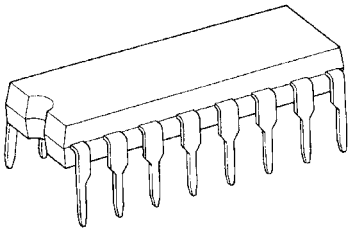
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8415P

STEPPING MOTOR CONTROLLER / DRIVER

The TA8415P is general purpose unipolar stepping motor controller / driver, applicable to 3 / 4 phase motors and 1, 1−2, 2 phase excitation drive by initial setting of control terminals.



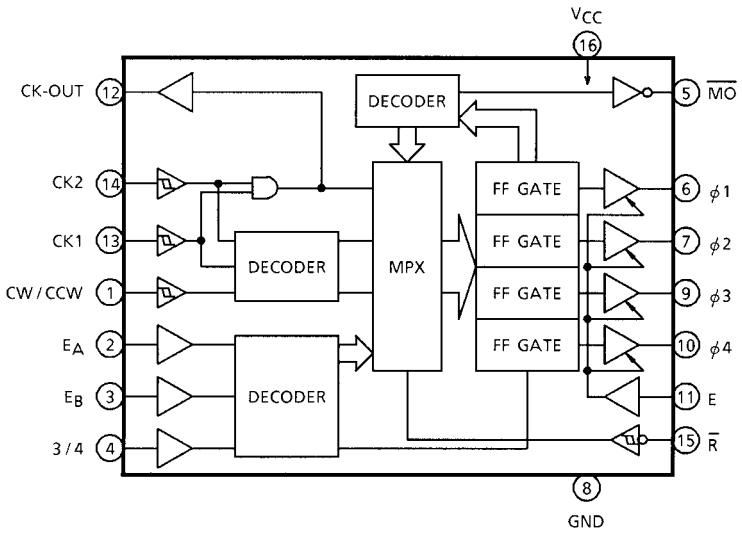
DIP16-P-300-2.54A

Weight: 1.11 g (Typ.)

FEATURES

- 1 chip stepping motor controller / driver.
- 3 or 4 phase and 1, 1−2, 2 phase excitation drive are available.
- CW / CCW rotation and 1 clock or 2 clock drive are available.
- Hysteresis is provided with clock, CW / CCW, reset inputs for noise protection.
- Output enable, initial detect are available.
- Output current up to 400mA (MAX.)

BLOCK DIAGRAM



PIN FUNCTION

PIN No.	SYMBOL	PIN NAME	FUNCTIONAL DESCRIPTION	
1	CW / CCW	Clock Wise / Counter Clock Wise	Direction Control Input Function Table A	
2	E_A	Excitation A	Phase Excitation Mode Input	Truth Table B
3	E_B	Excitation B		
4	3 / 4	3 Phases / 4 Phases	Phase Control Input	
5	$\overline{MO}$	Monitor Out	$\overline{MO}$ = “L” at Initial State	
6	φ1	φ1 Out	φ1 Output	
7	φ2	φ2 Out	φ2 Output	
8	GND	GND	GND	
9	φ3	φ3 Out	φ3 Output	
10	φ4	φ4 Out	φ4 Output	
11	E	Output Enable	Outputs are Enable at E = “H”	
12	CK−OUT	Clock−Out	Clock Output	
13	CK1	Clock I_n−1	Clock Input 1	Truth Table A
14	CK2	Clock I_n−2	Clock Input 2	
15	$\overline{R}$	Reset	Reset Input	
16	V_{CC}	V_{CC}	V_{CC}	

TRUTH TABLE A

CK1	CK2	CW / CCW	FUNCTION
↓	H	L	CW
↑	L	L	Inhibit
H	↓	L	CCW
L	↑	L	Inhibit
↓	H	H	CCW
↑	L	H	Inhibit
H	↓	H	CW
L	↑	H	Inhibit

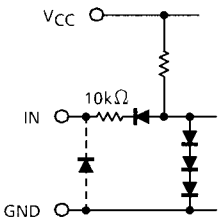
TRUTH TABLE B

E_A	E_B	3 / 4 (Note)	FUNCTION	
L	L	L	4 Phases	1 Phase Excitation
H	L	L		2 Phase Excitation
L	H	L		1−2 Phase Excitation
H	H	L	Test Mode φ1~φ4 ON	
L	L	H	3 Phases	1 Phase Excitation
H	L	H		2 Phase Excitation
L	H	H		1−2 Phase Excitation
H	H	H	Test Mode φ1~φ4 ON	

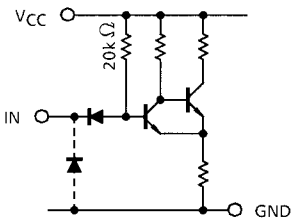
Note: Conversion of Phase Excitation Mode must be made after the Reset Mode is established.

SCHEMATIC OF INPUTS AND OUTPUTS

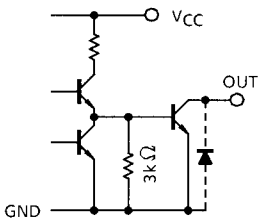
E_A, E_B, 3/4, E



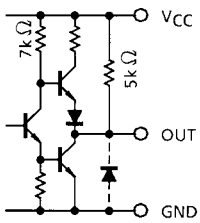
CK1, CK2, CW/CCW, $\overline{R}$



$\phi 1 \sim \phi 4$



$\overline{MO}$, CK-OUT



MAXIMUM RATINGS (Ta = 25°C Unless otherwise noted)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	−0.3~7.0	V
Output Sustaining Voltage	$V_{CE\,(SUS)\varphi}$	−0.3~28	V
Output Current (ϕn)	$I_{OUT\varphi}$	400	mA
Output Current ($\overline{MO}$, CK−OUT)	$I_{OUT\ \overline{MO}\ CK-OUT}$	10	mA
Input Voltage	V_{IN}	−0.3~V_{CC} + 0.3	V
Input Current	I_{IN}	±1	mA
Power Dissipation	P_D	1.2	W
Operating Temperature	T_{opr}	−30~85	°C
Storage Temperature	T_{stg}	−55~150	°C

RECOMMENDED OPERATION CONDITION (Ta = −30~85°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Supply Voltage		V_{CC}	—	4.5	5.0	5.5	V
Output Sustaining Voltage		$V_{CE\,(SUS)\varphi}$	—	0	—	26	V
Output Current φn	"L" Level	$I_{OUT\varphi}$	—	—	—	200	mA
Output Current $\overline{MO}$, CK−OUT	"H" Level	I_{OH}	—	—	—	−0.4	mA
	"L" Level	I_{OL}	—	—	—	8	
Input Voltage		V_{IN}	—	0	—	V_{CC}	V
Clock Frequency		f_{CLOCK}	—	0	—	100	kHz
Power Dissipation		P_D	—	—	—	0.6	W

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

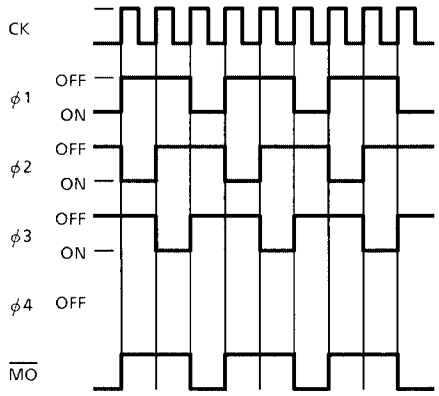
CHARACTERISTIC			SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Input Voltage	"H" Level		V_{IH}	—	—	2.0	—	—	V
	"L" Level		V_{IL}		—	—	—	0.8	
Input Current	"H" Level		I_{IH}	—	V_{CC} = 5.5 V, V_{IH} = 5.5 V	—	—	10	μA
	"L" Level		I_{IL}		V_{CC} = 5.5 V, V_{IL} = 0.4 V	—	—	−0.4	mA
Hysteresis			ΔV_T	—	—	—	150	—	mV
Supply Current			I_{CC}	—	—	—	—	100	mA
Output Leakage Current ϕn			$I_{OH\varphi}$	—	V_{CC} = 5.5 V, V_{OUT} = 26 V	—	—	100	μA
Output Voltage	"H" Level	$\overline{MO}$ CK-OUT	V_{OH}	—	V_{CC} = 4.5 V, I_{OH} = −0.4 mA	2.4	—	—	V
					V_{CC} = 5.0 V, I_{OH} = −10 μA	4.0	—	—	
	"L" Level	$\overline{MO}$ CK-OUT	V_{OL}	—	V_{CC} = 4.5 V, I_{OL} = 8 mA	—	—	0.4	
		φn	$V_{OUT\varphi}$	—	V_{CC} = 4.5 V, I_{OUT} = 400 mA t = 100 ms	—	—	1.1	
				—	V_{CC} = 4.5 V, I_{OUT} = 200 mA t = 100 ms	—	—	0.6	

SWITCHING CHARACTERISTICS (Ta = 25°C)

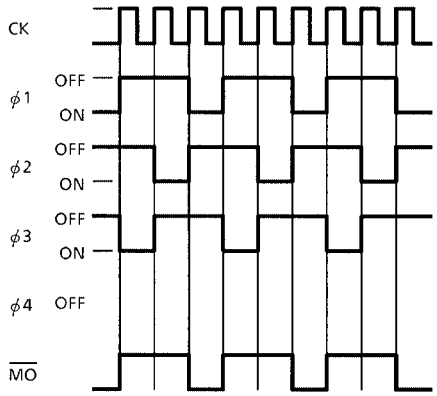
CHARACTERISTIC			SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Propa-gation Delay Time	"H" Level	CK-φn	t_{pLH}	—	—	—	2.0	—	μs
		CK-CK-OUT				—	1.0	—	
		CK-$\overline{MO}$				—	2.8	—	
		E-φn				—	1.0	—	
		R-φn				—	2.0	—	
	"L" Level	CK-φn	t_{pHL}			—	1.4	—	
		CK-CK-OUT				—	0.7	—	
		CK-$\overline{MO}$				—	2.1	—	
		E-φn				—	1.2	—	
		$\overline{R}$ -φn				—	1.0	—	
		R-MO				—	2.0	—	
Maximum Clock Frequency			f_{max}	—	—	—	250	—	kHz
Set Up Time CK, CW / CCW			t_{set-up}	—	—	—	0.1	—	
Hold Time CK, CW / CCW			t_{hold}	—	—	—	0.1	—	
Minimum Clock Pulse Width			$t_{w\,(CK)}$	—	—	—	1.0	—	
Minimum Reset Pulse Width			$t_{w\,(R)}$	—	—	—	1.0	—	
Maximum Clock Rise Time			t_r (CK)	—	—	—	10	—	μs

TIMING CHART
3 PHASES METHOD

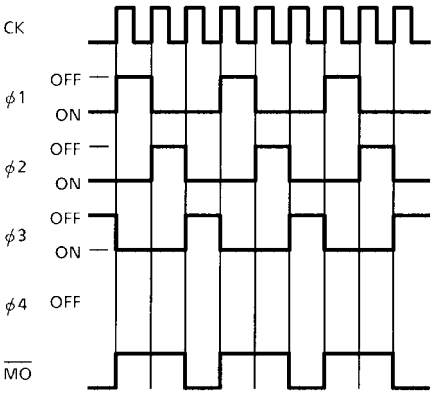
1 PHASE EXCITATION CW



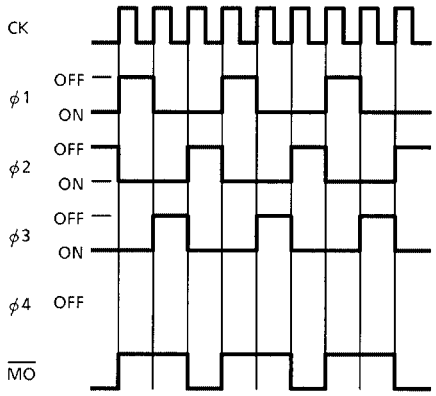
1 PHASE EXCITATION CCW



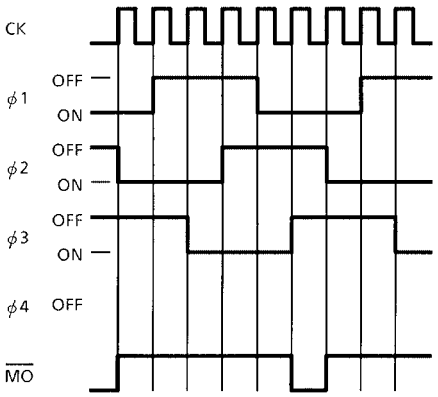
2 PHASE EXCITATION CW



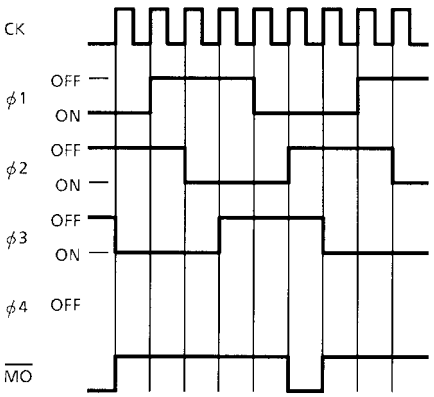
2 PHASE EXCITATION CCW



1−2 PHASE EXCITATION CW

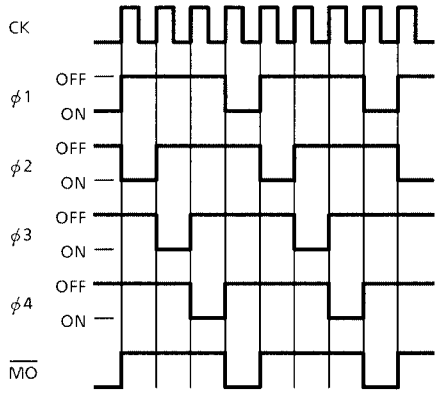


1−2 PHASE EXCITATION CCW

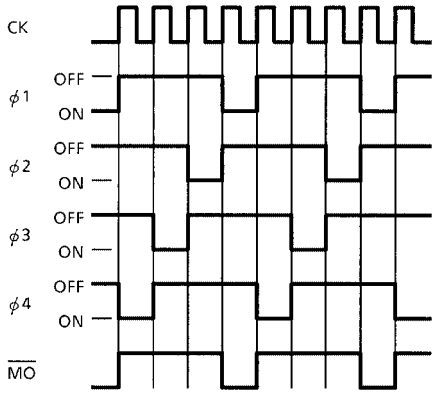


4 PHASES METHOD

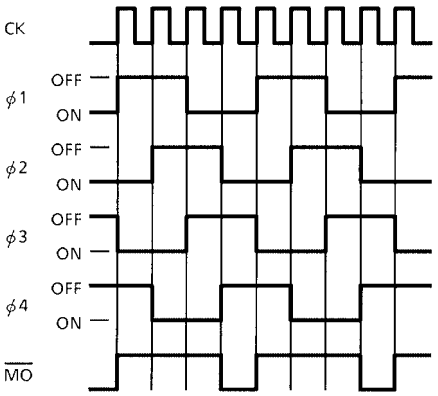
1 PHASE EXCITATION CW



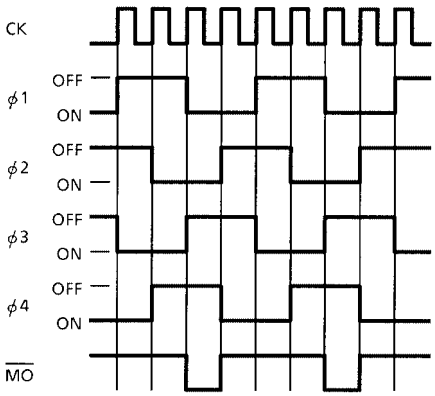
1 PHASE EXCITATION CCW



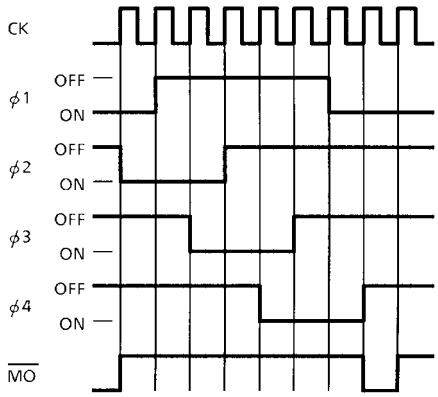
2 PHASE EXCITATION CW



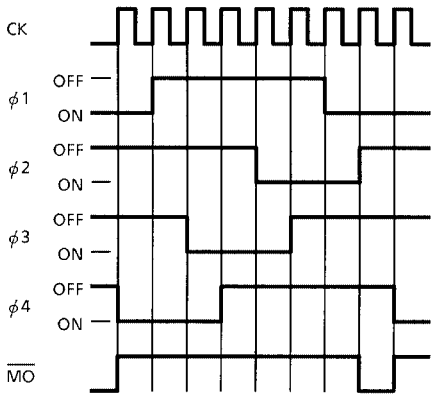
2 PHASE EXCITATION CCW

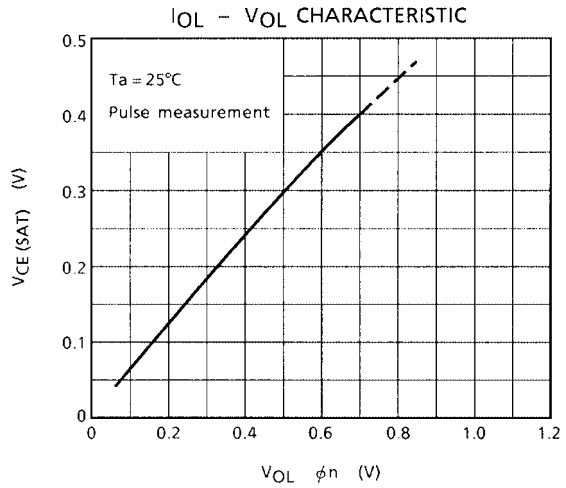


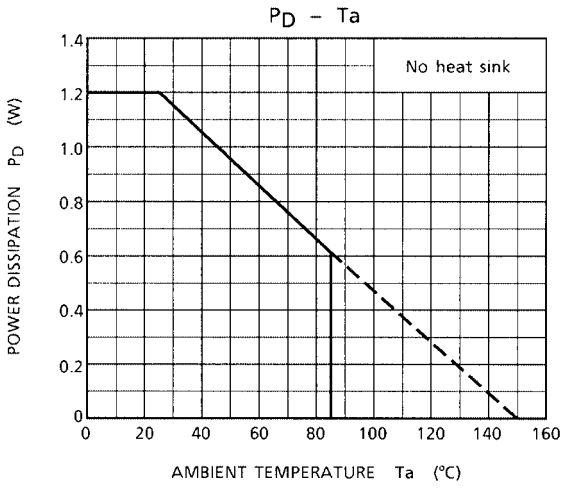
1−2 PHASE EXCITATION CW



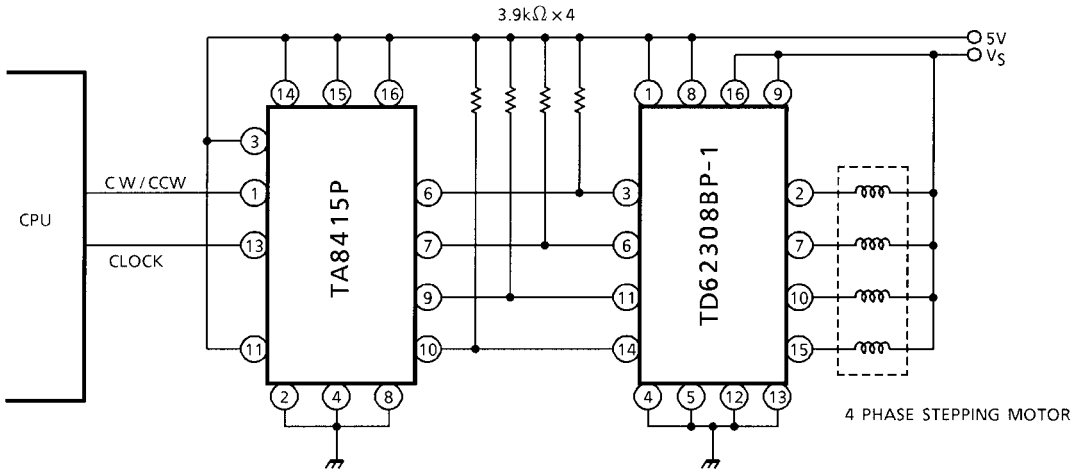
1−2 PHASE EXCITATION CCW



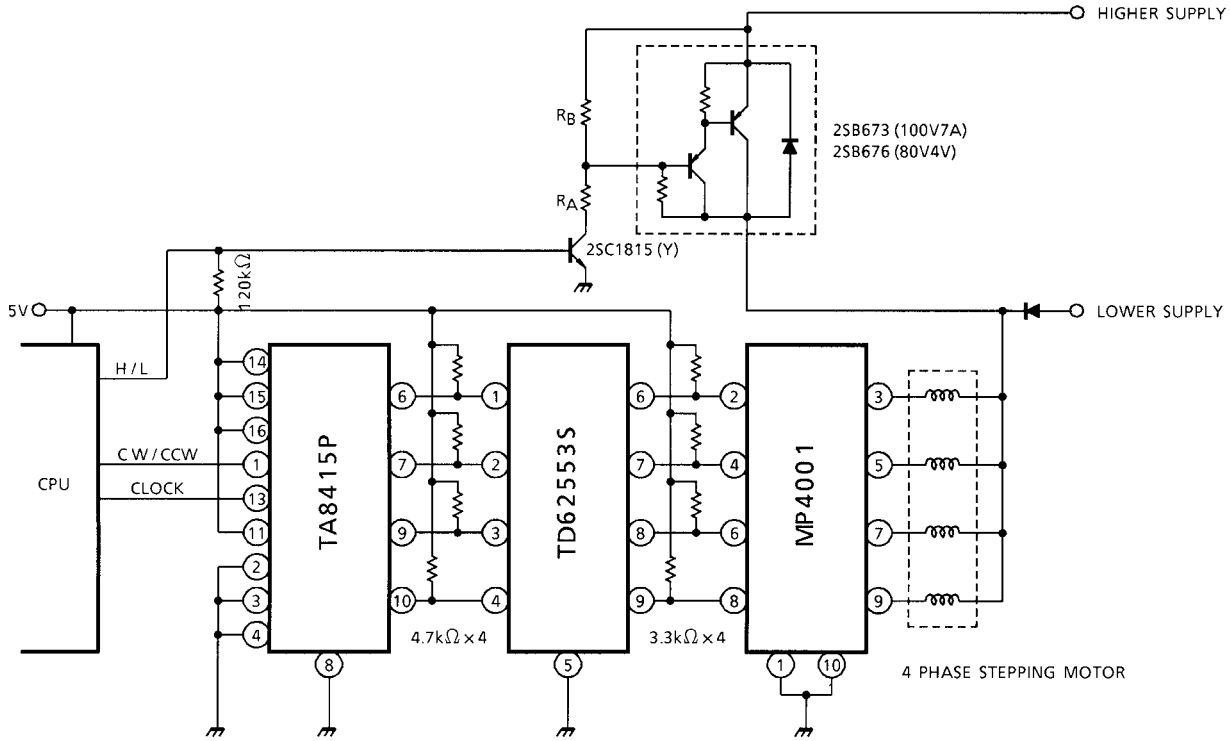

I_{OL} – V_{OL} CHARACTERISTIC
Ta = 25°C
Pulse measurement
$V_{CE (SAT)}$ (V)
V_{OL} ϕn (V)
0.5
0.4
0.3
0.2
0.1
0
0.2
0.4
0.6
0.8
1.0
1.2


P_D – Ta
No heat sink
POWER DISSIPATION P_D (W)
AMBIENT TEMPERATURE Ta (°C)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
160

APPLICATION CIRCUIT 1
(TA8415P + TD62308BP 4 phase stepping motor driver circuit)

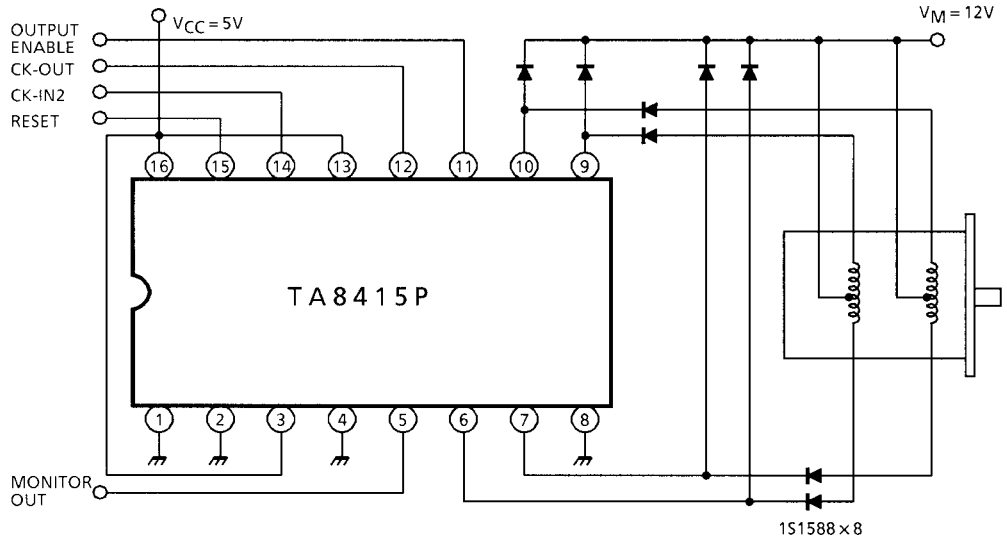


APPLICATION CIRCUIT 2
(TA8415P + TD62553S + MP4001 high efficiency stepping motor driver circuit)



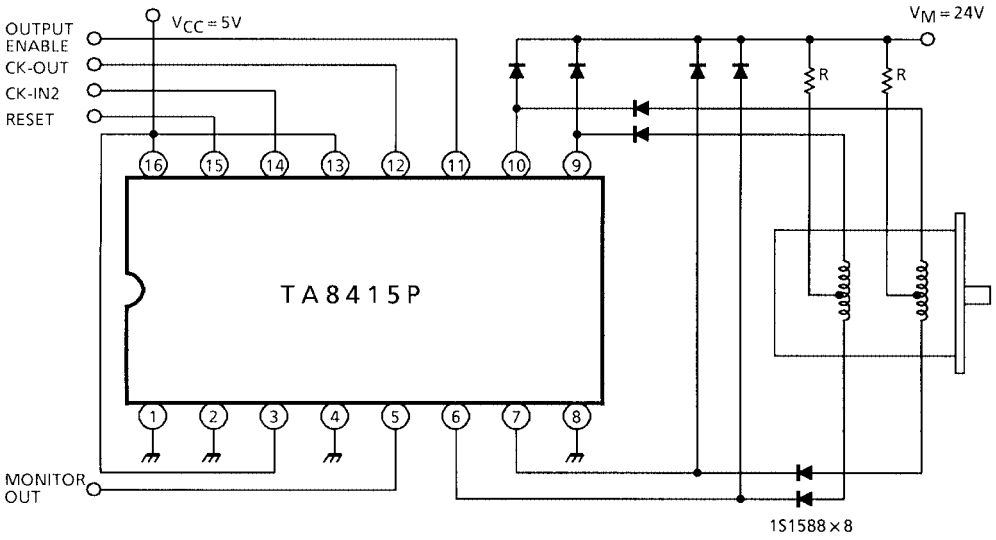
APPLICATION CIRCUIT 3

4 phase motor 1−2 phase excitation drive Ⅰ.



APPLICATION CIRCUIT 4

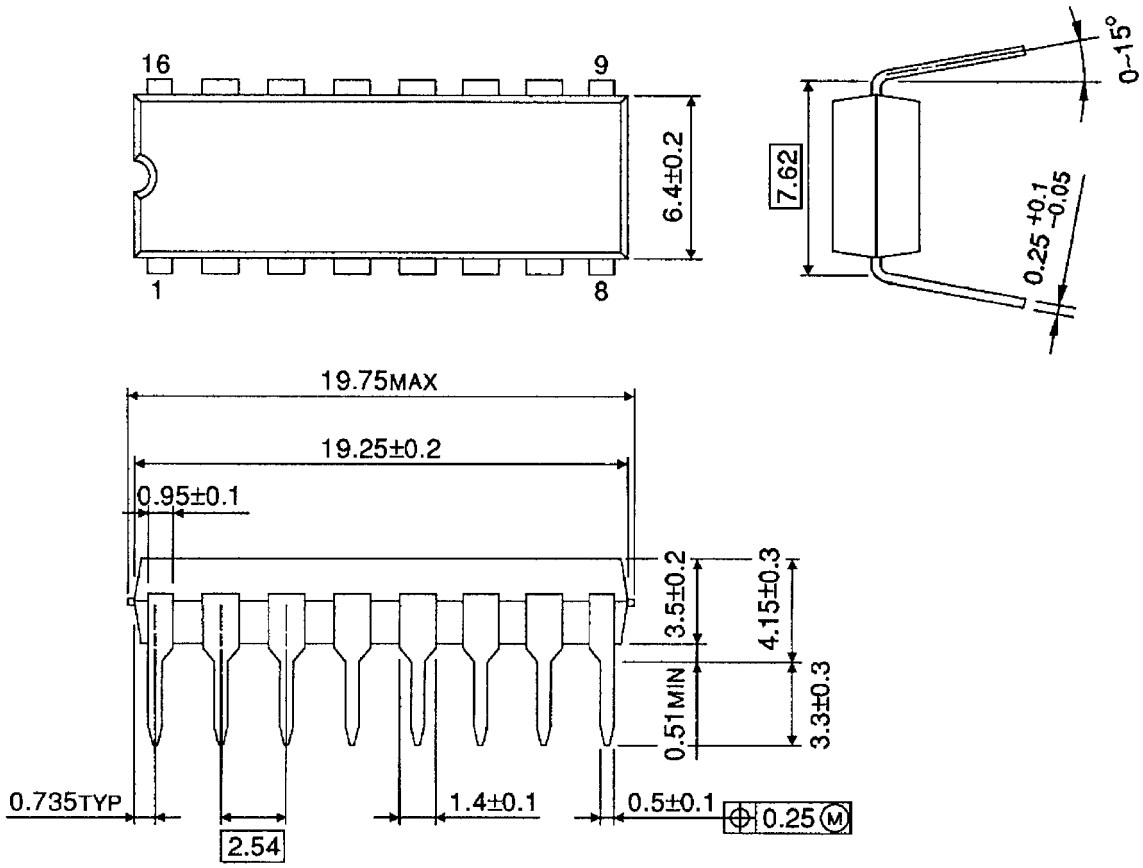
4 phase motor 1−2 phase excitation drive Ⅱ.



Note: Utmost care is necessary in the design of the output line, power supply and GND line since IC may be destroyed due to short−circuit between outputs, air contamination fault, or fault by improper grounding.

PACKAGE DIMENSIONS

DIP16−P−300−2.54A Unit: mm



Weight: 1.11 g (Typ.)

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000707EBA

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