To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Not recommend for new design

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

   “Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.

   “High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.

   “Specific”: Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

Not recommend for new design

M54670P

2-Phase Stepper Motor Driver

REJ03F0045-0100Z
Rev.1.0
Sep.19.2003

Not recommend for new design

Description

The M54670P is a semiconductor IC to drive a bipolar stepper motor directly by controlling the coil current with the constant current method.

Features

- Wide operating voltage range (10 – 35V)
- Wide output current control range (20 – 800mA)
- Bipolar and constant current drive
- Built in flywheel
- Current level can be changed by steps or continuously.
- Built in a thermal shutdown circuit

Application

Office automation equipment such as printer, FDD, HDD, and FAX

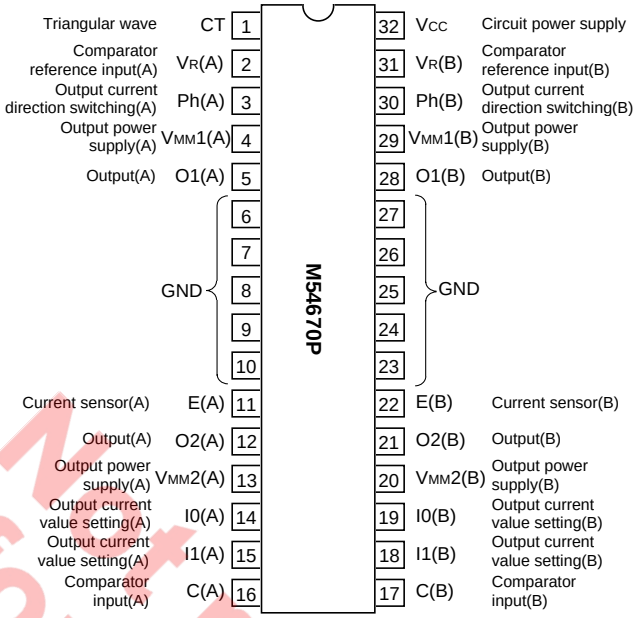
Function

The M54670P can drive a stepper motor by the 2-phase bipolar method and also control the coil current. Furthermore, it controls the direction of the coil current with Ph input pins (pins 3 and 30).

The coil current value can be selected among four levels (0 to max.) by selecting the combination of three internal comparators by logic input (pins 14, 15, 18 and 19). It also can be continuously controlled with VR pins (pins 2 and 31). By selecting an I input pin among pins 14, 15, 18 or 19, the operation timing, 2-phase excitation, 1-2-phase excitation or microstep, can be selected.

Because two control circuits are built in this IC, a stepper motor can be driven with a single IC by the 2-phase bipolar method.

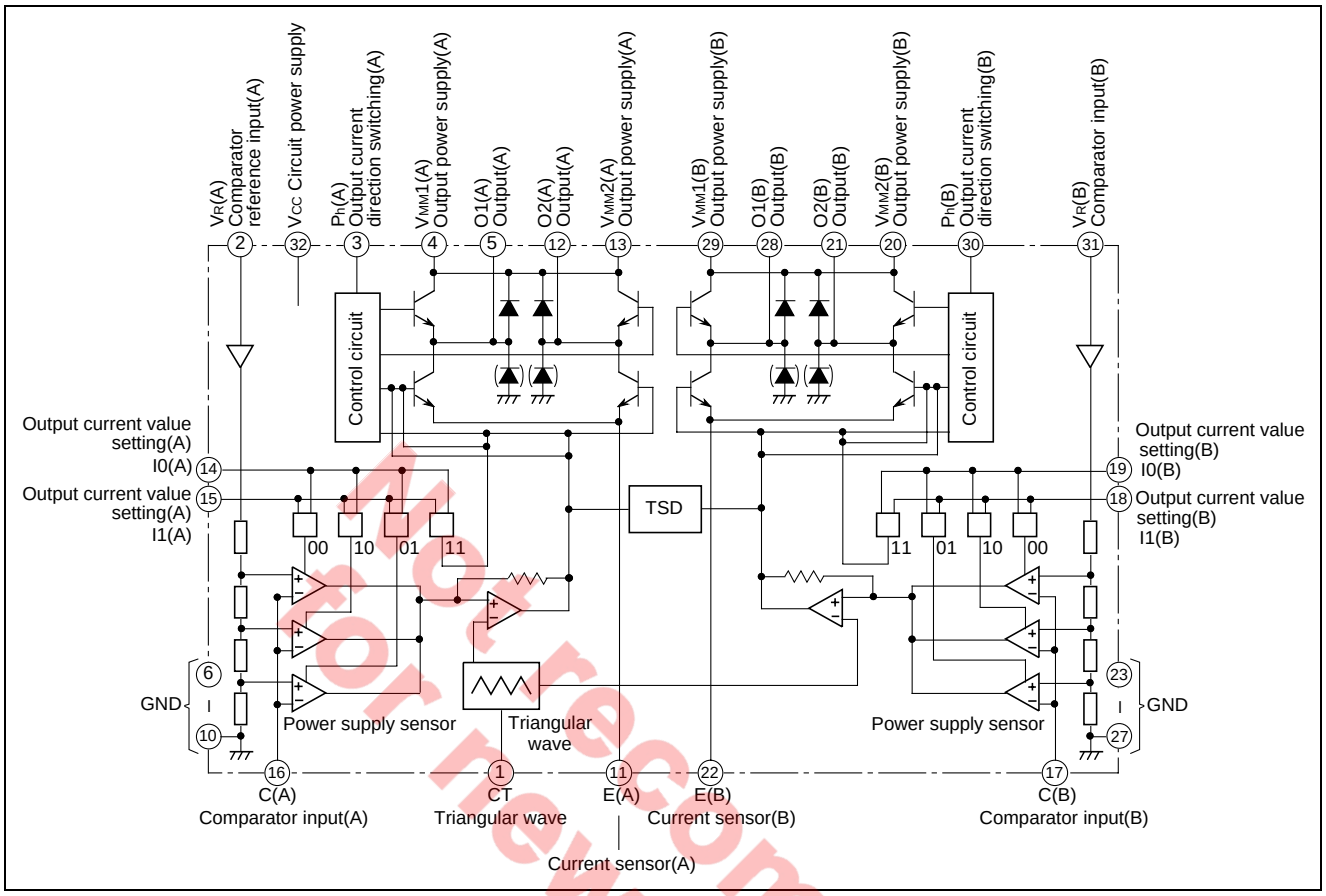
Pin Configuration



Outline 32P4B

Not recommend for new design

Block Diagram



Not recommend for new design

Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted.)

Parameter	Symbol	Ratings	Unit	Conditions
Supply voltage	VCC	–0.3 to 7	V	
Output supply voltage	VMM	–0.3 to 40	V	
Logic input voltage	VL	–0.3 to 6	V	
Comparator input voltage	VC	Vcc	V	
Reference input voltage	VR	7	V	
Output current	IO	±1.0	A	
Allowable power dissipation	Pd	1.92	W	Mounted on a board
Operating temperature	Topr	–20 to 75	℃	
Storage temperature	Tstg	–55 to 125	℃	

Recommended Operating Condition

(Ta = 25°C, VCC = 5.0V, unless otherwise noted.)

Parameter	Symbol	Limits			Unit
		Min.	Typ.	Max.	
Supply voltage	VCC	4.75	5.00	5.25	V
Output supply voltage	VMM	10		35	V
Reference input voltage	IR	0	—	800	V
Output current	IO	20		800	mA
Logic input rise time	tPLH			2.0	µS
Logic input fall time	tPHL			2.0	µS
Thermal shutdown temperature*	TON		175		℃

Note * : Refer to "PRECAUTIONS FOR USE."

Electrical characteristics

(Ta = 25°C, VCC = 5.0V, VMM = 10V, unless otherwise noted.)

Parameter		Symbol	Limits			Unit	Test conditions
			Min.	Typ.	Max.		
Logic input voltage	"H"	VIH	2.0		Vcc	V	VCC=5V
	"L"	VIL	0		0.8		
Comparator threshold		VCH	430	460	480	mV	VR=5V, I0=I1=0
		VCM	265	285	305		VR=5V, I0=1,I1=0
		VCL	90	110	130		VR=5V, I0=0, I1=1
Comparator input current		ICO	–20	–2	20	µA	I0=I1=1(Ta=25℃)
Output cutoff current		IOFF		0	100	µA	
Saturation voltage		Vsat		3.0	4.5	V	Voltage at sensing resistor is not included. IO=500mA
PWM oscillator frequency		fc	16.5	33	66	KHz	VMM=10V, Cf = 3900pF
Turnoff delay		td		1.0	2.0	µS	Ta=25℃, dVK/dt ≥ 50mV/µs
Supply current		ICC		8.0	25	mA	VCC=5V
Logic input current	"H"	IIH		180	400	µA	VI=2.4V
	"L"	IIL		20	50	µA	VI=0.4V

Not recommend for new design

Application Description

(1) PHASE INPUT

Phase input decides the output mode.

Phase	O1	O2
H	L	H
L	H	L

(2) I0, I1

I0 and I1 fixed based on the comparative voltage VR decide the output current level.

I0	I1	Current level
H	H	0
L	H	Low
H	L	Typ
L	L	High

(3) VR (Comparative voltage)

The current level can be continuously changed by changing the voltage at VR continuously.

(4) Current sensor

When the voltage fall at the current sensing resistor and the selected current level become of the same level, the output state is cut off for a certain time by inverting the comparator.

During this cutoff time, the current volume decreases slightly due to the L component of the motor and falls short of the comparative level. During the time fixed based on the PWM frequency, the output stage goes in ON state and then in OFF state and this ON/OFF operation is repeated.

(5) PWM oscillator

A capacitor C_t is externally connected to CT pin in order to fix the PWM oscillator frequency. The frequency fc is calculated as follows.

$$f_C = \frac{1}{7.77 \times 10^3 \times C_t}$$

(6) Analog control

The output current level can be continuously changed by changing the voltage at VR or the feedback voltage to the comparator.

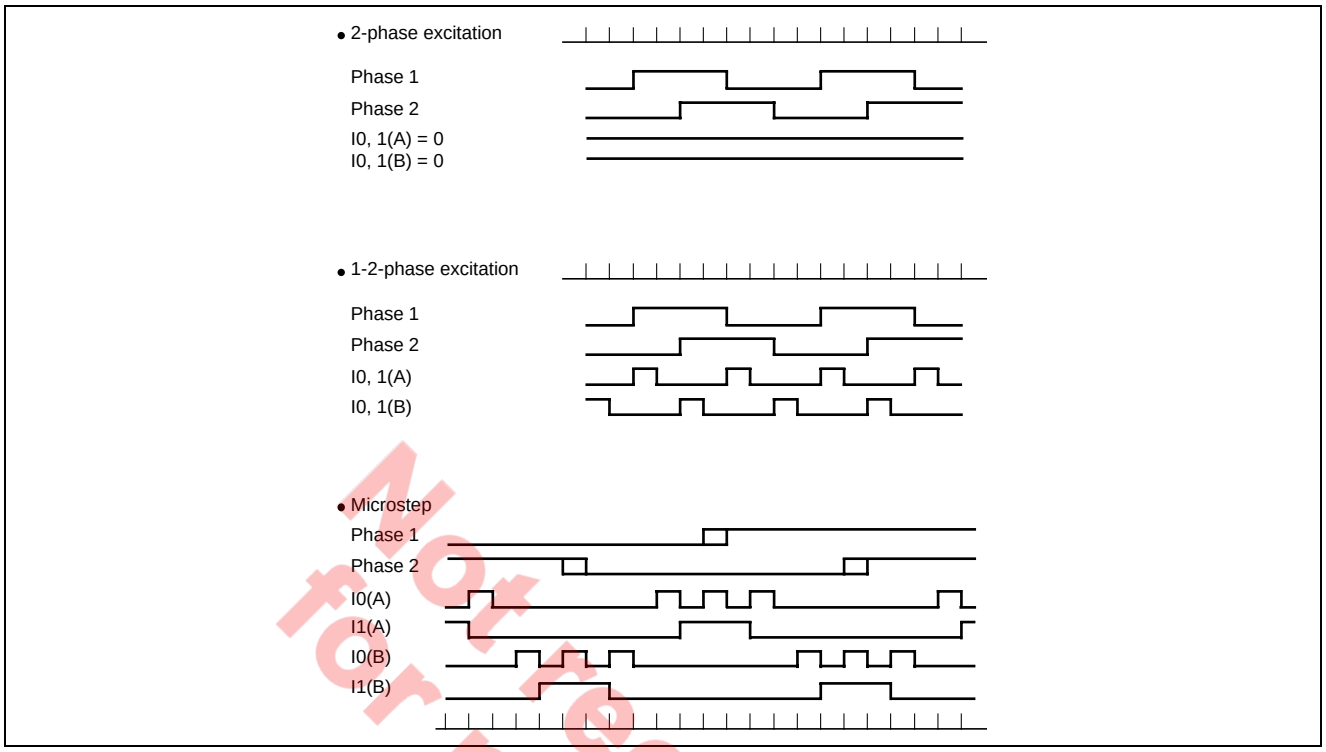
(7) Thermal shutdown function

This IC has a function to protect itself against thermal damage which is caused when the chip temperature rises abnormally.

Regarding this function, refer to “PRECAUTIONS FOR USE.”

Not recommend for new design

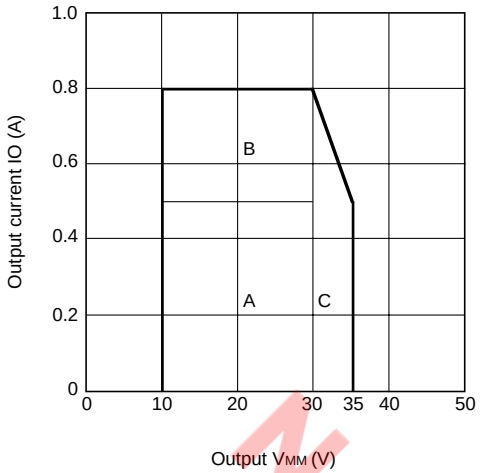
Timing Chart



Not recommend for new design

Typical Characteristics (Absolute maximum ratings)

Safety operating range

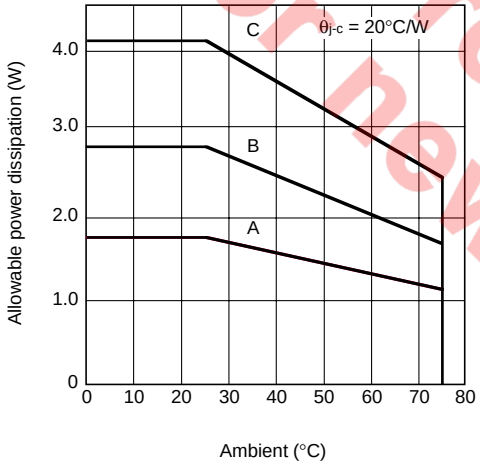


A : Recommended

B : Schottky diodes should be externally connected between output pin and power supply pin.

C : Schottky diodes should be externally connected between output pin and power supply pin and between output pin and GND pin.

Thermal derating



A : Free air ($\theta_{c\text{-}a}$ = 50°C/W)

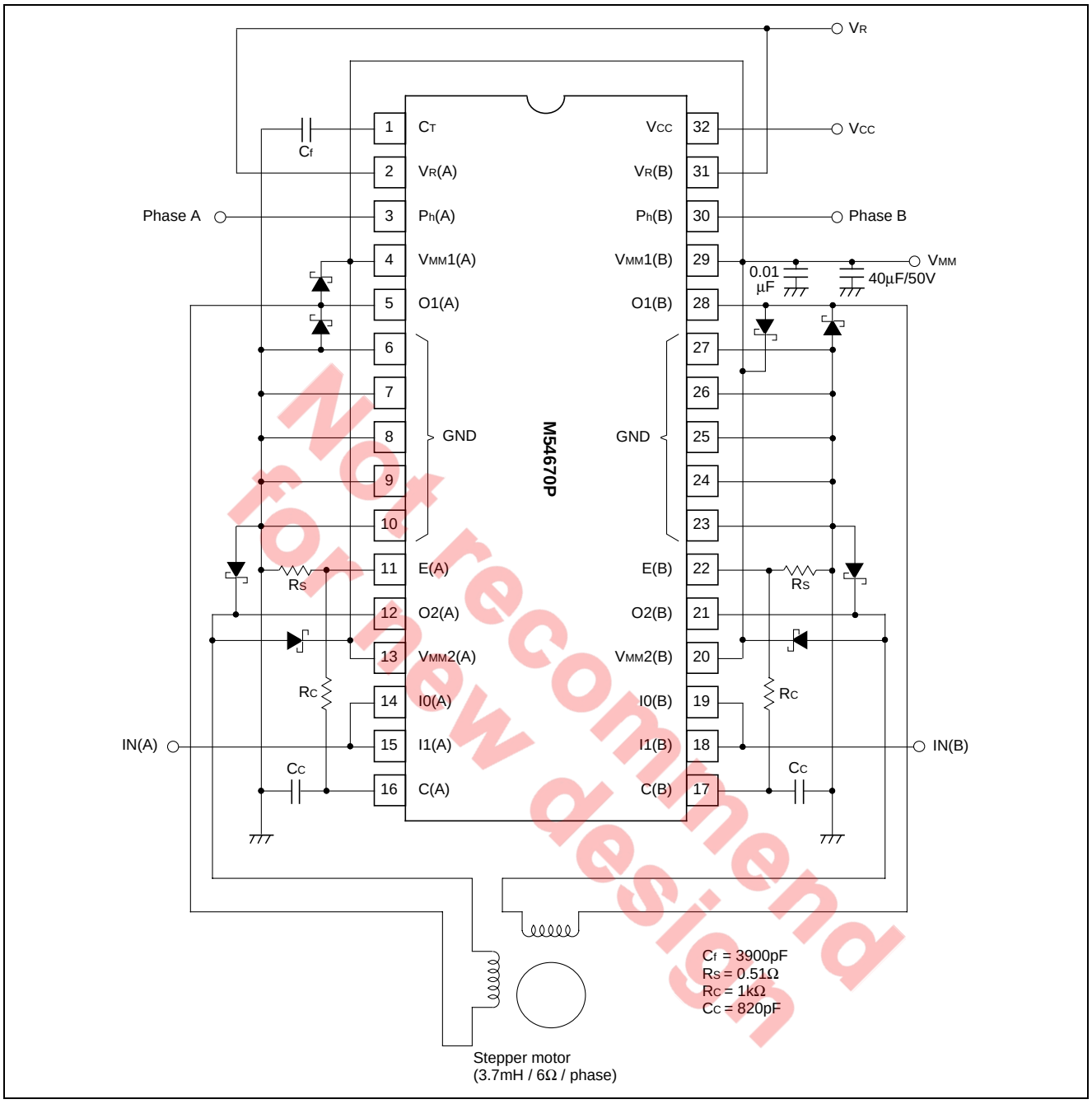
B : With 10cm^2 aluminum heat ($\theta_{c\text{-}a}$ = 25°C/W)

C : With 100cm^2 aluminum heat ($\theta_{c\text{-}a}$ = 10°C/W)

$T_{j(max)}$ = 150°C

Not recommend for new design

Application Example (Stepping motor driver)



Precautions for use

(1) When the whole output current changes by a large margin (for example, when thermal shutdown operation causes intermittent flow of output current), the supply voltage may undergo a change. Therefore, selection and wiring of power supply should be conducted cautiously to avoid such a situation that the supply voltage exceeds the absolute maximum ratings.

(2) When the supply voltage changes by a large margin, the operation of this IC may become unstable. In this case, the change of supply voltage can be controlled by connecting a capacitor between Vcc pin and GND pin.

(3) Thermal shutdown function

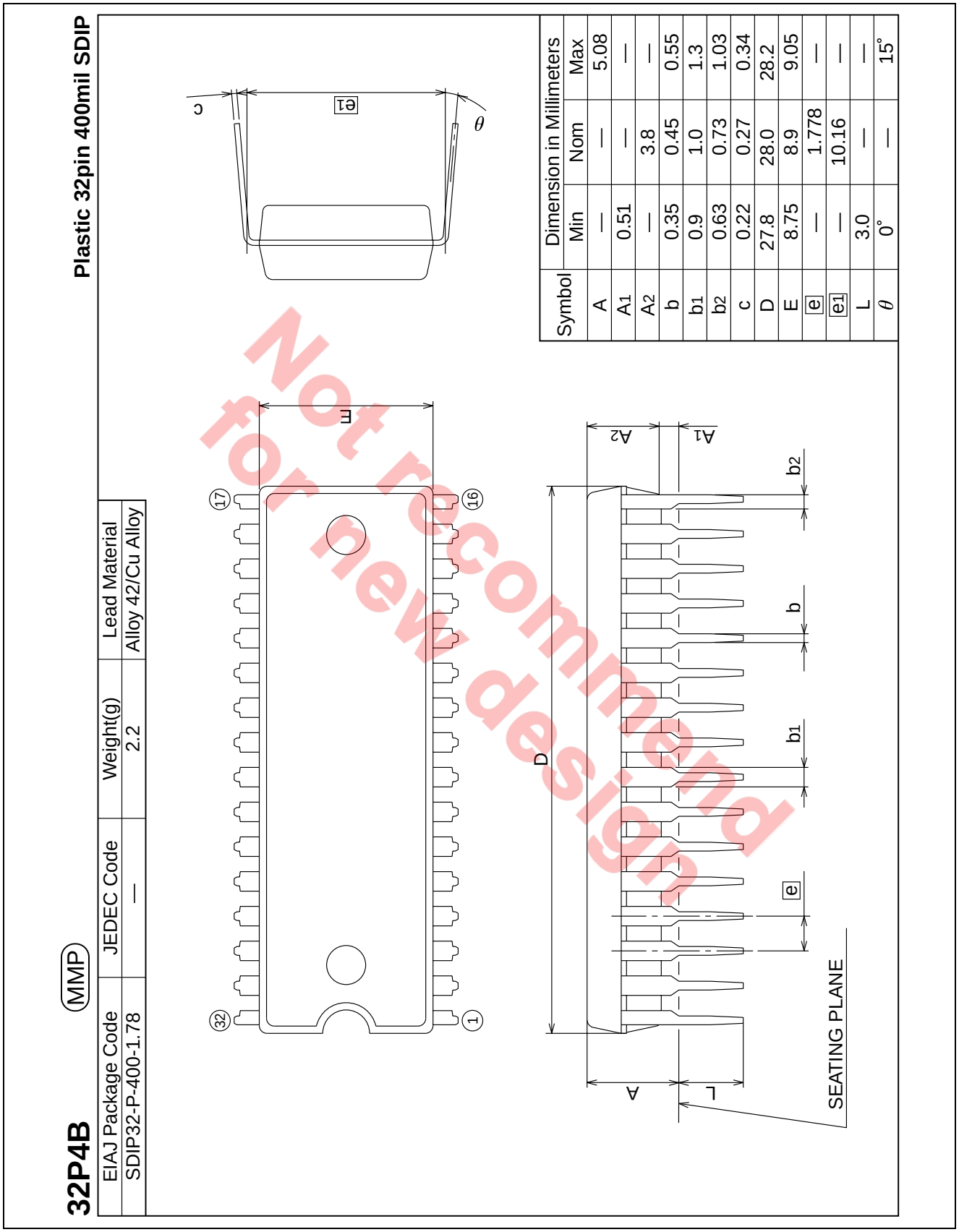
The state of thermal shutdown operation may differ according to the way of wiring within a board. Therefore, sufficient board evaluation should be conducted before use. When the board is changed, operation on the replacing board should be evaluated.

The circuit board on which this IC is mounted is designed to realize low impedance between power supply and output pin.

Therefore, it is desirable to take a safe measure such as fixing a fuse to avoid such a situation that the board is damaged by a fire when output pin is internally short-circuited by excessively applied surge voltage by accident.

Not recommend for new design

Package Dimensions



Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

Keep safety first in your circuit designs!
1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials
1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.
The information described here may contain technical inaccuracies or typographical errors.
Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (http://www.renesas.com).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.

Not Recommend for New Design

RENESAS SALES OFFICES

http://www.renesas.com

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500 Fax: <1> (408) 382-7501

Renesas Technology Europe Limited.
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, United Kingdom
Tel: <44> (1628) 585 100, Fax: <44> (1628) 585 900

Renesas Technology Europe GmbH
Dornacher Str. 3, D-85622 Feldkirchen, Germany
Tel: <49> (89) 380 70 0, Fax: <49> (89) 929 30 11

Renesas Technology Hong Kong Ltd.
7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2375-6836

Renesas Technology Taiwan Co., Ltd.
FL 10, #99, Fu-Hsing N. Rd., Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology (Shanghai) Co., Ltd.
26/F., Ruijin Building, No.205 Maoming Road (S), Shanghai 200020, China
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

Renesas Technology Singapore Pte. Ltd.
1, Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

© 2003. Renesas Technology Corp., All rights reserved. Printed in Japan.
Colophon 1.0