AN3821K

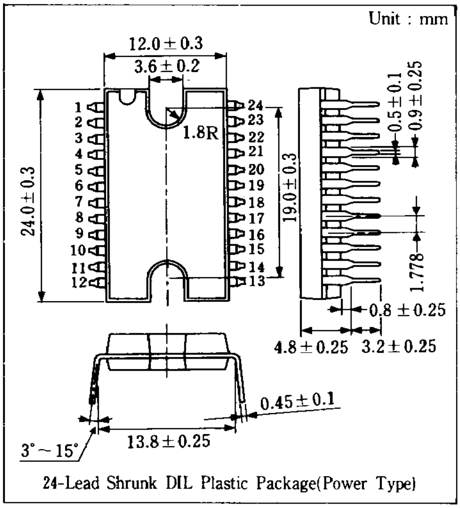
VCR Capstan Direct Motor Drive Circuit

■ Outline

The AN3821K is an integrated circuit designed to drive a VCR capstan DD motor.

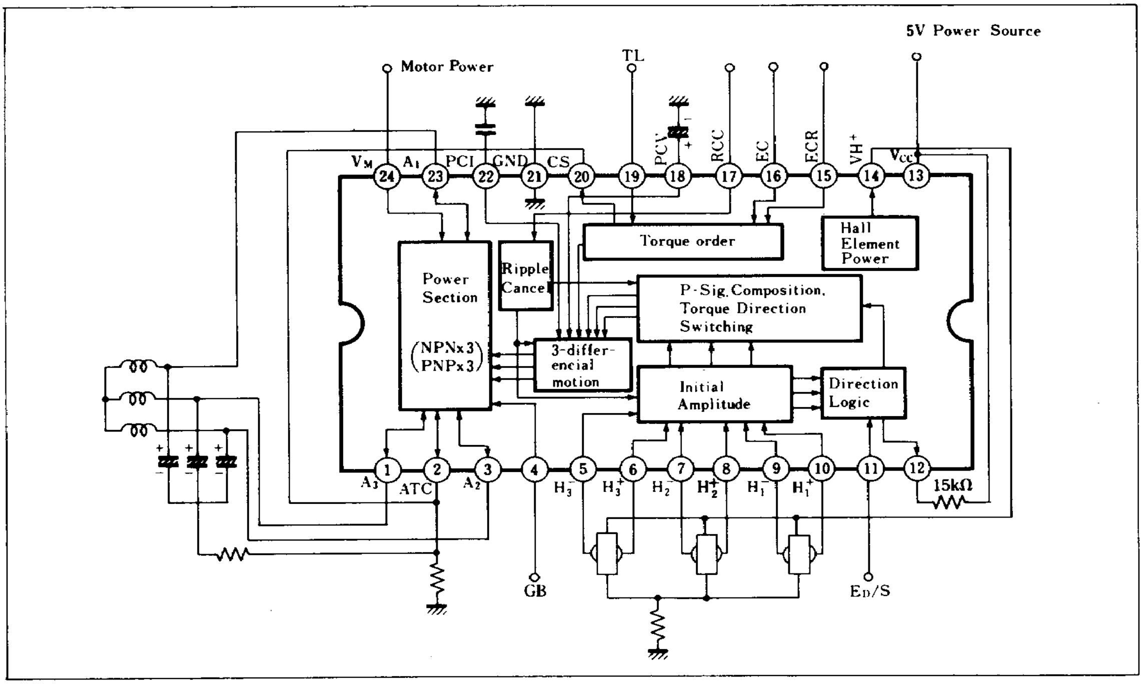
■ Features

- Three-phase full-wave operation.
- Output transistors built-in
- Torque ripple canceller circuit built-in
- Max. output current ($I_{o\ max}$): 1.5A
- Max. operation voltage of motor ($V_{M\ max}$): 24V
- Supply voltage : 5V



24-Lead Shrunk DIL Plastic Package(Power Type)

■ Block Diagram



■ Absolute Maximum Ratings (Ta=25℃)

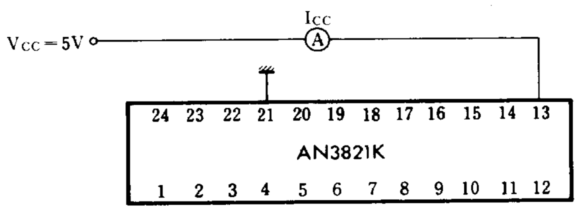
Item	Symbol	Raiting	Unit
Supply Voltage	V_{CC}	6	V
Motor Supply Voltage	$V_{M(24)}$	24	V
Motor Drive Voltage	I_1, I_3, I_{23}	±1.5	A
Output Pin Voltage	V_1, V_3, V_{23}	24	V
Power Dissipation	P_D	2000	mW
Operating Ambient Temperature	T_{opr}	−20～+70	℃
Storage Temperature	T_{stg}	−55～+150	℃

■ Electrical Characteristics (Ta=25℃)

Item	Symbol	Test Circuit	Condition	min.	typ.	max.	Unit
Supply Current	I_{CC}	1	V_{CC}=5V			15	mA
Torque Reference Voltage	ECR	2	V_{CC}=5V	2.3		3	V
Torque Command Voltage	EC	2	V_{CC}=5V, ECR=2.5V	1		4	V
Torque Command Voltage offset	EC_{offset}	2	V_{CC}=5V, ECR=2.5V	−150		+150	mV
Torque Command Voltage Dead Zone	EC_{dead}	2	V_{CC}=5V, ECR=2.5V	60		150	mV
Output Idle Voltage	EC_{Idle}	2	V_{CC}=5V, ECR=2.5V			4	mV
Input/Output Gain	G_{Io}	2	V_{CC}=5V, ECR=2.5V	0.51		0.65	times
Forward Motor Drive Command Voltage	$E_{D.F}$	3	V_{CC}=5V, ECR=2.5V			0.9	V
STOP Command Voltage	$E_{D.S}$	3	V_{CC}=5V, ECR=2.5V	1.3		3	V
Reverse Motor Drive Command Voltage	$E_{D.R}$	3	V_{CC}=5V, ECR=2.5V	3.5			V
Hall Element Supply Voltage	V_{H+}	4	V_{CC}=5V, I_H=20mA	2.6		3.2	V
Hall Element Input Allowable Voltage	$V_{H(IN)}$	5	V_{CC}=5V, I_H=20mA	1.2		2.35	V
Hall Element Input Conversion Offset	$V_{H(offset)}$	6	V_{CC}=5V, I_H=20mA	−5		5	mV
Saturation Voltage On V_M Side	$V_{p(sat)}$	7	I_a=1A	−1.2			V
Saturation Voltage On Ground side	$V_{N(sat)}$	7	I_a=1A			1.8	V
Torque Limit Current Sense Offset	$T_I\text{-}C_{S(offset)}$	8	V_{TL}=700mV	15		40	mV
Ripple Cancel Output	V_{RCC}	9	V_{CC}=5V	50			mV
Ripple Cancel ON Voltage	$V_{RCC.ON}$	9	V_{CC}=5V			0.9	V
Ripple Cancel OFF Voltage	$V_{RCC.OFF}$	9	V_{CC}=5V	1.3			V
Direction Detect Voltage	V_{ER}	10	V_{CC}=5V			0.5	V

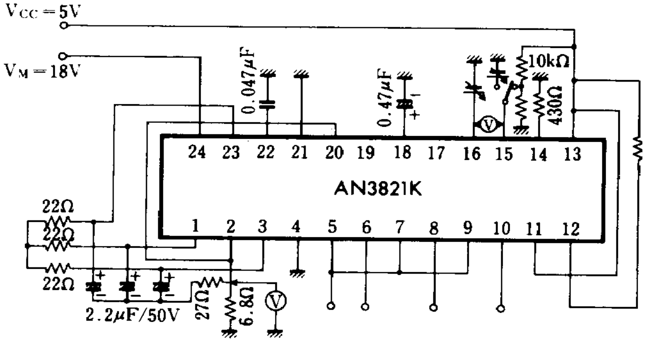
Note: Operating Supply Voltage Range: $V_{CC(opr)}$=4.5V～5.5V

Test Circuit 1 (I_{CC})

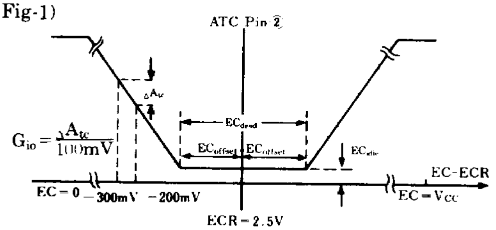


When V_{CC} Pin ⑬ and GND pin ㉑ are set to 5V and 0V respect : measure an inflow current to V_{CC} pin⑬

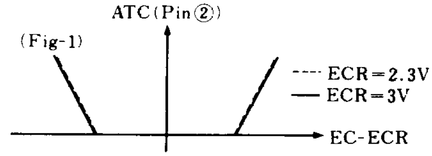
Test Circuit 2 (ECR, EC, EC_{offset}, EC_{dead}, EC_{idle}, G_{io})



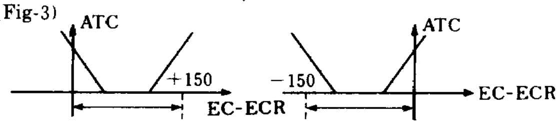
(Fig-1)



(Fig-2)



(Fig-3)



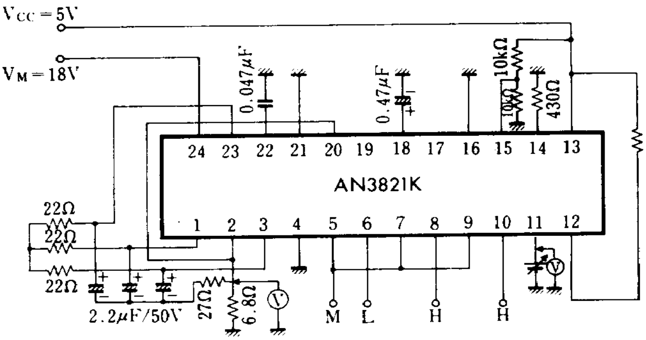
- ECR, EC:
  1. Input coditions are as follows.
     Provided, H = 1.9V
     M = 1.7V
     L = 1.5V
  2. When ECR is set at 2.3~3V, check V characteristics (see Fig.-1).
     Whereas after ECR Pin ⑮ is set and EC Pin ⑯ is made variable, measure ATC Pin ② voltage.

H_1^+Pin⑩	H_2^+Pin⑧	H_3^+Pin⑥	H_CPin⑨,⑦⑤
H	H	L	M

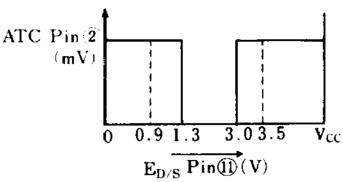
- EC_{offset}, EC_{idle}, G_{IO}:
  1. Under same conditions of ECR and EC, after ECR Pin ⑮ is set at 2.5V and EC Pin ⑯ is made variable from 0~V_{CC}, measure ATC Pin ② voltage (see Fig.-2).

Note: · Idle voltage denotes ATC voltage at dead zone.
· Torque command voltage offset (4) is assumed as characteristics shown in Fig.-3.
· The offset range is ±150mV in ECR specifications.

Test Circuit 3 ($E_{D\cdot F}$, $E_{D\cdot S}$, $E_{D\cdot R}$)



(Fig-4)



1. Setting conditions as shown left, set ED voltage Pin ⑪ at 0V.
2. Gradually increase ED voltage and measure a thresh point of characteristics diagram. (See Fig.-4.)

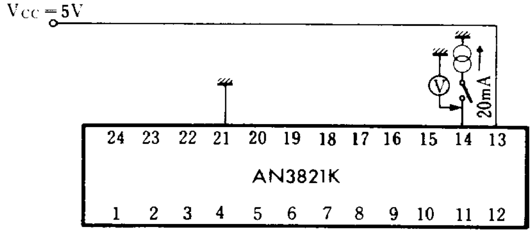
(Input conditions)

H_1^+Pin⑩	H_2^+Pin⑧	H_3^+Pin⑥	H_CPin⑨,⑦⑤
H	H	L	M

(Measuring method)

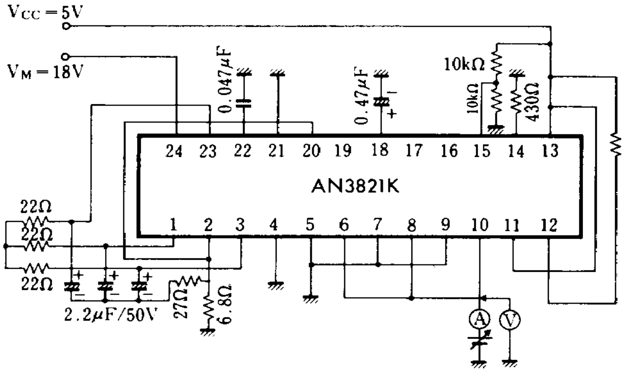
Symbol	E_DPin⑪	ATCPin②
$E_{D.F}$	Measurement	+
$E_{D.S}$	Measurement	0^V
$E_{D.R}$	Measurement	+

Test Circuit 4 (V_H)



1. Measure Pin ⑭ voltage when drawing out the rated current 20mA from V_H+Pin ⑭.

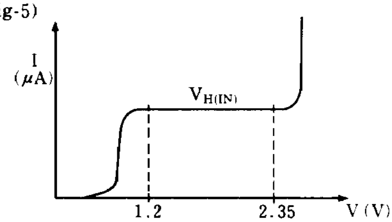
Test Circuit 5 ($V_{H(IN)}$)



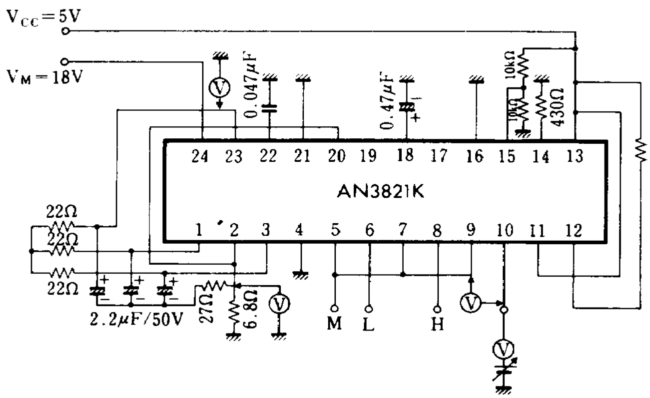
1. Connecting H_3+Pin ⑥, H_2+Pin ⑧, and H_1+ Pin ⑩, when 1.2V and 2.35V are applied, read each current value.

Note) Change of current when voltage is applied gradually from 0V is shown in Fig.5

(Fig-5)



Test Circuit 6 ($V_{H(offset)}$)

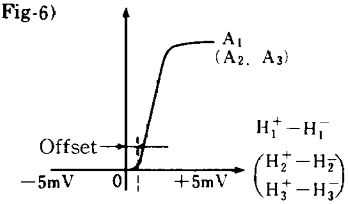


Input setting has the following three types. Circuit diagram shown left is an example of input setting 1. In this case, measuring methods are shown as follows.

1. Select the input setting to 1.
2. Observe change of A_1 Pin㉓ voltage when (H_1+Pin⑩ − H_1−Pin⑨) is changed at 1mV Step.
3. Differential voltage of input ($H_1^+ - H_1^-$) should be within ±5mV when A_1 voltage becomes from "L" to "H"

Follows the procedure above even in case of input settings 3 and 5.

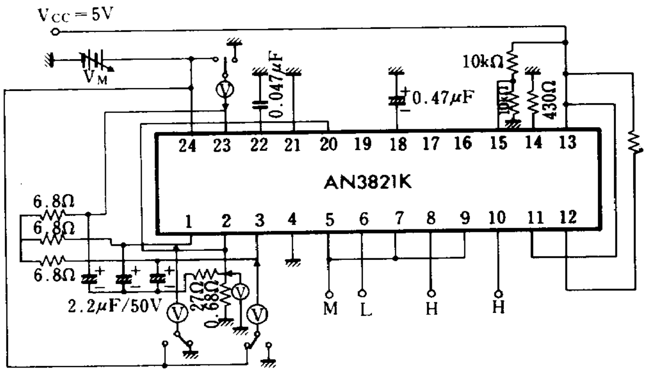
(Fig-6)



(Input)

Setting	Input			Output		
	H_1^+⑩	H_2^+②	H_3^+⑥	A_1㉓	$A_2$③	$A_3$①
1	Change	H	L	Change	H	L
3	L	Change	H	L	Change	H
5	H	L	Change	H	L	Change

Test Circuit 7 ($V_{P(sat)}$, $V_{N(sat)}$)



(Input)

Setting	Input			Output		
	H_1^+⑩	H_2^+⑧	H_3^+⑥	A_1㉓	$A_2$③	$A_3$①
1	H	H	L	M	H	L
3	L	H	H	L	M	H
5	H	L	H	H	L	M

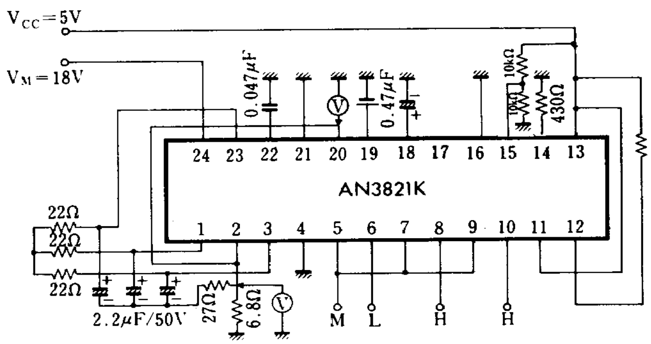
Input setting has the following three types. Circuit diagram left is the case of input setting 1. In this case, the measuring methods are shown as follows

1. Select the input setting 1.
2. Measure ATC Pin② voltage and adjust VM voltage so that Ia=1A, that is, ATC Pin② voltage will be 680mV.
3. Measure the voltage difference between Pin (in case of setting 1, A_2 Pin③) which becomes "H" for output and GND Pin㉔. This value is the saturation voltage on V_{CC} side.
4. Measure the voltage difference between Pin (in case of setting 1, A_2 Pin①) which becomes "H" for output and GND Pin㉑. The value at this time is the saturation voltage on ground side.

(Pin to be measured)

Setting	V_{CC} side	Ground side
1	③~㉔	①−GND
3	①~㉔	㉓−GND
5	㉓~㉔	③−GND

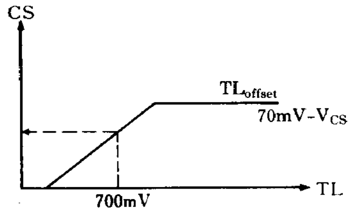
Test Circuit 8 (T_L-$C_{S(offset)}$)



1. Measure CS⑳ voltage when TL⑲ voltage is set at 700mV.

Note) Relationship between torque limit (TL) and current sense (CS) is as shown in Fig.-7.

(Fig-7)



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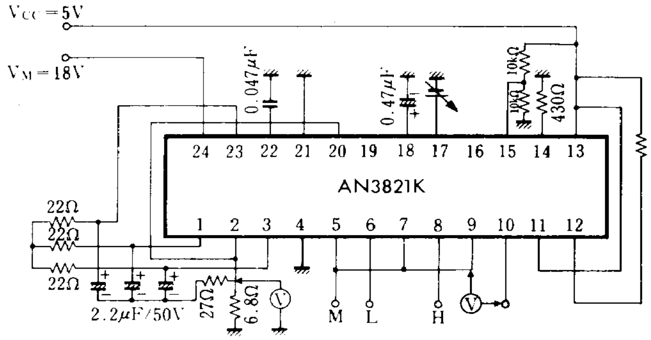
Test Circuit 9 (V_{RCC}, $V_{RCC\text{-}ON}$, $V_{RCC\text{-}OFF}$)



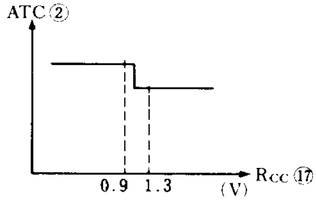
● V_{RCC}:

1. Set input.
2. Measure ATC② voltage when R_{CC}⑰=0V.
3. Lowering H_1^+⑩ voltage gradually.
4. Ripple cancel output voltage will be $VR_1 - VR_2$ when ATC② voltage for H_1^+⑩ − H_1^-⑨ = 20mV and H_1^+⑩ − H_1^- = 0mV is assumed as VR_1 and VR_2 respectively.

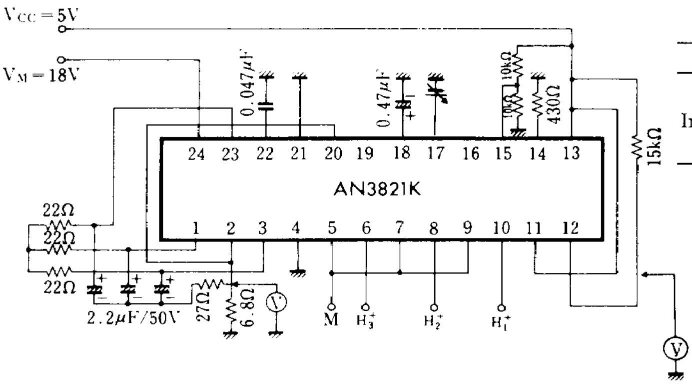
● V_{RCC}, V_{RCC-ON}, $V_{RCC-OFF}$:

1. Set input.
2. Measure ATC② voltage for R_{CC}⑰=0V.
3. Gradually increasing R_{CC} voltage, measure R_{CC} voltage when ATC level is changed. (See Fig.-8.)

(Fig-8)



Test Circuit 10 (V_{ER})

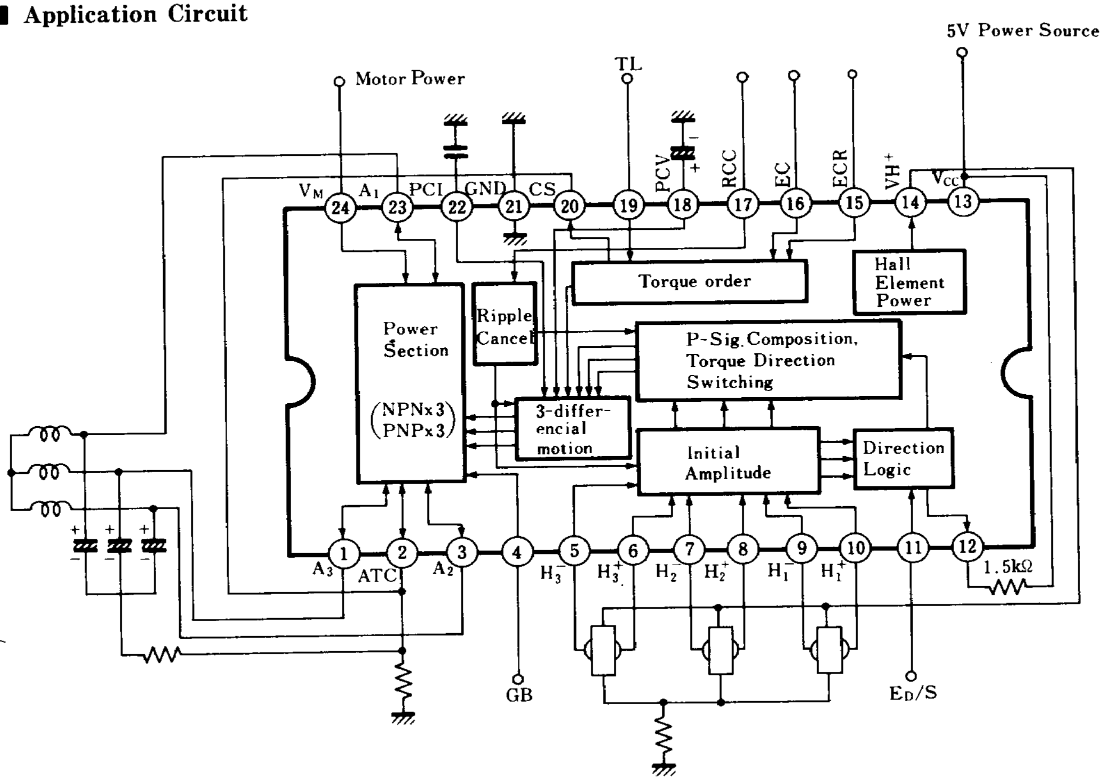


		1	2	3	4	5	6
Input	H_1^+⑩	H	L	L	L	H	H
	H_2^+⑧	H	H	H	L	L	L
	H_3^+⑥	L	L	H	H	H	L

Provided, H = 1.9V
M = 1.7V
L = 1.5V

First, set H_1^+, H_2^+ and H_3^+ to setting 6 and then change input in the order of 6→5→4→3→2→1 sequentially. Measure ER Pin ⑫. E at setting 1.

■ Application Circuit



■ Pin

Pin No.	Pin Name	Pin No.	Pin Name
1	Drive Output 3	13	V_{CC}
2	Total Output Current	14	Hall Element Supply Input
3	Drive Output 4	15	Reference Voltage Input
4	Generation Brake	16	Torque Order Input
5	Hall Element Input	17	Ripple Cancel Control Input
6	Hall Element Input	18	Voltage Feedback System Phase Compensation
7	Hall Element Input	19	Torque Limit Terminal
8	Hall Element Input	20	Current Detection Terminal
9	Hall Element Input	21	GND
10	Hall Element Input	22	Current Feedback System Phase Compensation
11	Rotation Direction Order Input	23	Drive Output 1
12	Rotation Direction Input	24	Motor Power