu H]$$

Then, the L value is provisionally selected to be 330 µH in consideration of generality.

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

2.1 Determining coil inductance - Continued

Also, calculate L value so that the overcurrent detection becomes maximum load current I_{OUT}: 200 mA or more. Overcurrent detection is calculated by the current flowing through the MOSFET when operating in continuous mode at the minimum switching frequency f_{SW} (Min) = 94 kHz. When the current flowing through the MOSFET (≠ the coil current at switching ON) exceeds the minimum value Ipeak (Min): 0.395 A of the overcurrent detection current, the MOSFET is turned OFF. Since a delay of approximately tdly = 0.1 µsec occurs, in reality, the peak current exceeds the Ipeak value and the peak current becomes Ip. The peak current Ip is obtained by setting the current slope at switching ON to ΔI_L,

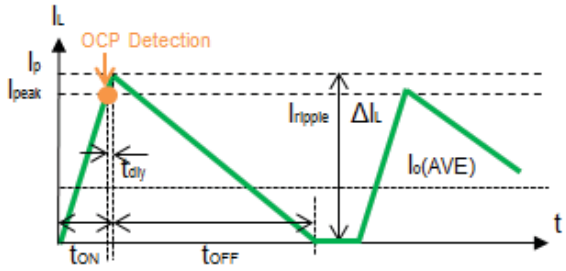


Figure 8. Coil waveform at overcurrent detection (DCM)

The peak current I_P at the time of over current detection is

$$I_P = I_{PEAK}(Min) + \Delta I_L \times tdly$$

$$I_P = I_{PEAK}(Min) + \frac{V_{IN}(Min) - V_{OUT}}{L} \times tdly = 421.4 \text{ [mA]}$$

Assuming the discontinuous mode (DCM), Switching ON time: ton, OFF time: toff are

$$t_{ON}(DCM) = \frac{I_P \times L}{V_{IN}(Min) - V_{OUT}} = 1.60 \text{ [µsec]}$$

$$t_{OFF}(DCM) = \frac{I_P \times L}{V_{OUT} + V_F} = 9.93 \text{ [µsec]}$$

$$t_{ON}(DCM) + t_{OFF}(DCM) = 11.53 \text{ [µsec]}$$

Since the total of ON time and OFF time is more than 10.64 µsec in switching cycle, it becomes continuous mode (CCM) when detecting over current. The current at the time of overcurrent detection in continuous mode (CCM): IOUT (LIM) is

$$I_{OUT}(LIM) = I_P - \frac{(V_{OUT} + V_F) \times (V_{IN}(Min) - V_{OUT})}{2 \times V_{IN}(Min) \times f_{SW} \times L} = 225.1 \text{ [mA]}$$

It is confirmed that the minimum over current detection current is 225.1 mA and the maximum load current is 200 mA or more.

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

2 Coil Selection - Continued

2.2 Inductor Current Calculation

Calculate the maximum peak current of the inductor. The condition where the peak current is maximized is when the input voltage is the maximum voltage VIN (Max): 380 V, the maximum load current Io (Max): 0.20 A, and the switching frequency is 106 kHz at the minimum. The peak current I_P of the coil is given by the following formula.

$$I_P = \sqrt{\frac{2\times I_O\times(V_{IN}(Max)-V_O)\times(V_O+V_F)}{F_{SW}(Max)\times L\times(V_{IN}+V_F)}} = 393 \text{ [mA]}$$

Select a coil with an rated current of 0.393 A or more.

In this EVK, we use inductance value: 330 µH, rated: 0.65 A product

Radial inductor (closed magnetic circuit type) Core Size Φ7.8 mm x 7.5 mm
Product: 744 731 331

Manufacture: Wurth Electronix

3 Diode Selection

3.1 Flywheel Diode: D1

Flywheel diode uses fast diode (fast recovery diode).The reverse voltage of the diode is V_{IN} (Max): 380 V when the output voltage at startup is 0 V. Consider the derating and select 600 V diode. The condition where the effective current of the diode is maximized is when the input voltage is the maximum voltage V_{IN} (Max): 380 V, the maximum load current Io (Max): 0.20 A, and the switching frequency is 94 kHz at the minimum.

$$Duty = \frac{V_{OUT}+V_F}{V_{IN}(Max)} = 3.7 \quad [\%]$$

The average current I_D of the diode is calculated from the peak current I_P: 0.393 A by the following formula

$$I_D(rms) = I_P \times \sqrt{\frac{1-Duty}{3}} = 0.222 \quad [A]$$

Select the rated current of 0.222 A or more.
In fact, we used RFN1LAM6S of 0.8 A / 600 V product as a result of mounting the board and considering the parts temperature.

3.2 VCC Rectifier Diode: D2

Rectifier diodes are used for diodes to supply VCC. The reverse voltage applied to the diode is V_{IN} (Max): 380 V. Consider the derating and select 600 V diode. Since the current flowing to the IC is small enough, we use the 0.2 A / 600 V RRE02VSM6S.

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Design Overview – Continued

4 Capacitor Selection

4.1 Input Capacitor: C1

The input capacitor is determined by input voltage V_I and output power P_{OUT}. As a guide, for an input voltage of 90 to 264 Vac, 2 x P_{OUT} [W] µF. For 176 to 264 Vac, set 1 x P_{OUT} [W] µF. Since the output power P_{OUT} = 2 W, 4.7 µF / 400 V is selected with a guidline of 5.2 µF.

4.2 VCC Capacitor: C3

The VCC capacitor C3 is required for stable operation of the device and stable feedback of the output voltage. A withstand voltage of 25 V or more is required, and 1.0 µF to 4.7 µF is recommended. 1 µF / 50 V is selected.

4.3 Output Capacitor: C2, C4

For the output capacitor, select output voltage V_O of 25 V or more in consideration of derating. For C2 electrolytic capacitors, capacitance, impedance and rated ripple current must be taken into consideration.

The output ripple voltage is a composite waveform generated by electrostatic capacity: C_{OUT}, impedance: ESR when the ripple component of inductor current: ΔI_L flows into the output capacitor and is expressed by the following formula.

$$\Delta Vripple = \Delta I_L \times \left(\frac{1}{8 \times Cout \times f_{sw}}\right) + ESR$$

The inductor ripple current is

$$\Delta I_L = 2 \times \{I_P - I_{OUT}(max)\} = 2 \times (0.393 - 0.200) = 0.386 \quad [A]$$

For this EVK, we use electrostatic capacity: 220 µF, ESR: 0.075 Ω, and the design value of output ripple voltage is less than 100 mV.

$$\Delta Vripple = \Delta I_L \times \left\{\left(\frac{1}{8 \times Cout \times f_{sw}}\right) + ESR\right\} = 0.386 \times \left\{\left(\frac{1}{8 \times 220\mu \times 100k}\right) + 0.075\right\} = 31.1 \quad [mV]$$

Next, check whether the ripple current of the capacitor satisfies the rated ripple current.

Inductor ripple current RMS conversion,

$$I_L[rms] = \Delta I_L \times \sqrt{\frac{1}{3}} = 0.223 \quad [A]$$

The ripple current of the capacitor is

$$I_C[rms] = \sqrt{{I_L}^2 - {I_{OUT}}^2} = \sqrt{0.223^2 - 0.200^2} = 0.099 \quad [A]$$

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

4.3 Output Capacitor C2, C4 - Continued

Select a rated current of 0.099 A or more.
The output capacitor C2 used a rated ripple current of 0.75 A at 220 µF / 25 V.
C8 has added a 0.1 µF ceramic capacitor to reduce switching noise.

5. Resistor Selection

5.1 Bleeder Resister: R1

Because it is indirectly fed back to the output voltage, the output voltage increases at light load. This board uses bleeder resistance for its improvement. Reducing the resistance value improves the rise in the output voltage of the light load, but increases the power loss. 10 kΩ / 0.1 W is used.

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Performance Data

Constant Load Regulation

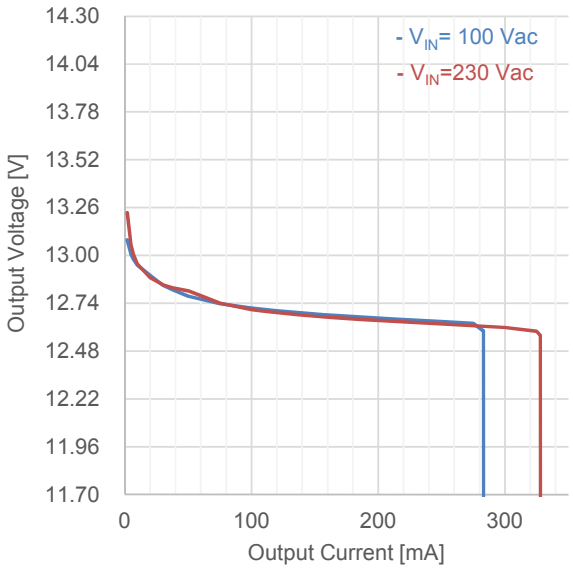


Figure 9. Load Regulation (I_{OUT} vs V_{OUT})

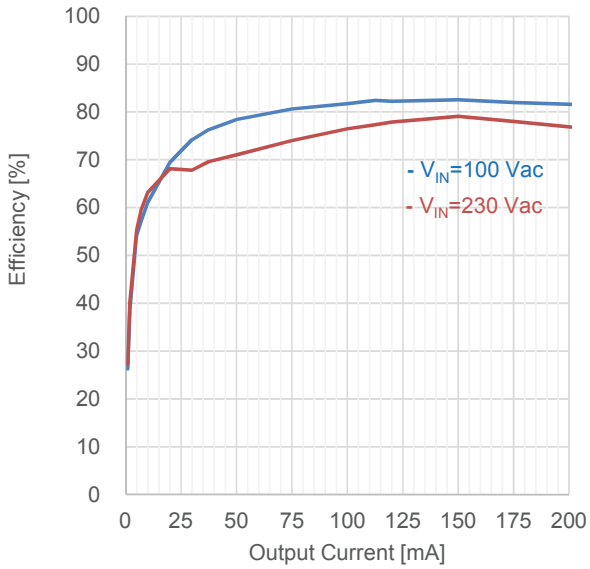


Figure 10. Load Regulation (I_{OUT} vs Efficiency)

Table 2. Load Regulation (V_{IN}=100 Vac)

I_{OUT}	V_{OUT}	Efficiency
50 mA	12.779 V	78.40 %
100 mA	12.713 V	81.70 %
150 mA	12.681 V	82.52 %
200 mA	12.659 V	81.59 %

Table 3. Load Regulation (V_{IN}=230 Vac)

I_{OUT}	V_{OUT}	Efficiency
50 mA	12.807 V	70.99 %
100 mA	12.705 V	76.44 %
150 mA	12.669 V	79.12 %
200 mA	12.647 V	76.86 %

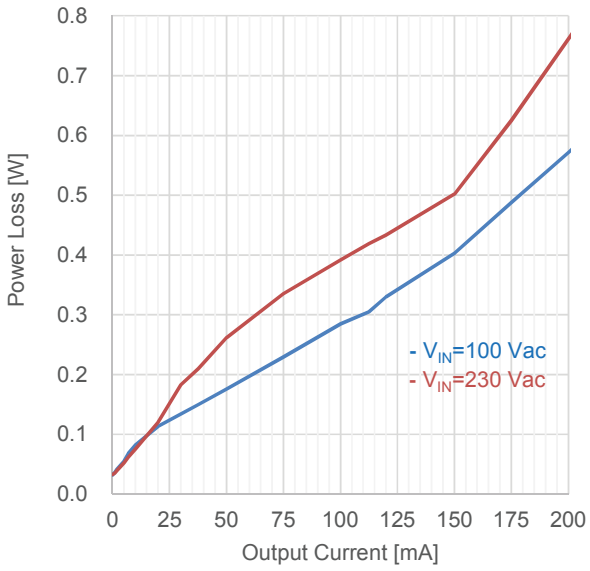


Figure 11. Load Regulation (I_{OUT} vs P_{LOSS})

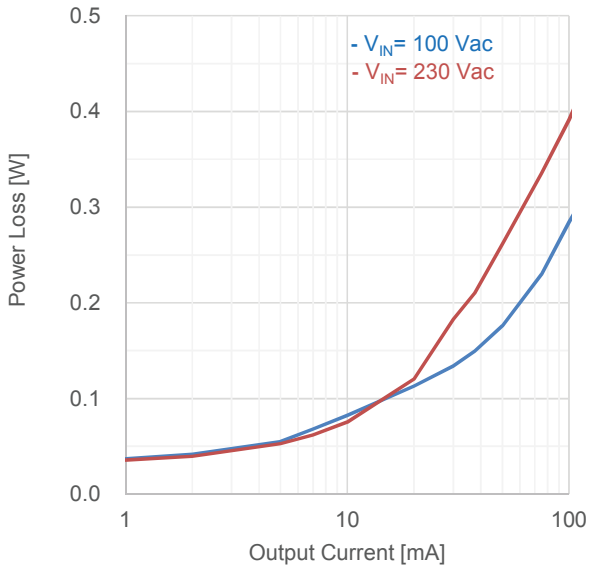


Figure 12. Load Regulation (I_{OUT} vs P_{LOSS})

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Performance Data - Continued

Table 4. Load Regulation : V_{IN}=100 Vac

V_{IN} [Vac]	P_{IN} [W]	V_{OUT} [V]	I_{OUT} [A]	P_{OUT} [W]	P_{LOSS} [W]	Efficiency [%]
100	0.032	13.242	0.0	0.000	0.032	0.00
100	0.050	13.137	1.0	0.013	0.037	26.27
100	0.068	13.084	2.0	0.026	0.042	38.48
100	0.120	13.006	5.0	0.065	0.055	54.19
100	0.159	12.976	7.0	0.091	0.068	57.13
100	0.212	12.947	10.0	0.129	0.083	61.07
100	0.371	12.892	20.0	0.258	0.113	69.50
100	0.519	12.840	30.0	0.385	0.134	74.22
100	0.630	12.813	37.5	0.480	0.150	76.27
100	0.815	12.779	50.0	0.639	0.176	78.40
100	1.185	12.738	75.0	0.955	0.230	80.62
100	1.556	12.713	100.0	1.271	0.285	81.70
100	1.734	12.704	112.5	1.429	0.305	82.42
100	1.854	12.699	120.0	1.524	0.330	82.19
100	2.305	12.681	150.0	1.902	0.403	82.52
100	2.705	12.670	175.0	2.217	0.488	81.97
100	3.103	12.659	200.0	2.532	0.571	81.59
100	3.425	12.651	220.0	2.783	0.642	81.26
100	3.912	12.640	250.0	3.160	0.752	80.78
100	4.330	12.631	275.0	3.474	0.856	80.22
100	4.460	12.590	283.0	3.563	0.897	79.89
100	0.050	0.000	284.0	0.000	0.050	0.00

Table 5. Load Regulation: V_{IN}=230 Vac

V_{IN} [Vac]	P_{IN} [W]	V_{OUT} [V]	I_{OUT} [A]	P_{OUT} [W]	P_{LOSS} [W]	Efficiency [%]
230	0.033	13.641	0.0	0.000	0.033	0.00
230	0.049	13.366	1.0	0.013	0.036	27.28
230	0.066	13.233	2.0	0.026	0.040	40.10
230	0.118	13.057	5.0	0.065	0.053	55.33
230	0.153	13.002	7.0	0.091	0.062	59.49
230	0.205	12.953	10.0	0.130	0.075	63.19
230	0.378	12.879	20.0	0.258	0.120	68.14
230	0.568	12.841	30.0	0.385	0.183	67.82
230	0.691	12.825	37.5	0.481	0.210	69.60
230	0.902	12.807	50.0	0.640	0.262	70.99
230	1.291	12.740	75.0	0.956	0.336	74.01
230	1.662	12.705	100.0	1.271	0.392	76.44
230	1.847	12.695	112.5	1.428	0.419	77.32
230	1.956	12.690	120.0	1.523	0.433	77.85
230	2.402	12.669	150.0	1.900	0.502	79.12
230	2.840	12.657	175.0	2.215	0.625	77.99
230	3.291	12.647	200.0	2.529	0.762	76.86
230	4.190	12.627	250.0	3.157	1.033	75.34
230	4.662	12.618	275.0	3.470	1.192	74.43
230	5.138	12.608	300.0	3.782	1.356	73.62
230	5.618	12.588	325.0	4.091	1.527	72.82
230	5.721	12.565	328.0	4.121	1.600	72.04
230	0.130	0.000	329.0	0.000	0.130	0.00

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Performance Data - Continued

Line Regulation

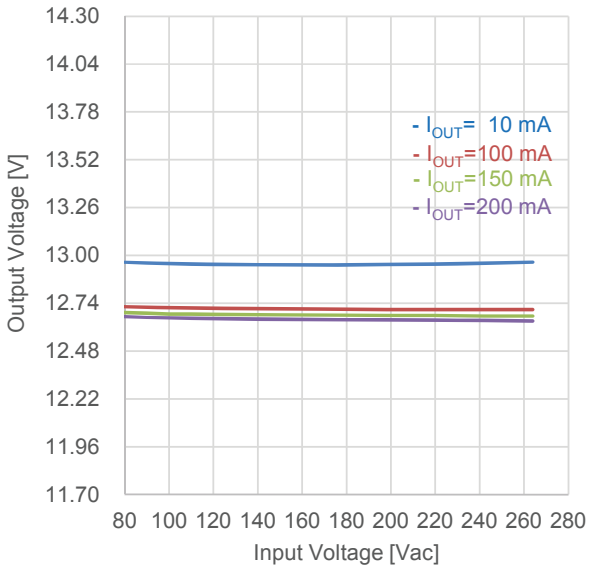


Figure 13. Line Regulation (V_{IN} vs V_{OUT})

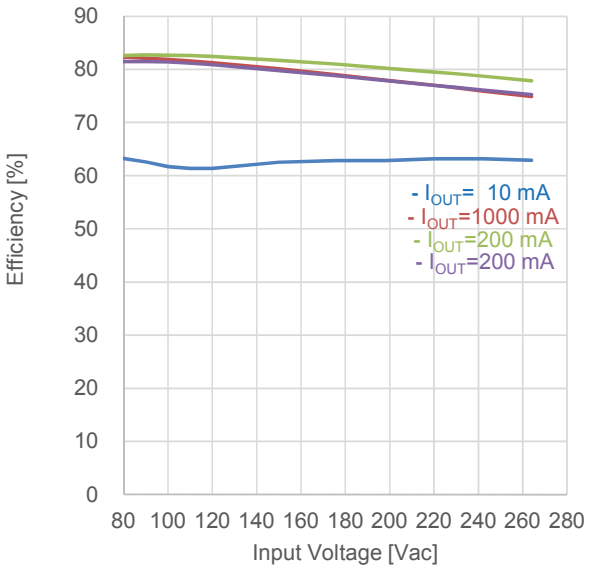


Figure 14. Line Regulation (V_{IN} vs Efficiency)

Switching Frequency

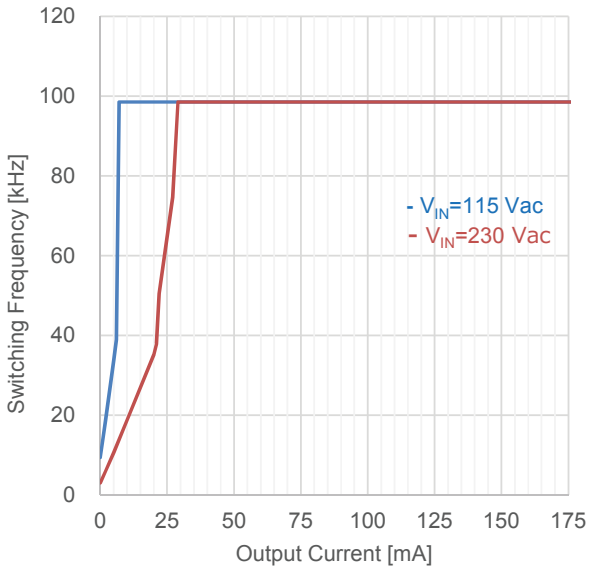


Figure 15. Switching Frequency (I_{OUT} vs f_{SW})

Coil Peak Current

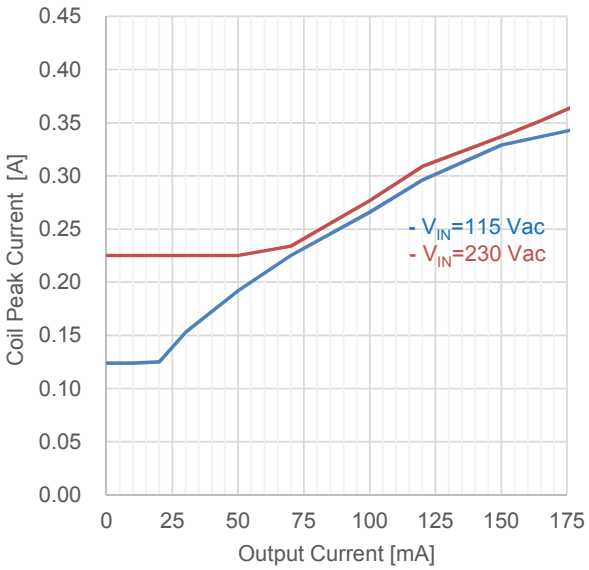


Figure 16. Coil Peak Current (I_{OUT} vs I_P)

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Performance Data - Continued

Output Ripple Voltage

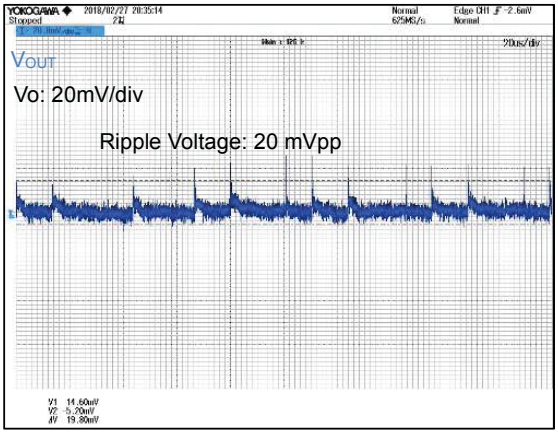


Figure 17. V_{IN} = 115 Vac, I_{OUT} = 10 mA

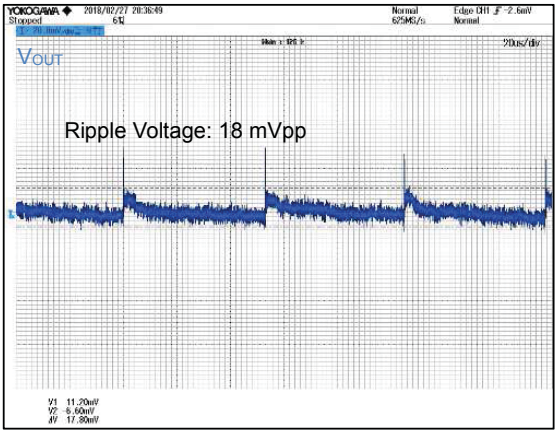


Figure 18. V_{IN} = 230 Vac, I_{OUT} = 10 mA

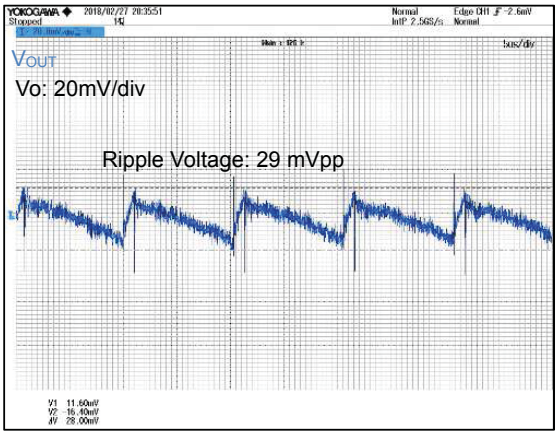


Figure 19. V_{IN} = 115 Vac, I_{OUT} = 0.15 A

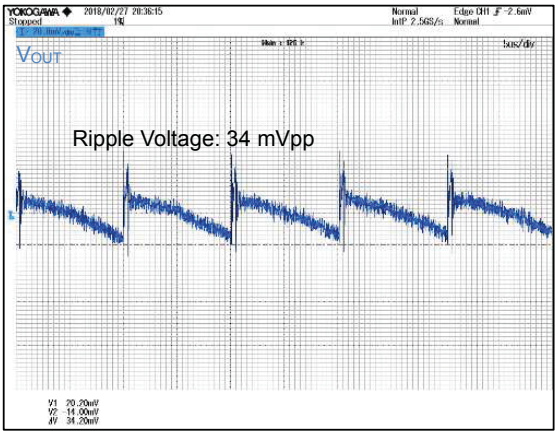


Figure 20. V_{IN} = 230 Vac, I_{OUT} = 0.15 A

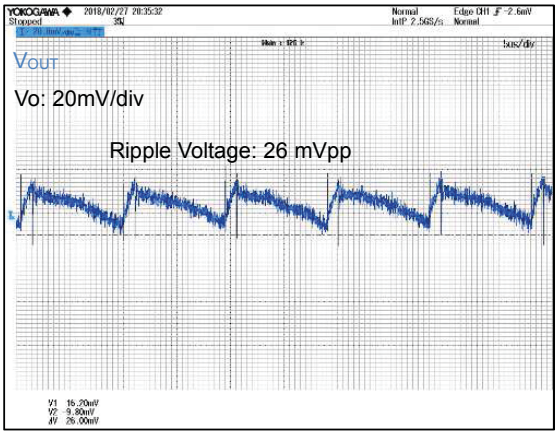


Figure 21. V_{IN} = 115 Vac, I_{OUT} = 0.20 A

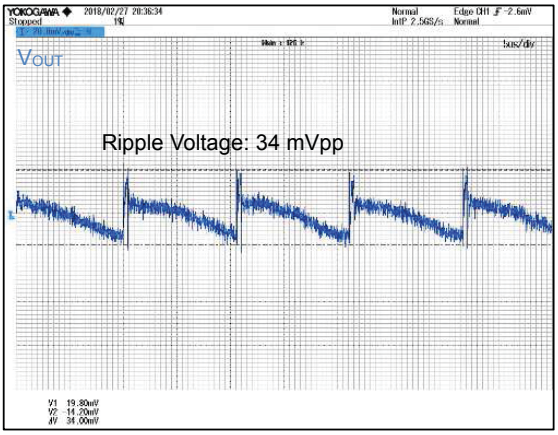


Figure 22. V_{IN} = 230 Vac, I_{OUT} = 0.20 A

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Performance Data – Continued

Parts surface temperature

Table 6. Parts surface temperature ※Ta = 25 ℃, measured 30 minutes after setup

Part	Condition			
	V_{IN}=90 Vac, I_{OUT}=0.15 A	V_{IN}=90 Vac, I_{OUT}=0.20 A	V_{IN}=264 Vac, I_{OUT}=0.15 A	V_{IN}=264 Vac, I_{OUT}=0.20 A
IC1	48.9 ℃	59.1 ℃	64.6 ℃	89.5 ℃
D1	51.8 ℃	57.0 ℃	58.4 ℃	69.4 ℃
L1	49.4 ℃	51.4 ℃	61.4 ℃	71.5 ℃

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Schematics

V_{IN} = 90 ~ 264 Vac, V_{OUT} = 13 V

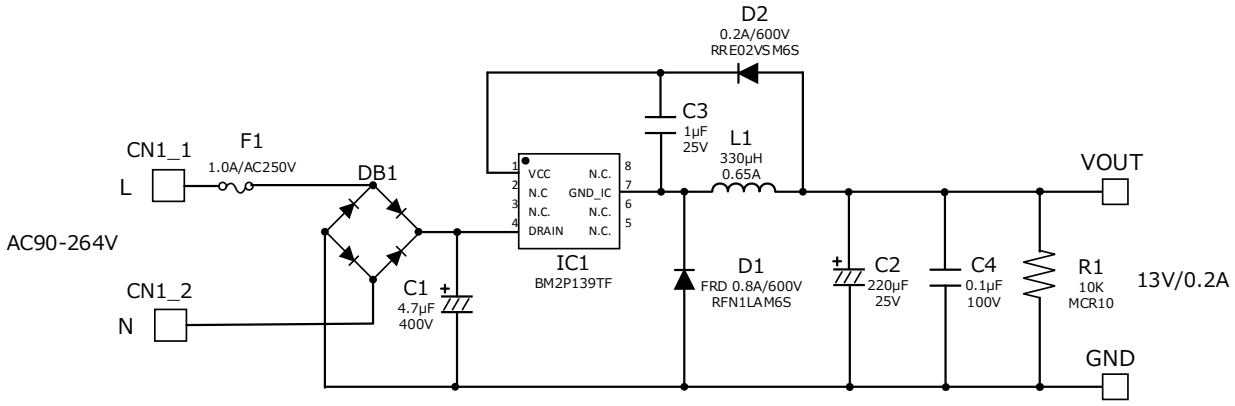


Figure 23. BM2P139TF-EVK-001 Schematics

Bill of Materials

Table 7. BoM of BM2P139TF-EVK-001

Part Reference	Qty.	Type	Value	Description	Part Number	Manufacture	Configuration mm (inch)
C1	1	Electrolytic	4.7 μF	400 V, ±20%	860 021 374 008	Wurth	-
C2	1	Electrolytic	220 μF	25 V, ±20%	860 080 474 010	Wurth	-
C3	1	Ceramic	1 μF	25 V, X7R, ±20%	TMK107B7105MA-T	Taiyo Yuden	1608 (0603)
C4	1	Ceramic	0.1 μF	100 V, X7R, ±20%	HMK107B7104MA-T	Taiyo Yuden	1608 (0603)
CN1	1	Connector	-	2pin	B2P-VH	JST	-
D1	1	FRD	0.8 A	600 V	RFN1LAM6S	ROHM	PMDS
D2	1	Diode	0.2 A	600 V	RRE02VSM6S	ROHM	TUMD2SM
DB1	1	Bridge	1 A	800 V	D1UBA80-7062	Shindengen	SOPA-4
F1	1	Fuse	1 A	250 V	39211000000	Littelfuse	-
IC1	1	AC/DC Converter	-	-	BM2P139TF	ROHM	SOP8
L1	1	Coil	330 μH	0.65 A	744 731 331	Wurth	-
R1	1	Resistor	10k Ω	0.1 W, ±5%	MCR10EZPJ103	ROHM	2012 (0805)

© 2018 ROHM Co., Ltd.

Downloaded from Arrow.com.

Layout

Size: 18 mm x 40 mm

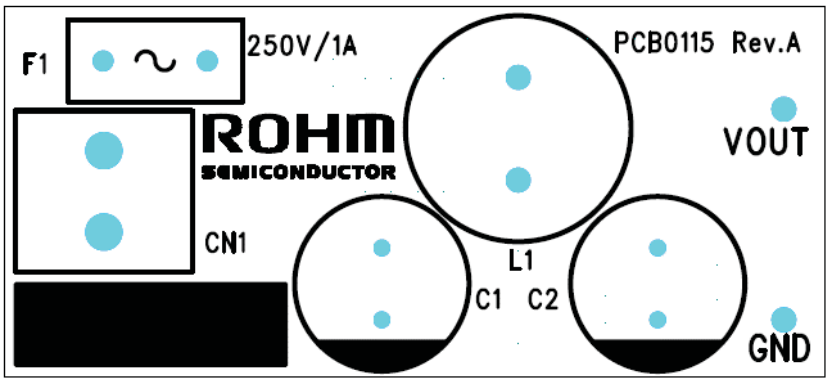


Figure 24. TOP Silkscreen (Top view)

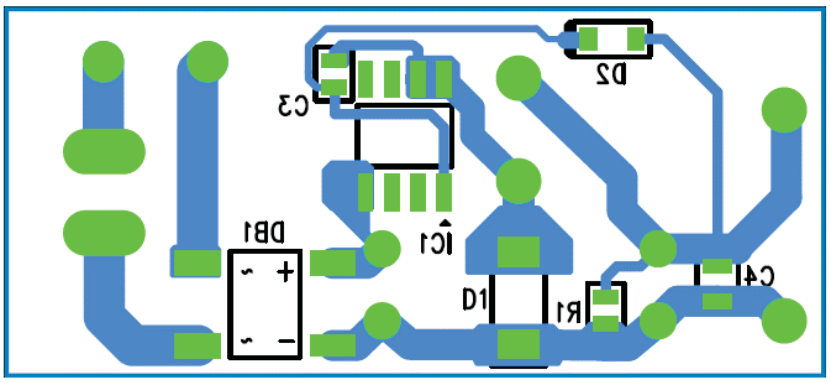


Figure 25. Bottom Layout (TOP View)

Downloaded from Arrow.com.

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 Poducts 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.

ROHM SEMICONDUCTOR

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

ROHM Customer Support System

http://www.rohm.com/contact/

© 2016 ROHM Co., Ltd. All rights reserved.

Downloaded from Arrow.com.