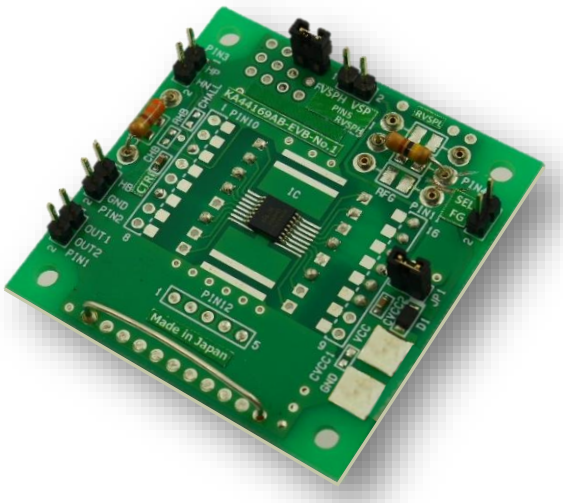
User's Manual for KE-KA44169AB Evaluation Board

This **KE-KA44169AB** evaluation board provides to verify the function of our original Auto Phase Control (APC) technology installed in KA44169AB, which is the single phase motor driver for Fan and Pump.
This EVB helps to accelerate products design-in to market-in.



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Disclaimer

Regarding the specifications of this product, it is considered that you have agreed to the disclaimer described below.

1. When the application system is designed using this product, please design the system at your own risk. Please read, consider, and apply appropriate usage notes and description in this standard.

2. When designing your application system, please take into the consideration of break down and failure mode occurrence and possibility in semiconductor products. Measures on the systems such as, but not limited to, redundant design, mitigating the spread of fire, or preventing glitch, are recommended in order to prevent physical injury, fire, social damages, etc. in using the Nuvoton Technology Japan Corporation (hereinafter referred to as NTCJ) products.

3. When using this product, for each actual application systems, verify the systems and the all functionality of this product as intended in application systems and the safety including the long-term reliability at your own risk

4. Please use this product in compliance with all applicable laws, regulations and safety-related requirements that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. NTCJ shall not be held responsible for any damage incurred as a result of this product being used not in compliance with the applicable laws, regulations and safety-related requirements.

5. This product does not have any security functions using cryptographic algorithms, such as authentication, encryption, tampering detection.

6. Unless this product is indicated by NTCJ to be used in applications as meeting the requirements of a particular industry standard (e.g., ISO 9001, IATF 16949, ISO 26262, etc.), this product is neither designed nor intended for use in such environments for that applications. NTCJ shall not be held responsible for not meeting the requirements of a particular industry standard.

7. Using product that have been indicated as compliant with industry functional safety standards does not warrant that the application meets the requirements of industry functional safety standards. NTCJ shall not be held responsible for the application compliance with requirements of the particular industry functional safety standard.

8. Unless this product is indicated by NTCJ to be used in applications as meeting the requirements of a particular quality standard (e.g., AECQ-100, etc.), this product is neither designed nor intended for use in such the environments for that applications. NTCJ shall not be held responsible for not meeting the requirements of a particular quality standard.

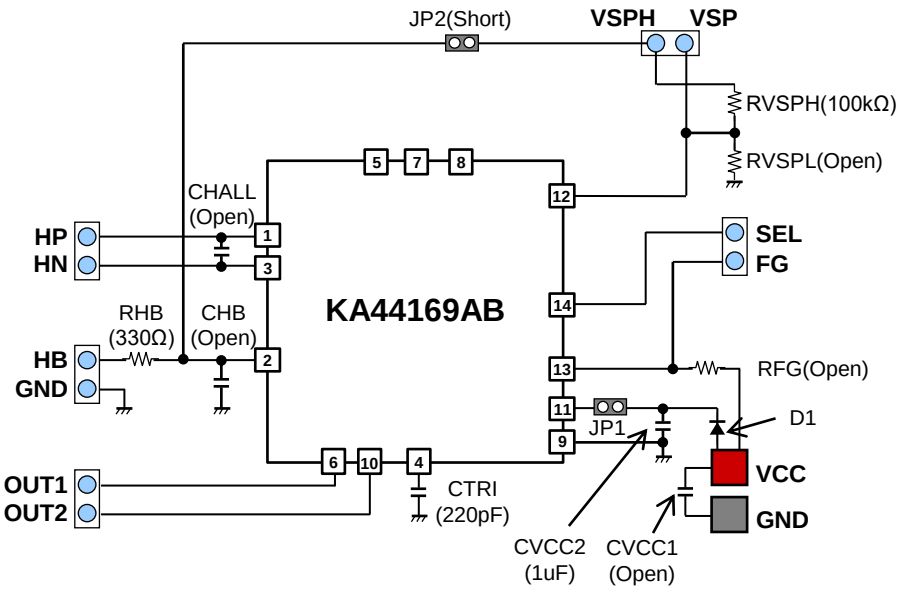
9. In case of damages, costs, losses, and/or liabilities incurred by NTCJ arising from customer's non-compliance with above from 1 to 8, customer will indemnify NTCJ against every damages, costs, losses and responsibility.

Recommended Operating Conditions

Parameter	Pin Name	Min.	Typ.	Max.	Unit	Notes
Supply voltage range	VCC	5.6	—	28	V	*1
Input voltage range	HP	0	—	1.5	V	*2
	HN	0	—	1.5	V	*2
	VSP	0	—	3	V	*2

Notes *1: It is a value under the conditions which do not exceed the absolute maximum rating and the power dissipation.
*2: For setting range of input control voltage, refer to the IC's Datasheet.

Circuit of Evaluation Board



( ) are default values of the mounted parts.

*( ) : Operation of mass production set is not guaranteed. Perform enough evaluation and verification on the design of mass production set. If the VCC Pin voltage is raised by the regenerative current, at the time of start-up or stop operating please connect a zener diode between VCC – GND Pin.

Description for Evaluation Board

Inputs & Outputs & Jumper setting

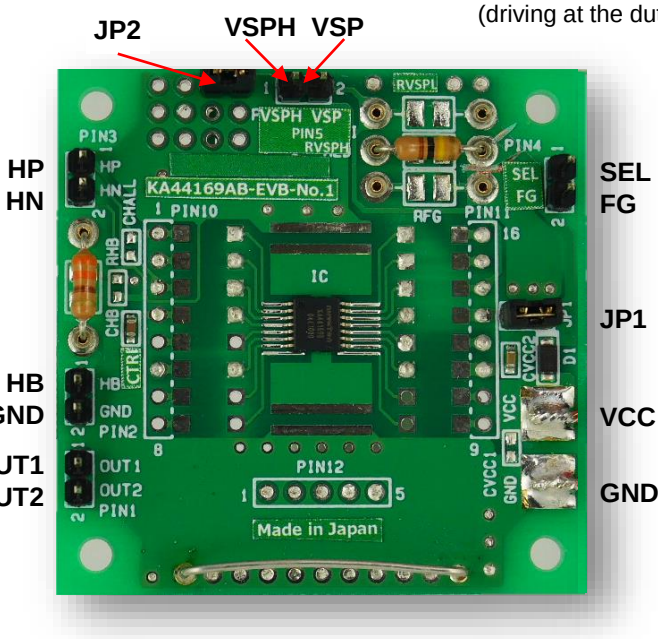
JP2:
Jumper for VSP pull-up
If the pull-up resistor for setting a initial value of the JP Pin is needed, please short the JP2.

SEL, FG:
External signal I/F
Output pin for FG and SEL
Driving mode, until FG pulse occurs twice at least, can be selected by the input voltage of SEL Pin.
Open(> 1.1V) : With the assist driving of 50% duty
< 0.4V : Without the driving assist
(driving at the duty which is set by VSP voltage)

HP, HN :
Input pin for Hall signals
Connect to Hall effect device.
Please refer to "Voltage polarity" shown below.

HB, GND :
Output pin for Hall bias
Connect to the power-Pin of Hall effect device.

OUT1, OUT2 :
Output pin for driving a motor Connect to a motor's coil.

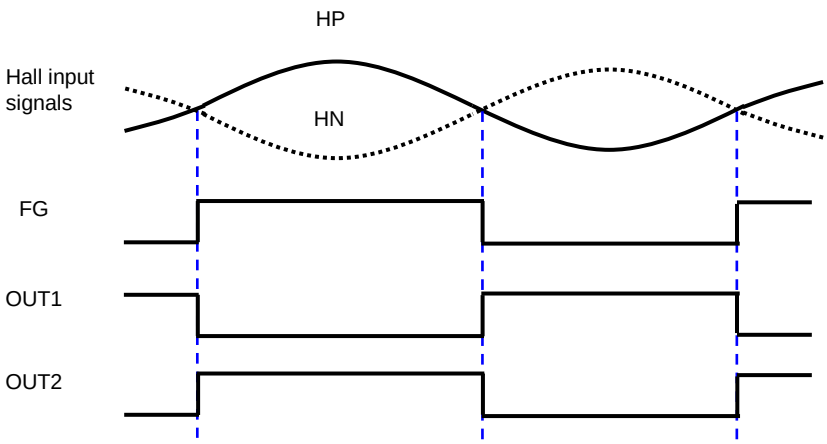


JP1:
Jumper for VCC short
Normally, please be used in short JP1.

VCC, GND:
External power supply pin
Supply the recommended operating power voltage(5.0V~28V).

Voltage polarity (exclude delay)

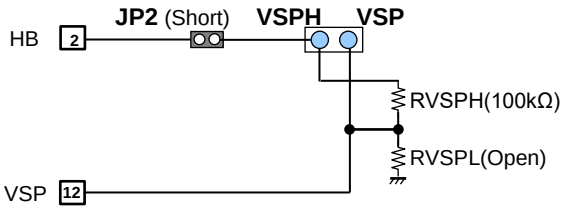
The voltage polarity of FG and OUT1/OUT2 to Hall input signals are as shown below.
Please note the voltage polarity when connecting to a motor.

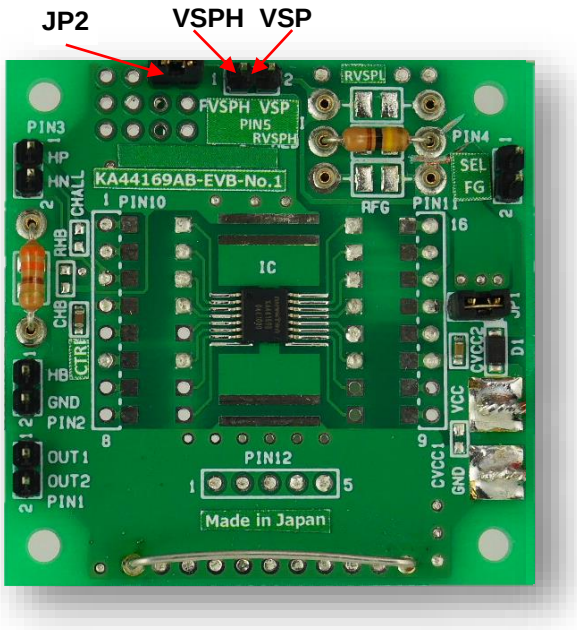


Description for Evaluation Board

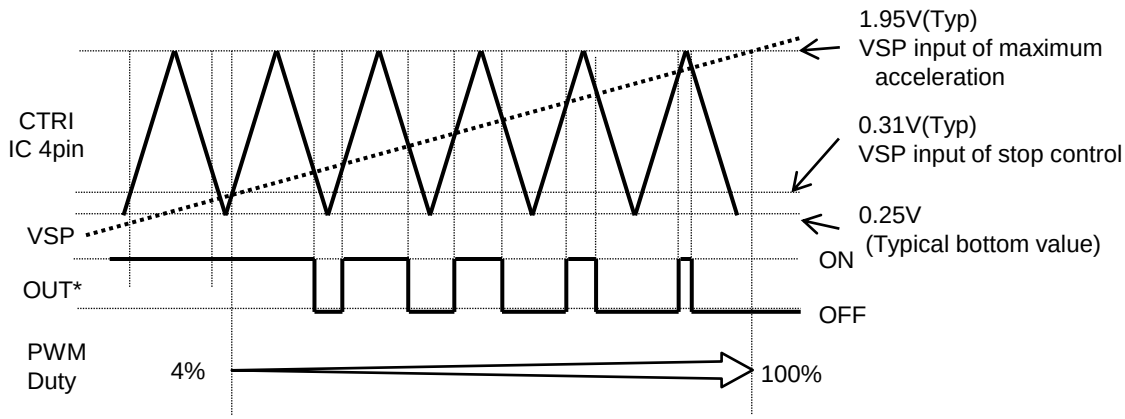
Input VSPH, VSP

VSPH, VSP:
External signal I/F
Input pin for torque direction. (DC voltage input system)
VSP input voltage can be changed by RVSPH/L resistor.





PWM duty is set by slicing the triangle waveform by VSP input voltage.
Please input the voltage within the rated voltage of VSP Pin.



Duty can be calculated by the following formula.
IC doesn't drive if VSP Pin voltage is lower than ,VSP input of stop control voltage, 0.31V(Typ).

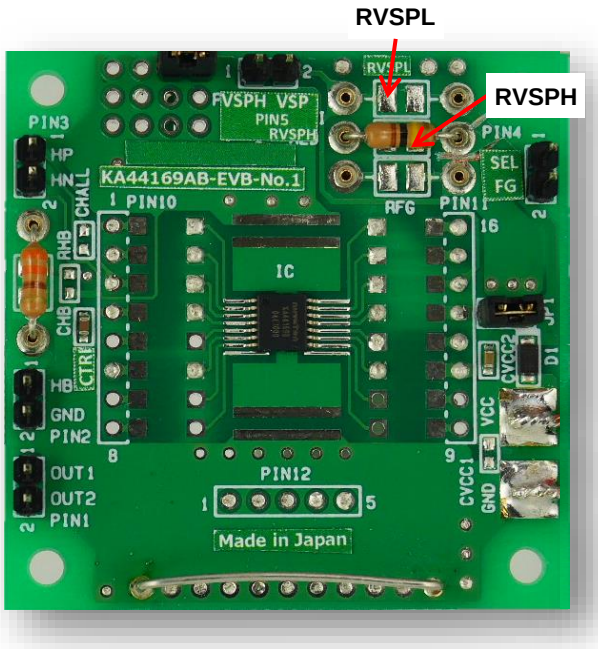
$$\text{Duty} = \frac{\text{“VSP Pin voltage”} - \text{“VSP input of stop control”}}{\text{“VSP input of maximum acceleration”} - \text{“VSP input of stop control”} - 0.06\text{V}} \times 100\ (\%)$$

Description for Evaluation Board

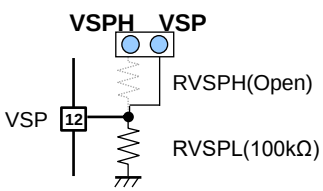
Resistance setting for VSP input

RVSPH/L

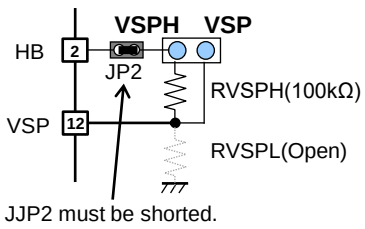
VSP input voltage level setting resistor
These are resistor for setting the input voltage level of VSP Pin.
Neither the pull-up resistor nor pull-down resistor are built.
If the initial setting is needed, RVSPH/L resistor must be set.
The default setting is “initial high setting”.



Ex1)Initial low setting

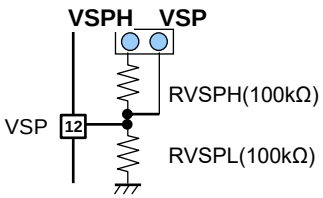


Ex2) Initial high setting



JJP2 must be shorted.

Ex3)Converting input level setting
（Attenuation=1/2）

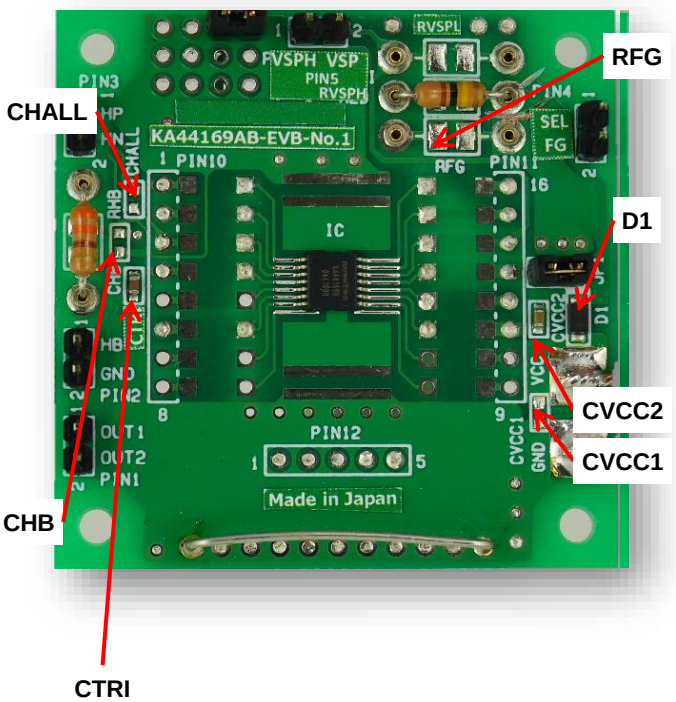


The resistance value of above reference example is reference value.
Please change according to the operating conditions.
If a resistor needs to be connected to HB Pin, please note the rated current of HB Pin

Description for Evaluation Board

Resistance & Capacitor setting

CHALL :
Differential capacitor for Hall signals
If necessary, please mount a capacitor for protection against noise.
If the addition of differential capacitor need, please note the delay of hall signal.
The default setting of CHALL is “open”



RFG :
Pull-up resistor for FG
The default setting is “open”.
If you want to pull FG-pin up to VCC, please set a resistor.

D1 :
Reverse connection protection diode
If necessary, please mount the reverse connection protection diode.

CVCC1,2 :
Bypass capacitor for power supply
If necessary, please mount a capacitor for protection against noise. (Open~10μF)
The default setting of CVCC1 is “open”
The default setting of CVCC2 is “1uF”

CHB :
Bypass capacitor for Hall bias
If necessary, please mount a capacitor for protection against noise. (Open~0.1μF)

CTRI

Triangle wave capacitor connection Pin for PWM duty & frequency
The default setting is 220pF, and PWM frequency is 27.7kHz(Typ).
PWM frequency must be set to 15kHz ~ 50kHz.
PWM frequency can be calculated by the following formula.

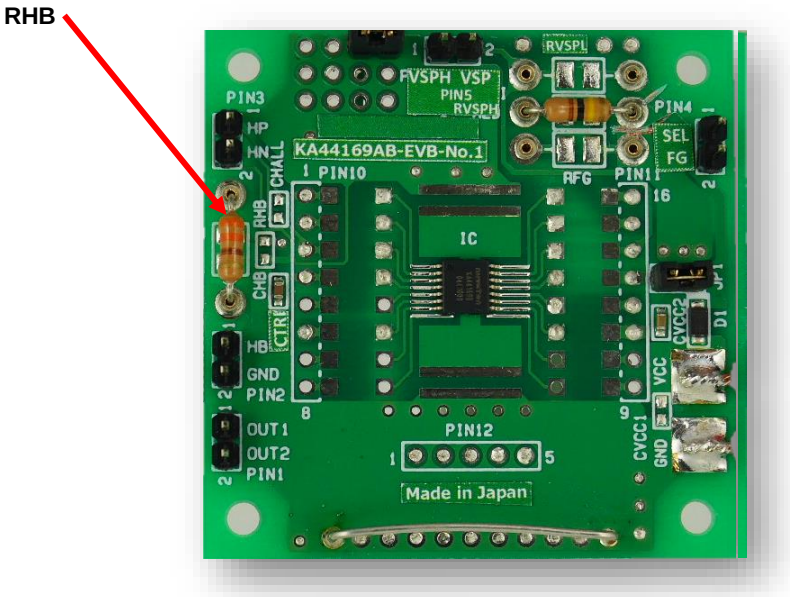
$$\text{PWM Frequency} = \frac{I_{TRI}\ (=20uA(Typ))}{(\text{“VSP input of maximum acceleration”} - \text{“VSP input of stop control”} - 0.06V) \times C_{TR} \times 2}\ (Hz)$$

Description for Evaluation Board

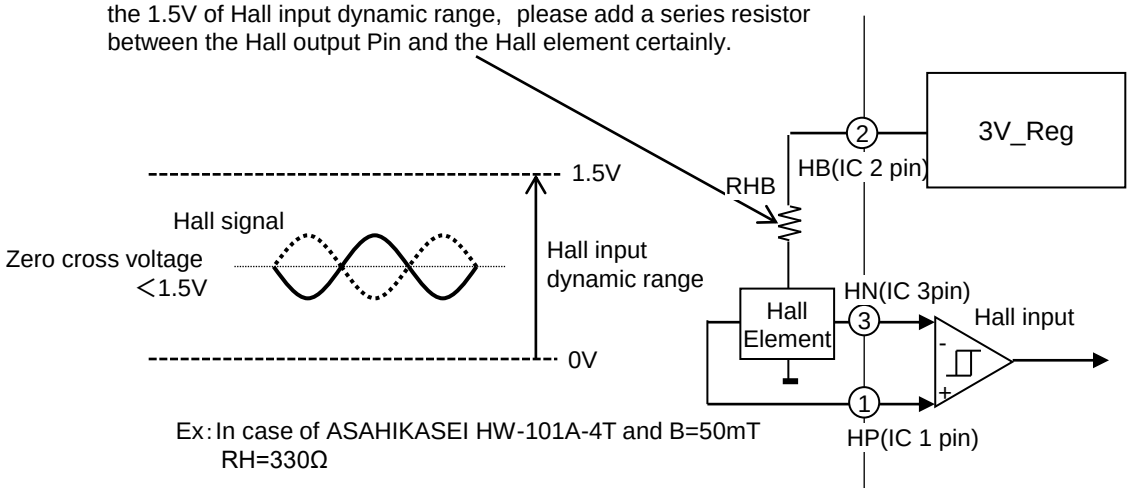
RHB setting

RHB:

Resistor to limit the Hall current and change the output voltage level of Hall signal .
Hall output voltage is 3.0V (Typical), Hall input dynamic range is 1.5V (Minimum).
As the zero-cross voltage of the Hall signal does not higher than the 1.5V of Hall input dynamic range.
Please mount a series resistor between the Hall output Pin and the Hall element.
Please note the rated current of HB Pin and Hall signal amplitude in the case of using RHB.
The default setting is 330Ω.

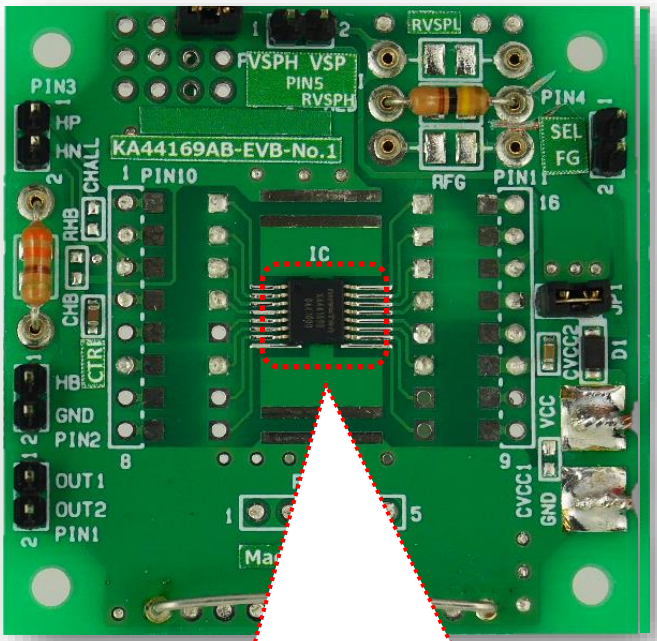


So that the zero-crossing voltage of the Hall signal is not higher than the 1.5V of Hall input dynamic range, please add a series resistor between the Hall output Pin and the Hall element certainly.



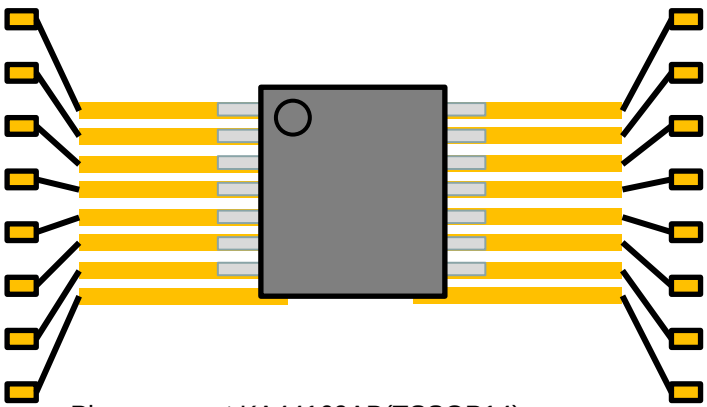
Ex: In case of ASAHIKASEI HW-101A-4T and B=50mT
RH=330Ω

Notes about mounting KA44169AB



Please refer to the following figure for the position to mount IC.

KA44169AB (TSSOP14)



Please mount KA44169AB(TSSOP14)
at the position put pin1 on the first land from the upper left.

Revision History

Date	Revision	Description	Page.
2023.11.1	1.00	1. initially issued.	

Important Notice

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All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.