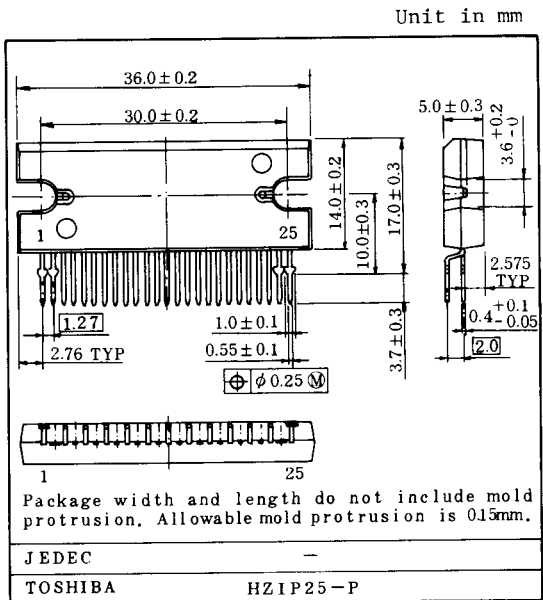


TA8425H

PWM CHOPPER TYPE BIPOLAR STEPPING MOTOR DRIVER.

TA8425H is PWM chopper type sinusoidal micro step bipolar stepping motor driver. Sinusoidal micro step operation is accomplished only a clock signal inputting by means of built-in hardware.

- . 1 chip bipolar sinusoidal micro step stepping motor driver.
- . Output current up to 1.5A(AVE) and 2.5A(PEAK).
- . PWM chopper type.
- . Structured by high voltage Bi-CMOS process technology.
- . Forward and reverse rotation are available.
- . 2, 1-2, W1-2, 2W1-2 phase 1 or 2 clock drive are selectable.
- . Package: CPP-25
- . 40kΩ(Typ.) of pull up resistors are provided with CK1,CK2, ENABLE terminals.
- . 40kΩ(Typ.) of pull down resistors are provided with M1,M2, REF IN terminals.



MAXIMUM RATINGS (Ta=25°C)

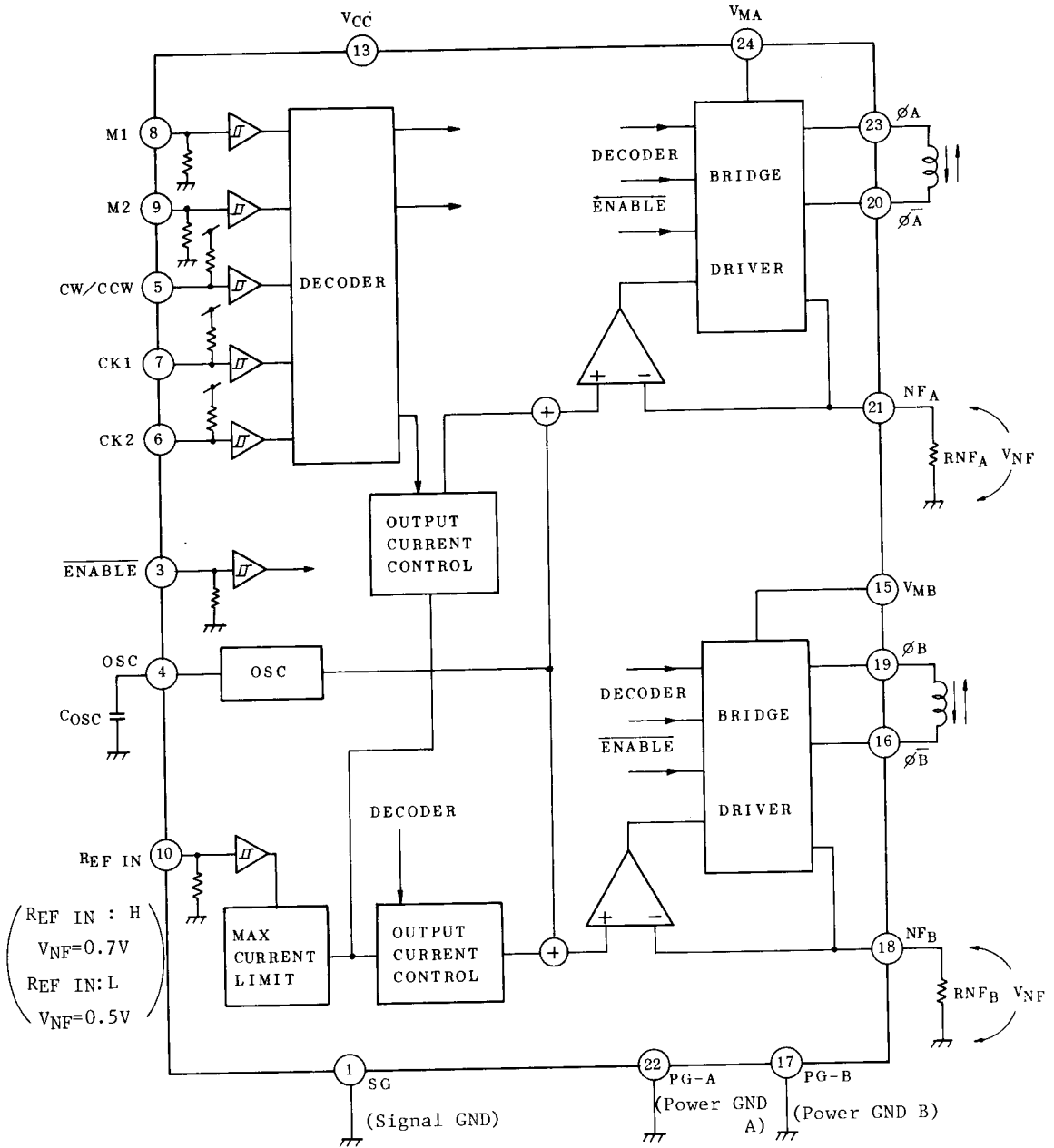
CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V _{CC}	5.5	V
	V _M	40	
Output Current	I _O (PEAK)	2.5	A
	I _O (AVE)	1.5	
Input Voltage	V _{IN}	~V _{CC}	V
Power Dissipation	P _D	*4	W
		**43	
Operating Temperature	T _{opr}	-40~85	°C
Storage Temperature	T _{stg}	-55~150	°C
Feed Back Voltage	V _I	1.0	V

* No heat sink

** T_c=85°C

TA8425H

BLOCK DIAGRAM



Pull Up/Pull Down Resistance : 40kΩ(Typ.)
 (2), (11), (12), (14), (25) Pin : No Connection.

FUNCTION TABLE

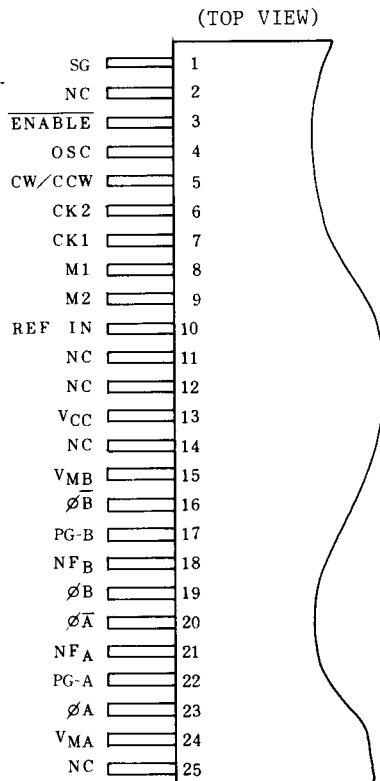
INPUT				MODE
CK1	CK2	CW/CCW	ENABLE	
	H	L	L	CW
	L	L	L	INHIBIT
H		L	L	CCW
L		L	L	INHIBIT
	H	H	L	CCW
	L	H	L	INHIBIT
H		H	L	CW
L		H	L	INHIBIT
X	X	X	H	Z

INPUT		MODE (EXCITATION)
M1	M2	
L	L	2 Phase
H	L	1-2 Phase
L	H	W1-2 Phase
H	H	2W1-2 Phase

Z : High impedance

X : Don't Care

PIN CONNECTION



Note. NC: No connection

TA8425H

RECOMMENDED OPERATING CONDITIONS (Ta=-40~85°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V _{CC}		4.5	5.0	5.5	V
Output Voltage	V _M		21.6	24	26.4	V
Output Current	I _{OUT}		-	1.5	-	A
Input Voltage	V _{IN}		-	-	V _{CC}	V
Clock Frequency	f _{CLOCK}		-	-	5	kHz
OSC Frequency	f _{OSC}		20	-	40	kHz

ELECTRICAL CHARACTERISTICS (Ta=25°C, V_{CC}=5V, V_M=24V)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Input Voltage	High	V _{IN H}	-	M1,M2,CW/CCW, REF IN ENABLE, CK1, CK2	3.5	-	V _{CC}	V	
	Low	V _{IN L}			GND	-	1.5		
Input Hysteresis Voltage		V _H			-	600	-	mV	
Input Current		I _{IN-1} (H)	-	M1,M2,REF IN, ENABLE V _{IN} =5.0V	-	125	250	μA	
		I _{IN-2} (H)	-	CW/CCW,CK1,CK2, V _{IN} =5.0V	-	0	10		
	SOURCE TYPE	I _{IN-1} (L)	-	REF IN, V _{IN} =0V	-	40	70		
		I _{IN-2} (L)	-	CW/CCW,CK1,CK2, V _{IN} =0V	-	125	250		
		I _{IN-3} (L)	-	ENABLE, V _{IN} =0V	-	100	160		
		I _{IN-4} (L)	-	M1,M2, V _{IN} =0V	-	20	50		
Quiescent Current	V _{CC}	I _{CC1}	-	Output Open (2,1-2 Phase excitation)	-	40	55	mA	
	V _{CC}	I _{CC2}	-	Output Open (W1-2,2W1-2 Phase excitation)	-	38	53		
Comparator Reference Voltage	High	V _{NF} (H)	-	REF IN H Output Open	Note	0.56	0.7	0.82	V
	Low	V _{NF} (L)	-	REF IN L Output Open		0.34	0.45	0.66	
Output Differential		ΔV _O	-	B/A C _{OSC} =0.0033μF, R _{NF} =0.7Ω	-10	-	10	%	
V _{NF} (H) - V _{NF} (L)		ΔV _{NF}		V _{NF} (L)/V _{NF} (H) C _{OSC} =0.0033μF, R _{NF} =0.7Ω	61	67	81	%	

Note. 2 Phase excitation, R_{NF}=0.7Ω, C_{OSC}=0.0033μF

ELECTRICAL CHARACTERISTICS (Ta=25°C, VCC=5V, VM=24V)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
NF Terminal Current	INF	-	SOURCE TYPE	-	170	-	μA
OSC Frequency	fOSC	-	COSC=0.0033μF	25	44	62	kHz
Minimum OSC Frequency	fOSC(MAX)	-		100	-	-	kHz
Maximum OSC Frequency	fOSC(MIN)	-		-	-	10	kHz

OUTPUT BLOCK

Output Saturation Voltage	Upper Side	VSAT U1	-	IOUT=1.5A	-	2.1	2.8	V				
	Lower Side	VSAT L1			-	1.3	2.0					
	Upper Side	VSAT U2	-	IOUT=0.8A	-	1.8	2.2					
	Lower Side	VSAT L2			-	1.1	1.5					
	Upper Side	VSAT U3	-	IOUT=2.5A Pulse width 30ms	-	2.5	-					
	Lower Side	VSAT L3			-	1.8	-					
Diode Forward Voltage	Upper Side	VF U	-	IOUT=1.5A A/B OUT	-	3.2	-	V				
	Lower Side	VF L			A/B OUT	-	1.5		2.1			
	Upper Side	VFU2	-	IOUT=2.5A, Pulse width 30ms Output A, B	-	4.0	-					
	Lower Side	VFL2			Output A, B	-	1.8		-			
	Output Dark Current (A+B Channels)		IM1	-	ENABLE : H Level	-	-		50	μA		
			IM2	-	ENABLE : L Level	-	8		15	mA		
A-B Chopping Current (Note 1)	2W1-2φ	W1-2φ	1-2φ	VECTOR	-	θ=0/8	REF IN: H RNF=0.7Ω COSC=0.0033μF	-	100	-	%	
	2W1-2φ	-	-					θ=1/8	-	100		-
	2W1-2φ	W1-2φ	-					θ=2/8	83	90		96
	2W1-2φ	-	-					θ=3/8	74	82		90
	2W1-2φ	W1-2φ	1-2φ					θ=4/8	65	74		82
	2W1-2φ	-	-					θ=5/8	55	64		72
	2W1-2φ	W1-2φ	-					θ=6/8	45	52		62
	2W1-2φ	-	-					θ=7/8	29	39		48
	2 Phase excitation mode VECTOR									-		141

Note 1. Maximum current (θ=0) : 100%

2W1-2φ : 2W1,2 phase excitation mode

W1-2φ : W1,2 phase excitation mode

1-2φ : 1,2 phase excitation mode

TA8425H

ELECTRICAL CHARACTERISTICS (Ta=25°C, VCC=5V, VM=24V)

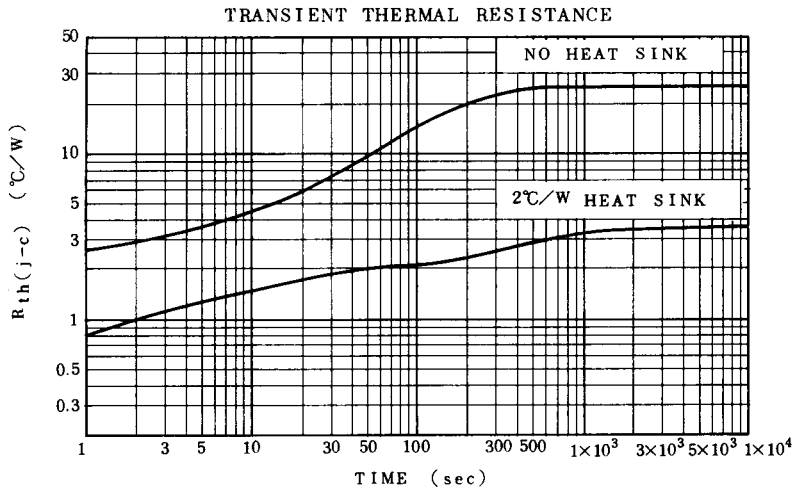
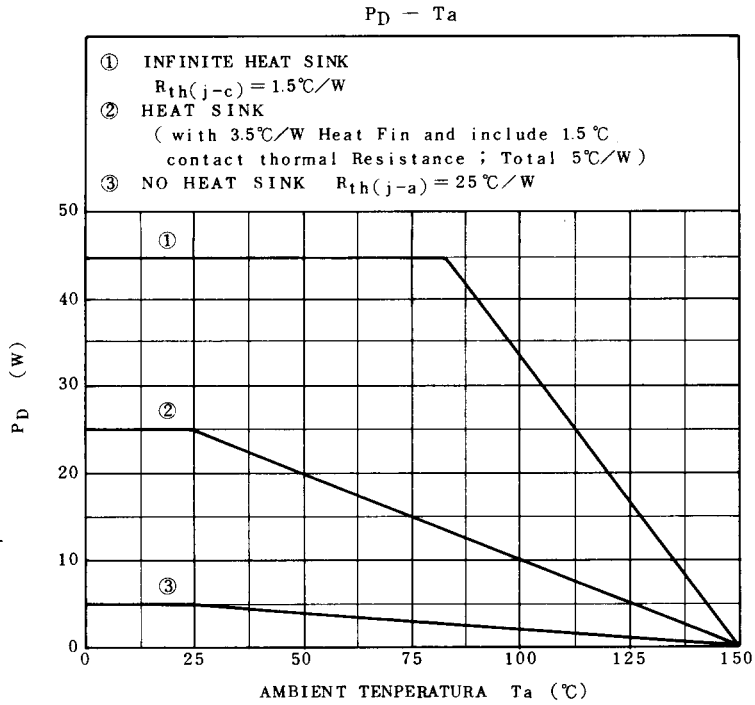
CHARACTERISTIC			SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
A-B Chopping Current (Note 1)	2W1-2φ	W1-2φ	1-2φ	VECTOR	-	θ=0/8 θ=1/8 θ=2/8 θ=3/8 θ=4/8 θ=5/8 θ=6/8 θ=7/8 RFE IN: L RNF=0.7Ω COSC=0.0033μF	-	100	-	%
	2W1-2φ	-	-				-	100	-	
	2W1-2φ	W1-2φ	-				-	90	-	
	2W1-2φ	-	-				-	83	-	
	2W1-2φ	W1-2φ	1-2φ				-	77	-	
	2W1-2φ	-	-				-	69	-	
	2W1-2φ	W1-2φ	-				-	61	-	
	2W1-2φ	-	-				-	51	-	
2 Phase excitation mode VECTOR					-	141	-			
Feed Back Voltage Step			ΔVNF	-	Δθ=0/8-1/8 Δθ=1/8-2/8 Δθ=2/8-3/8 Δθ=3/8-4/8 Δθ=4/8-5/8 Δθ=5/8-6/8 Δθ=6/8-7/8 REF IN: H RNF=0.7Ω COSC=0.0033μF	-	0	-	mV	
						-	62	-		
						-	54	-		
						-	54	-		
						-	75	-		
						-	77	-		
						-	90	-		
Output Tr Switching Characteristics			tr	-	RL=2Ω, VNF=0V, CL=15pF	-	0.3	-	μs	
						tf	-	2.2		-
						tpLH	-	1.5		-
							-	2.7		-
						tpHL	-	5.4		-
							-	6.3		-
Output Leakage Current	Upper Side	IOH	-	VM=30V	-	-	50	μA		
	Lower Side	IOL			-	-	50			

Note 1. Maximum current (θ=0) : 100%

2W1-2φ : 2W1,2 phase excitation mode

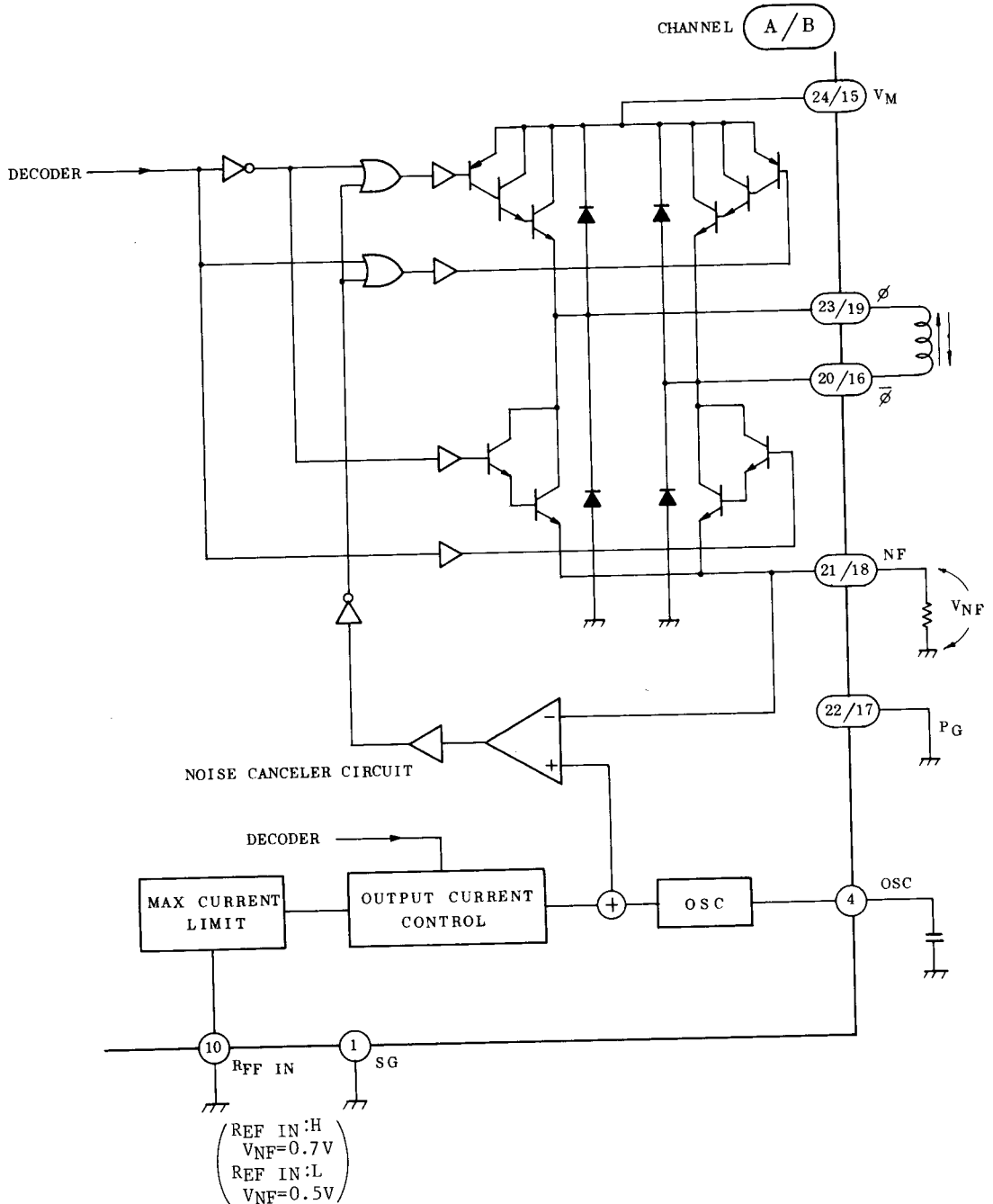
W1-2φ : W1,2 phase excitation mode

1-2φ : 1,2 phase excitation mode



TA8425H

OUTPUT CIRCUIT



TA8425H

OSC FREQUENCY CALCULATION

Sawtooth OSC circuit consists of Q1 through Q4 and R1 through R4.

Q2 is turned "off" when V_{OSC} is less than the voltage of 2.5V+V_{BE} Q2 approximately equal to 3.2V.

V_{OSC} is increased by C_{OSC} charging through R1.

Q3 and Q4 are turned "on" when V_{OSC} becomes 3.2V (Higher level.)

Lower level of V₍₄₎ pin is equal to V_{BE} Q2+V_{SAT} Q4 approximately equal to 1.4V.

V_{OSC} is calculated by following equation

$$V_{OSC} = 5 \cdot (1 - e^{-\frac{1}{C_{OSC} \cdot R1} t})$$

Assuming that V_{OSC}=1.4V (t=t₁) and =3.2V (t=t₂)

C_{OSC} is external capacitance connected to pin (4) and R1 is on-chip 10kΩ resistor.

Therefore, OSC frequency is calculated as follows.

$$t_1 = -C_{OSC} \cdot R1 \cdot \ln \left(1 - \frac{1.4}{5} \right)$$

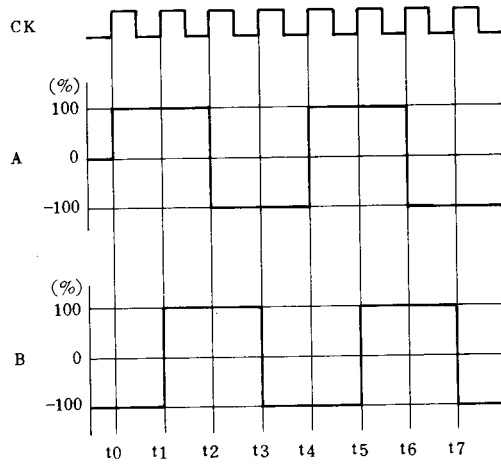
$$t_2 = -C_{OSC} \cdot R1 \cdot \ln \left(1 - \frac{3.2}{5} \right)$$

$$f_{OSC} = \frac{1}{t_2 - t_1} = \frac{1}{C_{OSC} \left(R1 \cdot \ln \left(1 - \frac{1.4}{5} \right) - R1 \cdot \ln \left(1 - \frac{3.2}{5} \right) \right)}$$

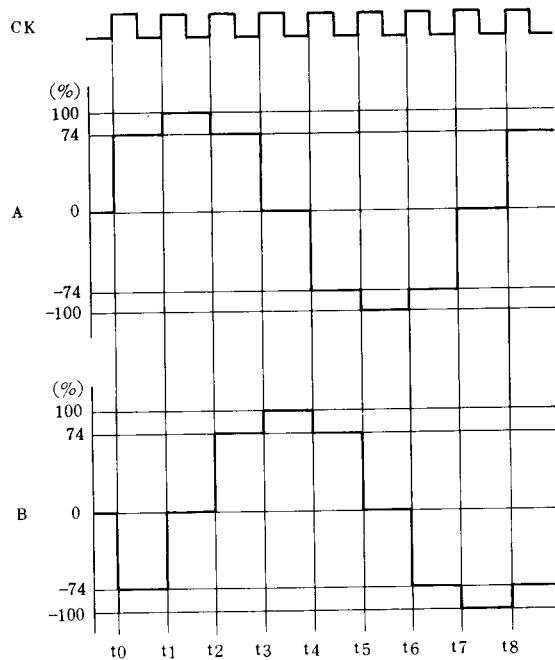
$$\approx \frac{1}{6.93 \cdot C_{OSC}} \quad (\text{kHz}) \quad (C_{OSC} : \mu\text{F})$$

EXCITATION

2 Phase Excitation (M1:L, M2:L)

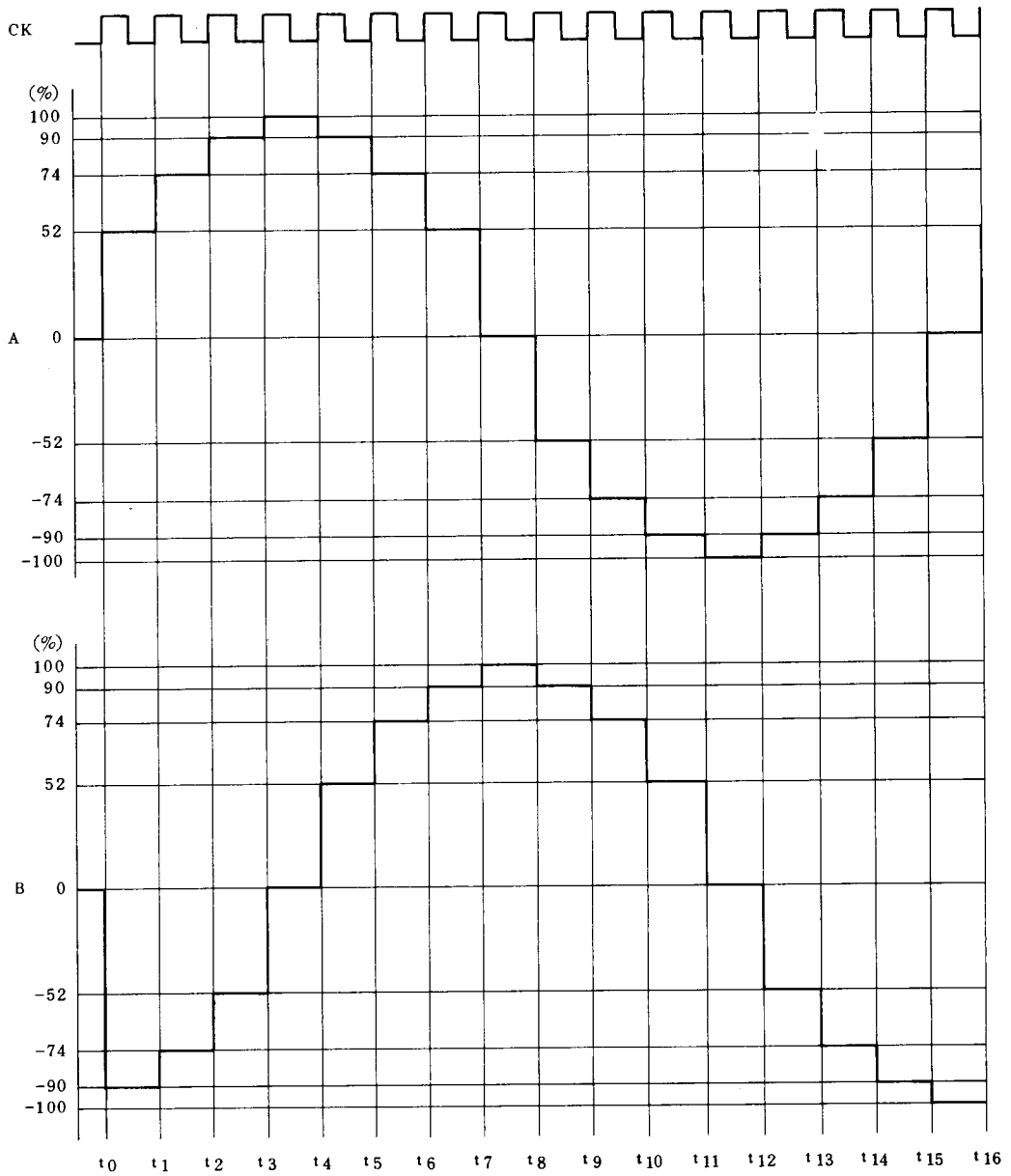


1-2 Phase Excitation (M1:H, M2:L)

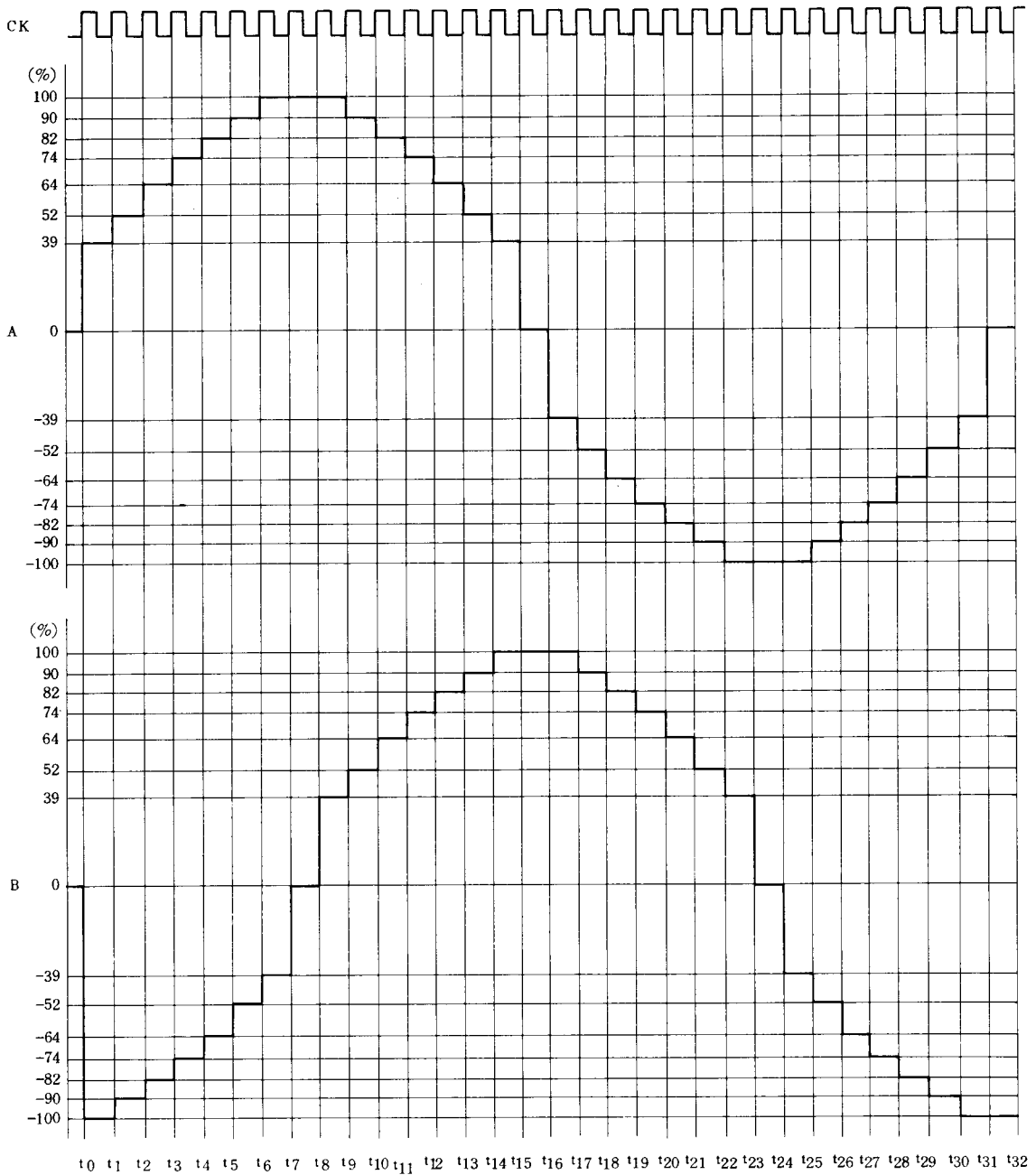


TA8425H

W1-2 Phase Excitation (M1:L, M2:H)

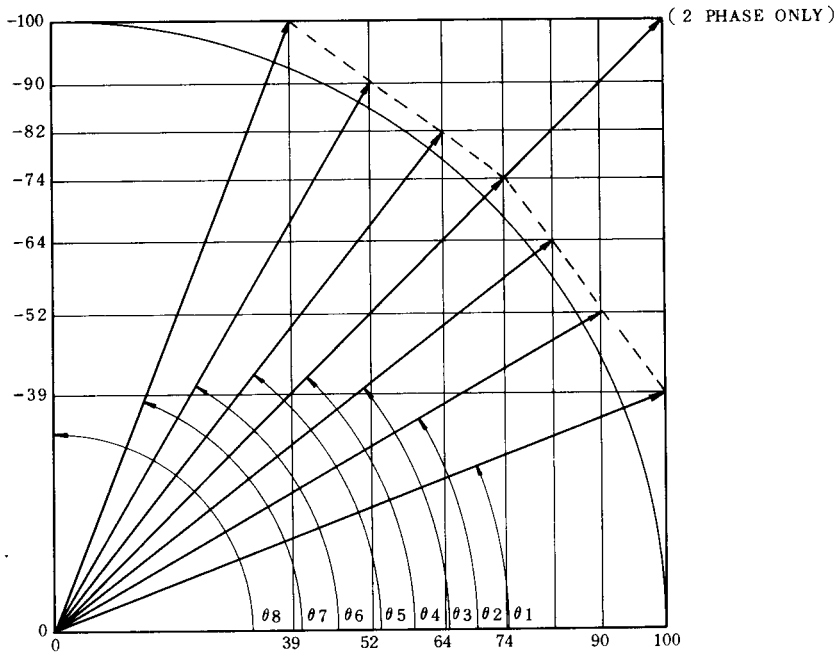


2W1-2 Phase Excitation (M1:H, M2:H)



TA8425H

OUTPUT CURRENT VECTOR ORBIT (NORMALIZE TO 90 DEG FOR EACH ONE STEP)



θ	ROTATION ANGLE		VECTOR LENGTH		
	Ideal	Real	Ideal	Real	
θ_0	0°	0°	100	100.00	-
θ_1	11.25°	21.31°	100	107.34	-
θ_2	22.5°	30.02°	100	103.94	-
θ_3	33.75°	37.97°	100	104.02	-
θ_4	45°	45°	100	104.65	141.42
θ_5	56.25°	52.03°	100	104.02	-
θ_6	67.5°	59.98°	100	103.94	-
θ_7	78.75°	68.69°	100	107.34	-
θ_8	90°	90°	100	100.00	-
1-2, W1-2, 2W1-2 Phase					2 Phase