

# SLA7050M/7051M/7052M

October 2005

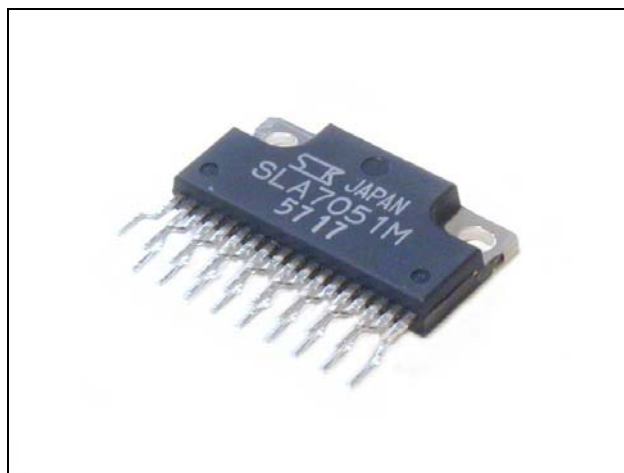
## General Description

Combining low-power CMOS logic with high-current, high-voltage power FET outputs, the Series SLA705xM translator/driver provides complete control and drive for a two-phase unipolar stepper motor with internal fixed off time, pulse-width modulation (PWM) control of the output current in a power multi-chip module (PMCM™).

The CMOS logic section provides the sequencing logic, direction, full/half-step control, synchronous/asynchronous PWM operation, and a "sleep" function. The minimum CLOCK input is an ideal fit for applications where a complex  $\mu P$  is unavailable or overburdened. TTL or LSTTL may require the use of appropriate pull-up resistors to ensure a proper input-logic high. For PWM current control, the maximum output current is determined by the user's selection of a reference voltage and sensing resistor. The NMOS outputs are capable of sinking up to 1, 2 or 3 A and withstanding 46 V in the off state. Ground-clamp and flyback diodes provide protection against inductive transients. Special power-up sequencing is not required.

Full-step (2 phase) and half-step operation are externally selectable. Two-phase drive energizes two adjacent phases in each detent position (AB-BC-CD-DA). This sequence mode offers an improved torquespeed product, greater detent torque, and is less susceptible to motor resonance. Half-step excitation alternates between the one-phase and two-phase modes (A-AB-B-BC-C-CD D-DA), providing an eight-step sequence.

## Package----SLA18Pin



## Applications

- PPC
- Printer
- OA Equipment

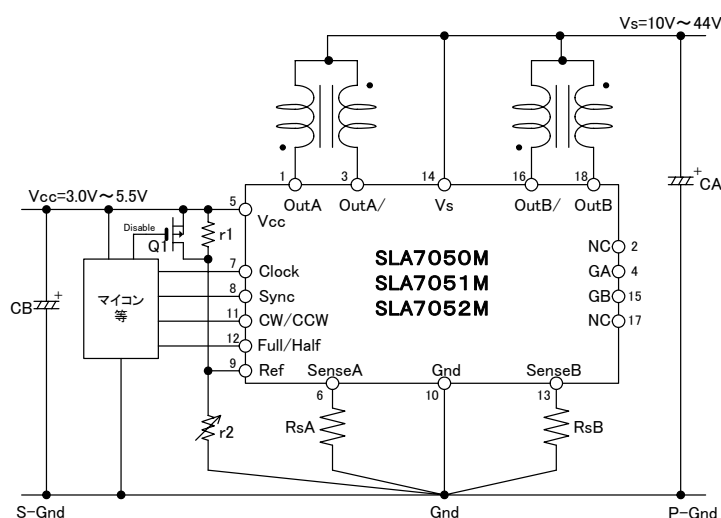
## Features

- To 3A Output Rating
- Internal Sequencer for Full or Half-Step Operation
- PWM Constant-Current Motor Drive
- Cost-Effective, Multi-Chip Solution
- 100 V, Avalanche-Rated NMOS
- Low  $r_{DS(on)}$  NMOS Outputs (300 milli-ohms typical)
- Advanced, Improved Body Diodes
- Half-Step and Full-Step Unipolar Drive
- Inputs Compatible with 3.3 V or 5 V Control Signals
- Sleep Mode
- Internal Clamp Diodes

## Key Specifications

- Motor Supply Voltage ( $V_M$ ) : 44V max
- Load Supply Voltage ( $V_S$ ) : 10V~44V
- Logic Supply Voltage ( $V_{CC}$ ) : 3V~5.5V
- Output Current ( $I_O$ ) : 1A(SLA7050M)  
2A(SLA7051M)  
3A(SLA7052M)
- Output Maximum Voltage ( $V_{DSS}$ ) : 100V min

## Typical Connection



Sanken Electric Co., Ltd.

<http://www.sanken-ele.co.jp/en/>

I03-002EA-051006

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## Scope

The present specifications shall apply to Sanken 2 Phase Stepper Motor Driver IC, SLA705xM Series.

The present specifications shall apply to SLA 705xM Series which is performed RoHS instructions.

Lead part solder : Pb free    Inner solder : Lead content > 85%

## Outline

|              |                                                                                |
|--------------|--------------------------------------------------------------------------------|
| Type         | Hybrid integrated circuit                                                      |
| Structure    | Plastic molded (transfer mold)                                                 |
| Applications | To drive a 2 phase stepper motor.<br>(Full or Half Step. PWM Current Control.) |

## Absolute maximum ratings

| Characteristic              | Symbol    | Ratings                  | Unit       | Remarks                            |
|-----------------------------|-----------|--------------------------|------------|------------------------------------|
| Motor Supply Voltage        | $V_M$     | 46                       | V          |                                    |
| Load Supply Voltage         | $V_S$     | 46                       | V          |                                    |
| Logic Supply Voltage        | $V_{CC}$  | 7                        | V          |                                    |
| Output Current              | $I_O$     | 1.0                      | A          | SLA7050M                           |
|                             |           | 2.0                      |            | SLA7051M                           |
|                             |           | 3.0                      |            | SLA7052M                           |
| Logic Input Voltage         | $V_{IN}$  | $-0.3 \sim V_{CC} + 0.3$ | V          |                                    |
| REF Input Voltage           | $V_{REF}$ | $-0.3 \sim V_{CC} + 0.3$ | V          |                                    |
| Sense Voltage               | $V_{RS}$  | $-2 \sim 2$              | V          | $T_w < 1\mu S$ doesn't contain it. |
| Total Device Dissipation    | $P_D$     | 4                        | W          | at $T_a = 25^\circ C$              |
|                             |           | 20                       | W          | at $T_c = 25^\circ C$              |
| Junction Temperature        | $T_j$     | 150                      | $^\circ C$ |                                    |
| Operating Temperature Range | $T_a$     | $-20 \sim 85$            | $^\circ C$ |                                    |
| Storage Temperature Range   | $T_{stg}$ | $-30 \sim 150$           | $^\circ C$ |                                    |

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## Electrical characteristics

### Recommendable Operating Range

| Characteristic       | Symbol           | Ratings |     | Unit | Remarks                                                          |
|----------------------|------------------|---------|-----|------|------------------------------------------------------------------|
|                      |                  | MIN     | MAX |      |                                                                  |
| Motor Supply Voltage | V <sub>M</sub>   |         | 44  | V    |                                                                  |
| Load Supply Voltage  | V <sub>S</sub>   | 10      | 44  | V    |                                                                  |
| Logic Supply Voltage | V <sub>CC</sub>  | 3.0     | 5.5 | V    | Please adjust the V <sub>CC</sub> surge voltage to 0.5V or less. |
| REF Input Voltage    | V <sub>REF</sub> | 0.1     | 1.0 | V    | The control current accuracy decreases in 0.1V or less.          |
| Package Temperature  | T <sub>c</sub>   |         | 100 | °C   | 10Pin temperature (at No Fin)                                    |

### Electrical Characteristic (Ta=25°C, Vs=24V, Vcc=5V Unless Otherwise Noted)

| Characteristic            | Symbol              | Limits                |                  |                       | Unit | Test Condition                               |
|---------------------------|---------------------|-----------------------|------------------|-----------------------|------|----------------------------------------------|
|                           |                     | MIN                   | TYP              | MAX                   |      |                                              |
| Load Supply Current       | I <sub>S</sub>      |                       |                  | 15                    | mA   | Regularity                                   |
|                           | I <sub>SS</sub>     |                       |                  | 100                   | μA   | at SLEEP operates                            |
| Logic Supply Current      | I <sub>CC</sub>     |                       |                  | 3                     | mA   |                                              |
| Output Maximum Voltage    | V <sub>DSS</sub>    | 100                   |                  |                       | V    | V <sub>S</sub> =44V<br>I <sub>DSS</sub> =1mA |
| FET On-State Resistance   | R <sub>DS(on)</sub> |                       | 0.3              | 0.5                   | Ω    | I <sub>D</sub> =1A                           |
| FET Diode Forward Voltage | V <sub>SD</sub>     |                       | 0.8              | 1.1                   | V    | I <sub>SD</sub> =1A                          |
| Maximum Clock Frequency   | F <sub>clock</sub>  |                       |                  | 100                   | kHz  |                                              |
| Logic Input Voltage       | V <sub>IL</sub>     |                       |                  | V <sub>CC</sub> ×0.25 | V    |                                              |
|                           | V <sub>IH</sub>     | V <sub>CC</sub> ×0.75 |                  |                       | V    |                                              |
| Logic Input Current       | I <sub>IL</sub>     |                       | ±1               |                       | μA   |                                              |
|                           | I <sub>IH</sub>     |                       | ±1               |                       | μA   |                                              |
| REF Input Voltage         | V <sub>REF</sub>    | 0                     |                  | 1.5                   | V    | Stationary current control                   |
|                           | V <sub>REFS</sub>   | 2.0                   |                  | V <sub>CC</sub>       | V    | Output OFF(Sleep)                            |
| REF Input Current         | I <sub>REF</sub>    |                       | ±10              |                       | μA   |                                              |
| Sense Voltage             | V <sub>RS</sub>     |                       | V <sub>REF</sub> |                       | V    |                                              |

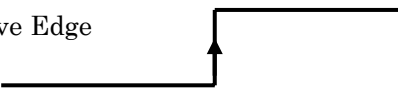
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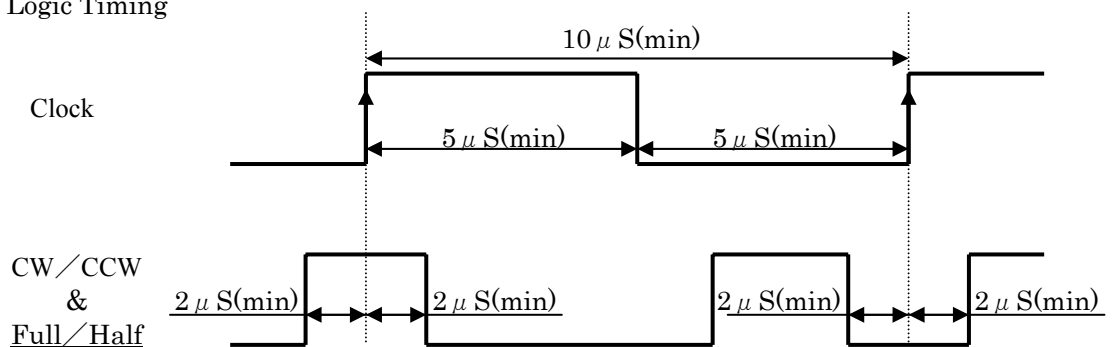
Electrical Characteristic (Ta=25°C, Vs=24V, Vcc=5V Unless Otherwise Noted)

| Characteristic           | Symbol   | Limits |     |     | Unit          | Test Condition               |
|--------------------------|----------|--------|-----|-----|---------------|------------------------------|
|                          |          | MIN    | TYP | MAX |               |                              |
| PWM OFF Time             | TOFF     |        | 12  |     | $\mu\text{S}$ |                              |
| PWM Minimum ON Time      | TON(min) |        | 5   |     | $\mu\text{S}$ |                              |
| Sleep-Enable return time | TSE      | 100    |     |     | $\mu\text{S}$ | VREF : 2.0→1.5V<br>Io : 1.5A |
| Switching Time           | TONC     |        | 2.5 |     | $\mu\text{S}$ | Clock→Out                    |
|                          | TOFFC    |        | 2.0 |     | $\mu\text{S}$ | Clock→Out                    |

Truth table

| Pin Function | Low level                                                                            | High level            |
|--------------|--------------------------------------------------------------------------------------|-----------------------|
| CW/CCW       | Forward(CW)                                                                          | Reverse(CCW)          |
| Full/Half    | Full Step                                                                            | Half Step             |
| REF          | Enable                                                                               | Output disable(Sleep) |
| Sync         | Non synchronous PWM                                                                  | Synchronous PWM       |
| Clock        |  |                       |

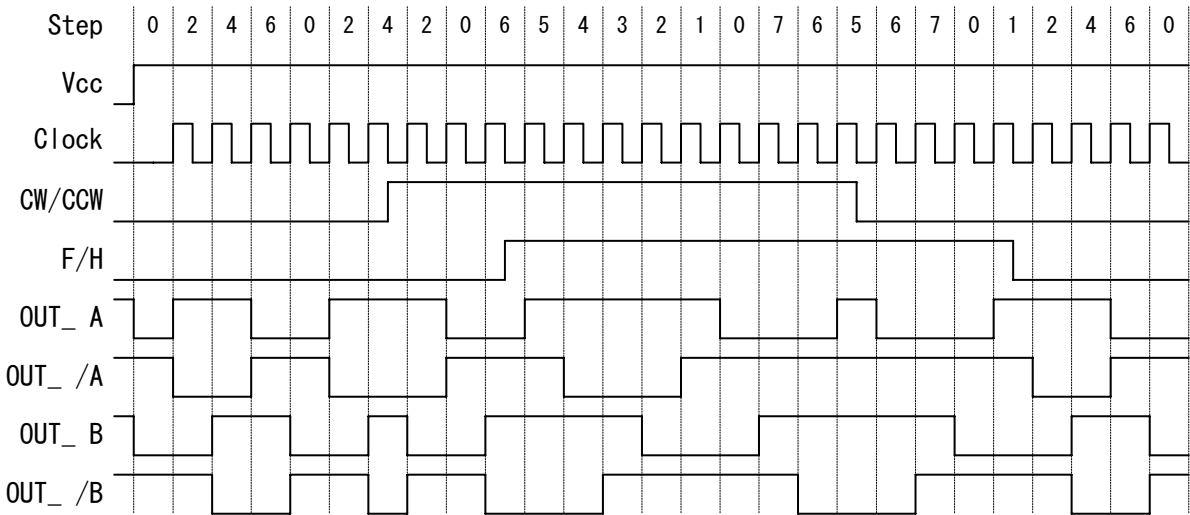
Input Logic Timing



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Timing chart



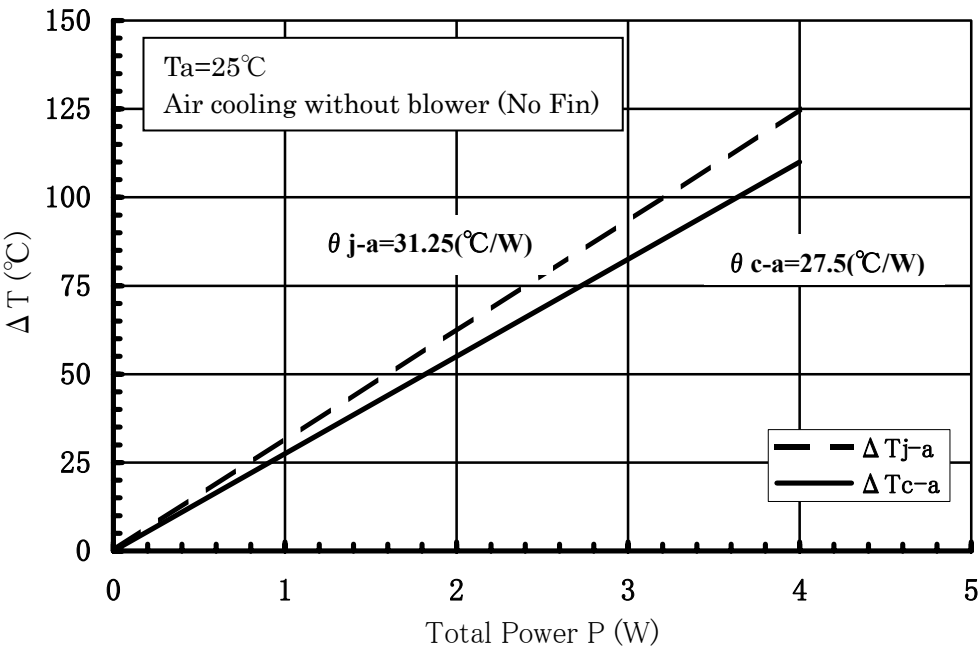
- This timing chart is a voltage mark.
- PWM signal for current control is not superimposed on this timing chart.

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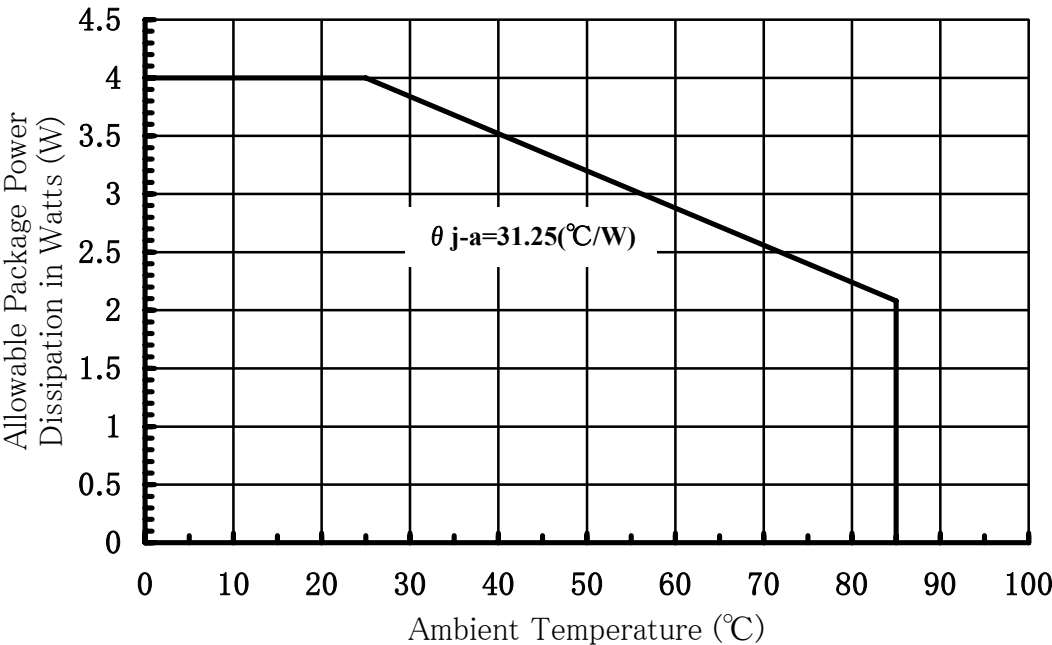
Heat design data

Total Power—  $\Delta T$  indegc



※The temperature of the case is 10pin.

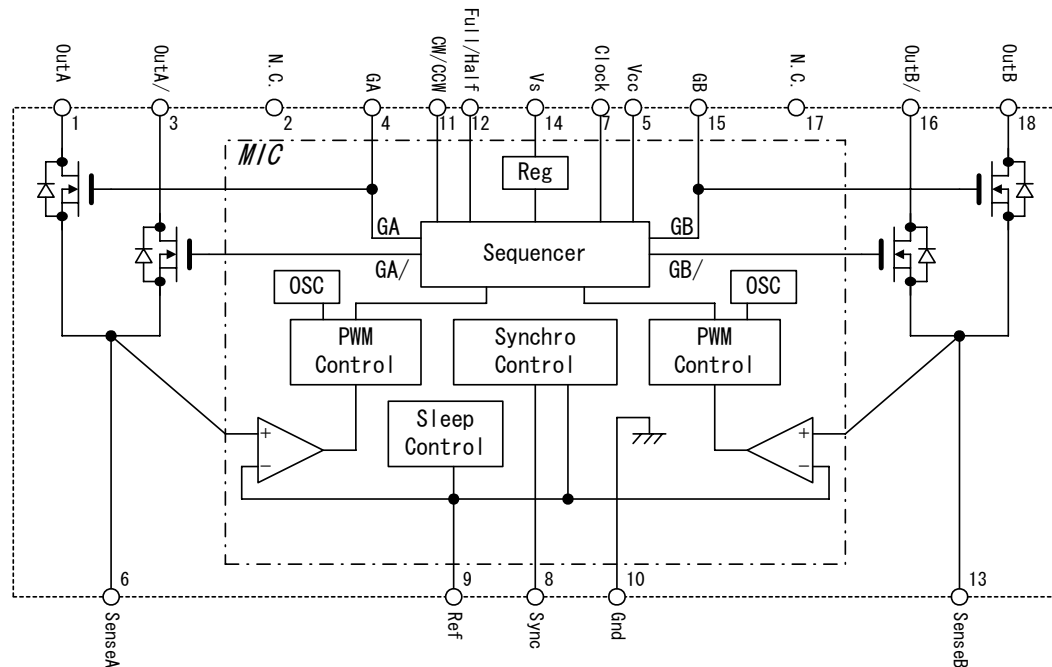
$T_a$  - P



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## Block diagram (Connection diagram)



Pin arrangement ,Functional table

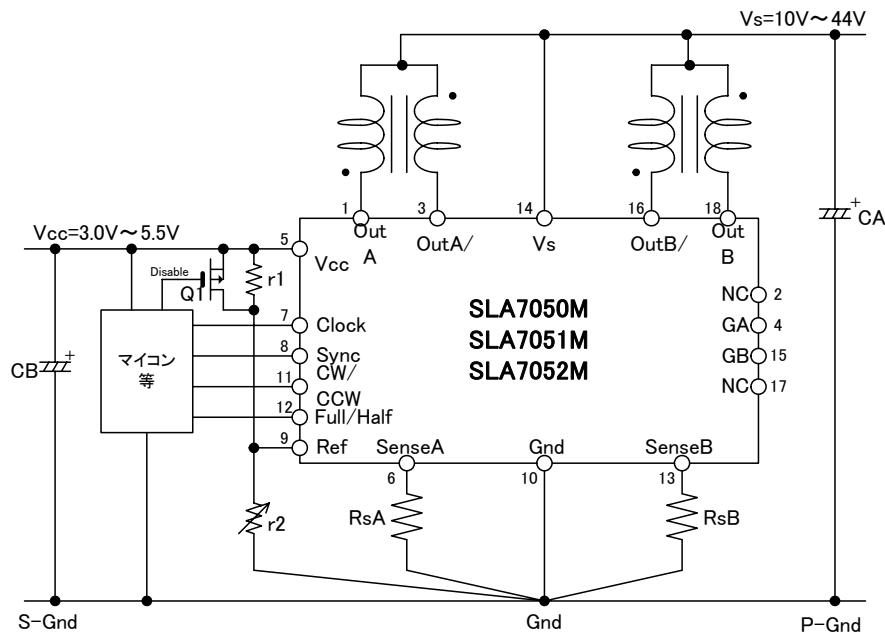
| Pin Number | Symbol    | Function                           |
|------------|-----------|------------------------------------|
| 1          | OutA      | Phase A Output                     |
| 2          | N.C.      | No Contact                         |
| 3          | OutA/     | Phase A/ Output                    |
| 4          | GA*       | Phase A Gate                       |
| 5          | Vcc       | Logic supply                       |
| 6          | SenseA    | Phase A current sense              |
| 7          | Clock     | Step clock                         |
| 8          | Sync      | Synchronous PWM control            |
| 9          | Ref       | Current reference & Output disable |
| 10         | GND       | GND                                |
| 11         | CW/CCW    | Forward reverse control            |
| 12         | Full/Half | Full step half step control        |
| 13         | SenseB    | Phase B current sense              |
| 14         | Vs        | Load supply                        |
| 15         | GB*       | Phase B Gate                       |
| 16         | OutB/     | Phase B/ Output                    |
| 17         | N.C.      | No Contact                         |
| 18         | OutB      | Phase B Output                     |

\*The gating signal of MOS FET outputs, and use 4pin and 15pin by the unwiring, please.

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## Example application circuit



Reference constant

$$R_s = 0.1 \sim 2 \Omega \text{ (Loss attention } P \doteq I_o^2 \times R_s)$$

$$R_1 = 10k \Omega$$

$$R_2 = 5.1k \Omega \text{ (VR)}$$

$$CA = 100 \mu F / 50V$$

$$CB = 10 \mu F / 10V$$

Q1 :

☆Be careful of especially the noise on Vcc line.

If the noise on Vcc line exceeds 0.5V, a product may incorrect-operate.

☆When you do not use Logic inputs (CW/CCW and F/H, Sync), please be sure to connect with Vcc or GND.

☆To minimize the effect of system ground I·R drops on the logic and reference input signals, Ground pin should have a low-impedance return to system ground.

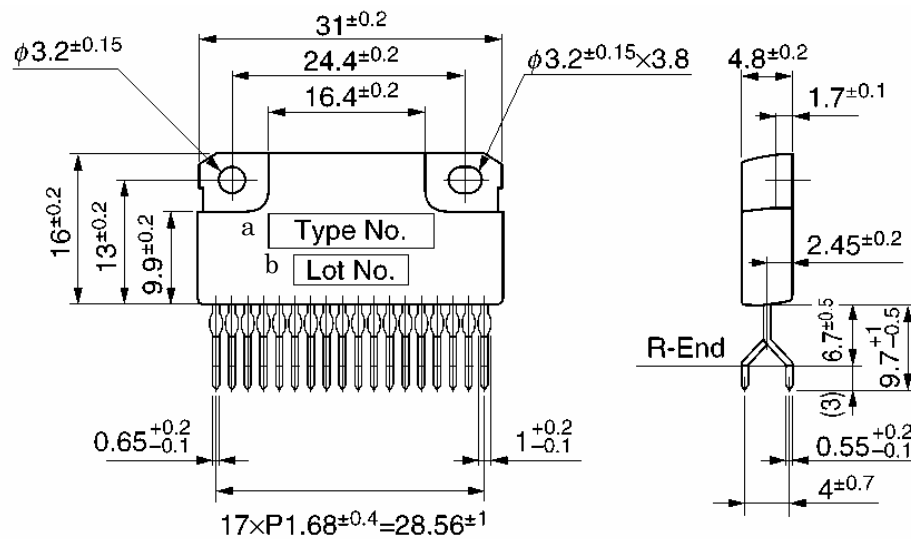
☆2pin, 4pin, 15pin and 17pin are No Contact.

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## Package information s

Package type and physical dimensions



a. Type Number SLA705xM

b. Lot Number

1st letter The last digit of year  
 2nd letter Month  
 1~9 月 : Arabic Numerals  
 10 月 : O  
 11 月 : N  
 12 月 : D  
 (1 to 9 for Jan. to Sept. O for Oct.  
 N for Nov. D for Dec.)  
 3rd & 4th letter day  
 01~31 : Arabic Numerals

Dimensions in mm

### Appearance

The body shall be clean and shall not bear any stain, rust or flaw.

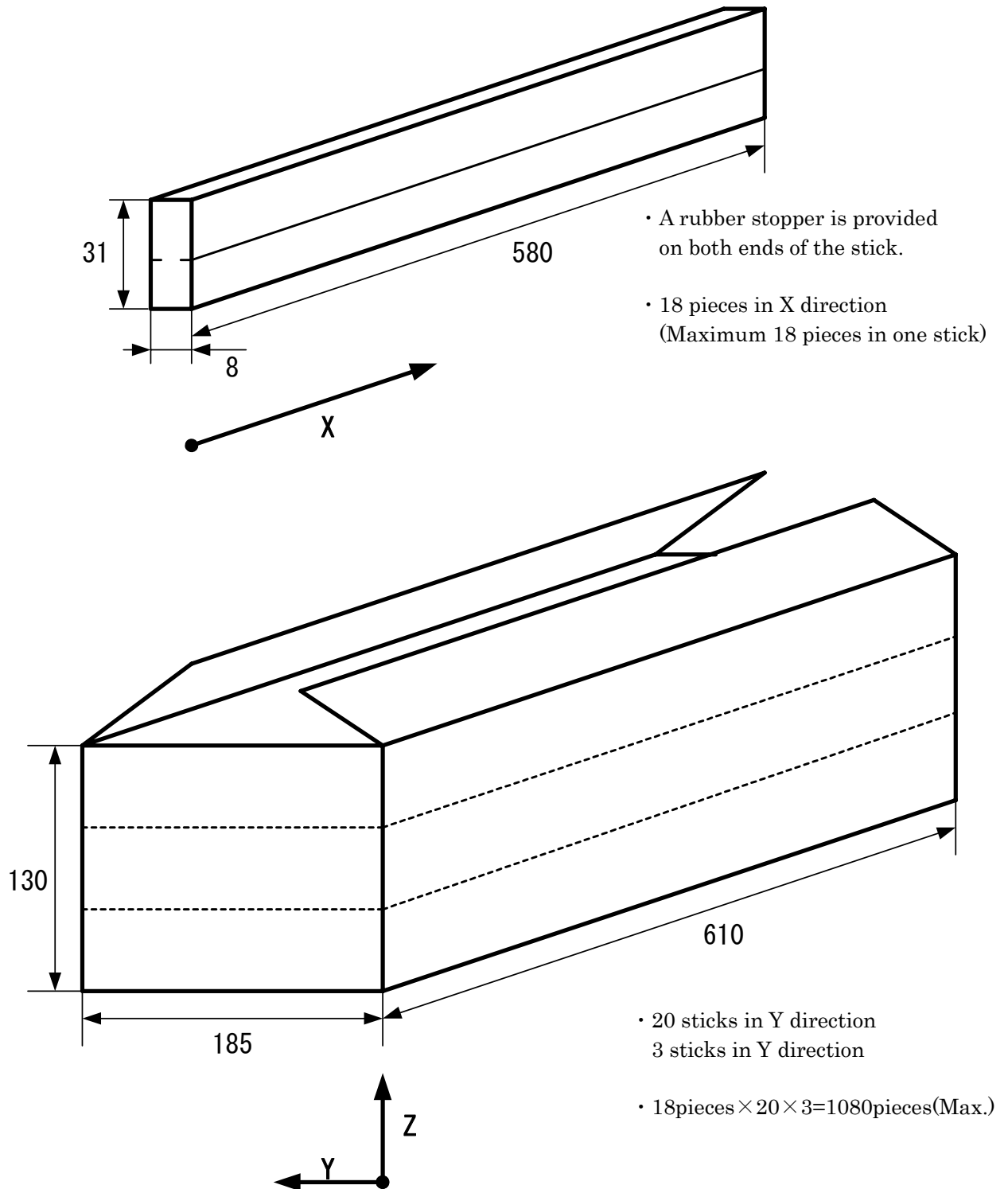
### Marking

The type number and lot number shall be clearly marked in white.

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## Packing specifications



Dimensions in mm

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## Cautions and warnings

The calculation of control current

SLA705xM Series control current  $I_o$  is calculated as follow.

$$I_o = V_{REF} / R_s$$

REF Voltage range is 0.1V~1.0V

※When the  $REF < 0.1V$ , the accuracy of control current is reduce.

Moreover, if REF voltage is set up more than 2.0V, all outputs will be in OFF state.

Installation to a heat sink

1)Recommended Clamping Torque (to External Heat sink) 0.490~0.822N·m

2)Recommended Silicone

G746 {SHIN-ETSU CHEMICAL}

YG6260 {GE TOSHIBA SILICONES}

SC102 {DOW CORNING TORAY SILICONE}

Notice

This driver has C-MOS inputs. Please notice as following contents.

- When static electricity is a problem, care should be taken to properly control the room humidity. This is particularly true in the winter when static electricity is most troublesome.
- Care should be taken with device leads and with assembly sequencing to avoid applying static charges to IC leads. PC board pins should be shorted together to keep them at the same potential to avoid this kind of trouble.

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## <Worldwide Contacts>

### Asia Pacific

#### China

##### **Sanken Electric Hong Kong Co., Ltd.**

Suite 1026 Ocean Centre, Canton Road, Tsimshatsui, Kowloon, Hong Kong

Tel: 852-2735-5262

Fax: 852-2735-5494

##### **Sanken Electric (Shanghai) Co., Ltd.**

Room3202, Maxdo Centre, Xingyi Road 8, Changning district, Shanghai, China

Tel: 86-21-5208-1177

Fax: 86-21-5208-1757

##### **Taiwan Sanken Electric Co., Ltd.**

Room 1801, 18th Floor, 88 Jung Shiau East Road, Sec. 2, Taipei 100, Taiwan R.O.C.

Tel: 886-2-2356-8161

Fax: 886-2-2356-8261

#### India

##### **Saket Devices Pvt. Ltd.**

Office No.13, First Floor, Bandal - Dhankude Plaza, Near PMT Depot, Paud Road, Kothrud, Pune - 411 038, India

Tel: 91-20-5621-2340

91-20-2528-5449

Fax: 91-20-2528-5459

#### Japan

##### **Sanken Electric Co., Ltd. Overseas Sales Headquarters**

Metropolitan Plaza Bldg. 1-11-1 Nishi-Ikebukuro, Toshima-ku, Tokyo 171-0021, Japan

Tel: 81-3-3986-6164

Fax: 81-3-3986-8637

#### Korea

##### **Sanken Electric Korea Co., Ltd.**

Mirae Asset Life Bldg. 6F, 168 Kongduk-dong, Mapo-ku, Seoul, 121-705, Korea

Tel: 82-2-714-3700

Fax: 82-2-3272-2145

#### Singapore

##### **Sanken Electric Singapore Pte. Ltd.**

150 Beach Road, #14-03 The Gateway West, Singapore 189720

Tel: 65-6291-4755

Fax: 65-6297-1744

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## Europe

### United Kingdom

**Sanken Power Systems (UK) Limited**

Pencoed Technology Park, Pencoed, Bridgend CF35 5HY. UK

Tel: 44-1656-869-100

Fax: 44-1656-869-162

## North America

### United States

**Allegro MicroSystems, Inc.**

115 Northeast Cutoff, Worcester, Massachusetts 01606, U.S.A.

Tel: 1-508-853-5000

Fax: 1-508-853-3353

**Allegro MicroSystems, Inc. (Southern California)**

14 Hughes Street, Suite B105, Irvine, CA 92618

Tel: 1-949-460-2003

Fax: 1-949-460-7837

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