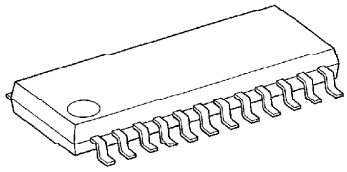
TENTATIVE TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

TB6526F

CHOPPER-TYPE BIPOLAR STEPPING MOTOR CONTROL DRIVER IC

The TB6526F is a PWM chopper-type sinusoidal micro-step bipolar stepping motor driver IC.
It is capable of 1-2 and 2W1-2 phase excitation modes and forward and reverse rotation modes, low-vibration, low-torque ripple, and high-efficiency driving.



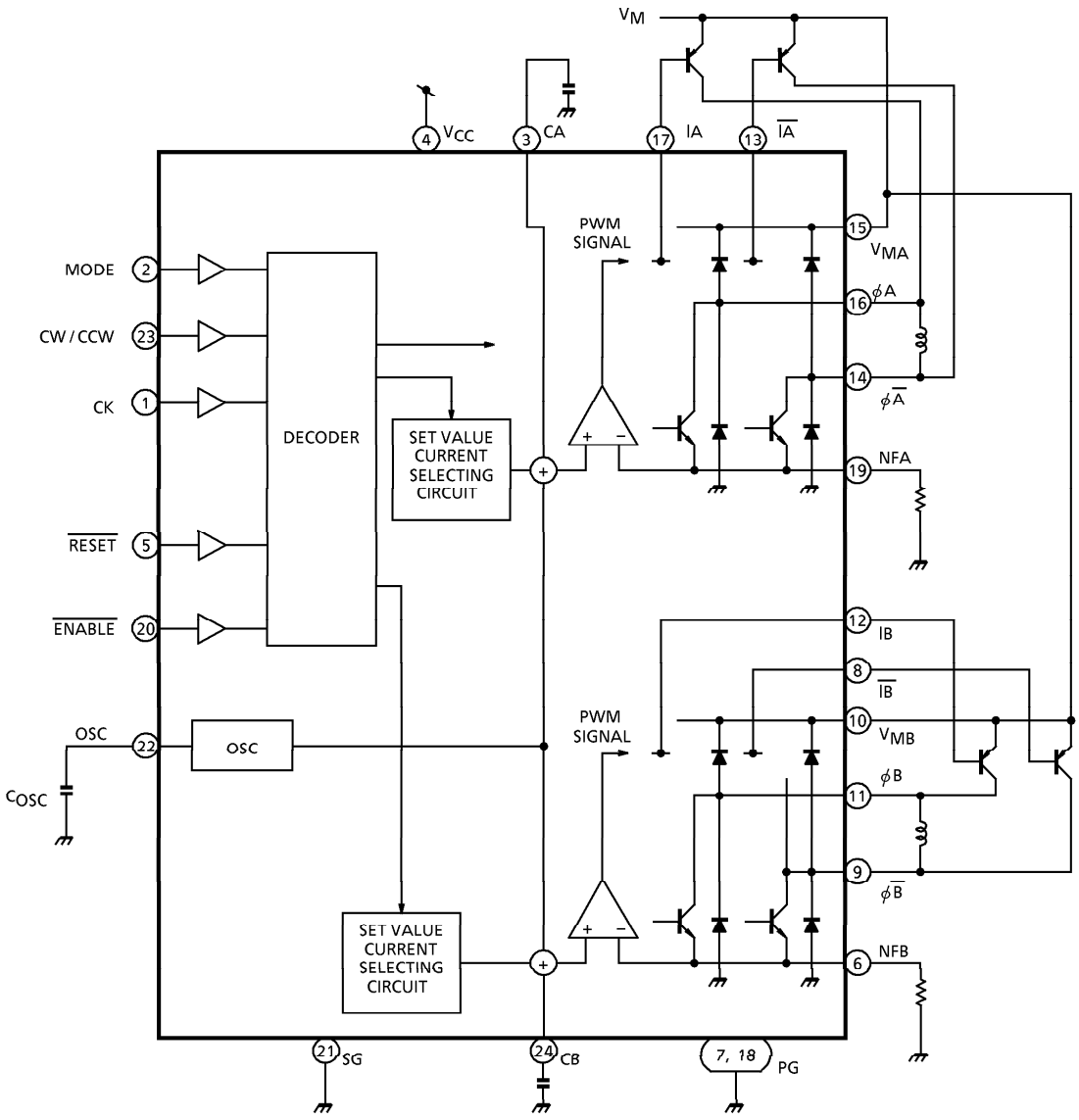
SSOP24-P-300-1.00B

Weight : 0.27g (Typ.)

FEATURES

- Forward and reverse rotations are available.
- 1-2, 2W1-2 phase driving is available.
- Structured by high breakdown voltage Bi-CMOS process.
- Package: SSOP24-P-300-1.00B
- Externally equipped with PNP output transistor.
- Reset and enable pins are attached.

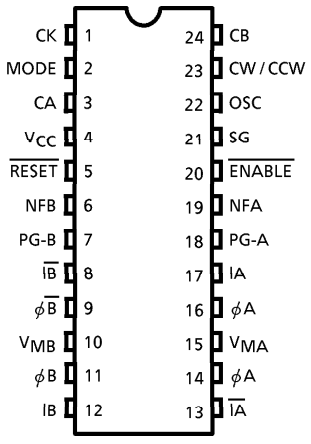
BLOCK DIAGRAM



PIN FUNCTION

PIN No.	SYMBOL	FUNCTIONAL DESCRIPTION	
1	CK	CLOCK Signal Input	Truth table A
2	MODE	Excitation Mode Setting terminal	Truth table B
3	CA	Noise reduction condenser outer terminal	
4	V_{CC}	Power voltage supply terminal for Logic	
5	$\overline{RESET}$	$\overline{RESET}$ Signal Input terminal	Truth table A
6	NFB	B Channel current detective terminal	
7	PG-B	Power GND B terminal	
8	$I\overline{B}$	Upper PNP Transistor Base terminal ($\overline{B}$ phase)	
9	$\phi\overline{B}$	$\overline{B}$ output	
10	V_{MB}	Power voltage supply terminal for Motor B	
11	ϕB	Output B terminal	
12	IB	Upper PNP Transistor Base terminal (B phase)	
13	$I\overline{A}$	Upper PNP Transistor Base terminal ($\overline{A}$ phase)	
14	$\phi\overline{A}$	Output $\overline{A}$ terminal	
15	V_{MA}	Power voltage supply terminal for Motor A	
16	ϕA	Output A terminal	
17	IA	Upper side PNP transistor Base terminal (A phase)	
18	PG-A	Power GND A terminal	
19	NFA	A Channel current detection terminal	
20	$\overline{ENABLE}$	$\overline{ENABLE}$ Signal input terminal	Truth table A
21	SG	Signal GND terminal	
22	OSC	Internal Oscillation frequency detective terminal with external condenser	
23	CW / CCW	Forward rotation / Reverse rotation signal input	Truth table A
24	CB	Noise reduction condenser outside terminal	

PIN CONNECTION



TRUTH TABLE A

INPUT				MODE
CK1	CW / CCW	$\overline{\text{RESET}}$	$\overline{\text{ENABLE}}$	
↓	L	H	L	CW
↓	H	H	L	CCW
X	X	L	L	INITIAL MODE
X	X	X	H	Z

Z : High Impedance
X : Don't Care

(Note) Do not use INHIBIT MODE.

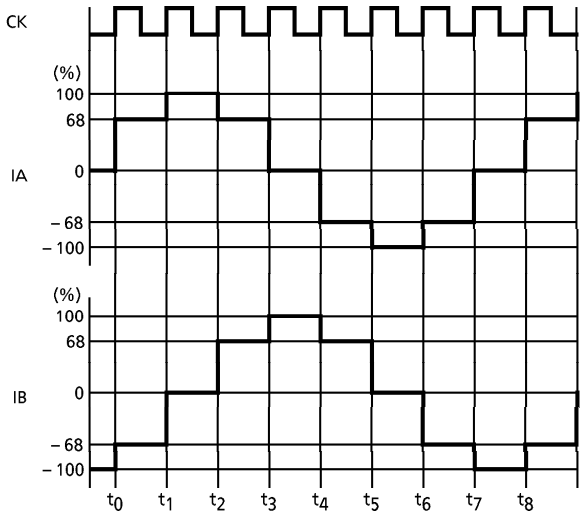
TRUTH TABLE B

INPUT / MODE	MODE (EXCITATION)
L	1-2 phase
H	2W1-2 phase

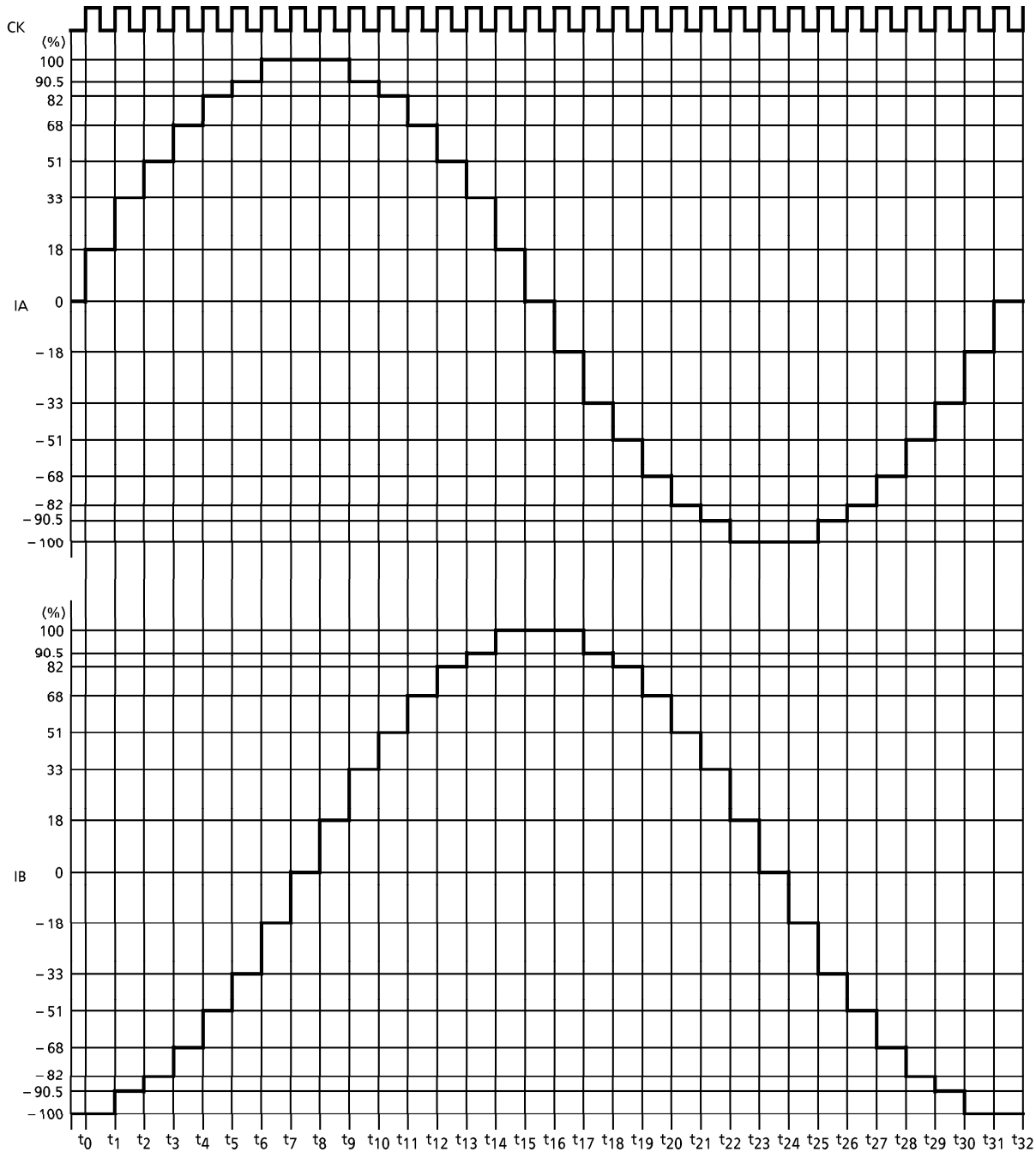
INITIAL MODE

MODE EXCITATION	A-PHASE CURRENT	B-PHASE CURRENT
1-2 phase	100%	0%
2W1-2 phase	100%	0%

1-2 PHASE EXCITATION (MODE : L, CW mode)



2W1-2 EXCITATION (MODE : H, CW mode)



MAXIMUM RATING (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	5.5	V
Output Voltage	$V_{M\ (opr.)}$	4.0~8.0	V
	$V_{M\ (MAX.)}$	10.0	
Output Current	$I_{O\ (MAX.)}$	120	mA
Input Voltage	V_{IN}	~V_{CC}	V
Power Dissipation	P_D	0.83 (Note 1)	W
		1.04 (Note 2)	
Operating Temperature	T_{opr}	– 30~85	°C
Storage Temperature	T_{stg}	– 55~150	°C
Feed Back Voltage	V_I	1.0	V

(Note 1) No heat sink
(Note 2) When mounted on substrate (50 × 50 × 1.6mm Cu 10%)

RECOMMENDED OPERATING CONDITIONS (Ta = – 30~85°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Control Power Supply Voltage	$V_{CC\ (opr.)}$		2.7	3.0	5.5	V
Motor Power Supply Voltage	$V_{M\ (opr.)}$		4.0	—	8.0	V
Output Current	I_{OUT}		—	—	100	mA
Input Voltage	V_{IN}		—	—	V_{CC}	V
Clock Frequency	f_{CLOCK}		—	—	5	kHz
OSC Frequency	f_{OSC}		15	—	80	kHz

ELECTRICAL CHARACTERISTICS

Unless otherwise specified (Ta = 25°C, V_{CC} = 3V, V_M = 5V, load inductance : L = 8mH / R = 50Ω, with outer PNP)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Input Voltage	High	$V_{IN\ (H)}$	1	MODE, CW / CCW, $\overline{ENABLE}$ CK, $\overline{RESET}$	V_{CC} × 0.7	—	V_{CC} + 0.4	V
	Low	$V_{IN\ (L)}$			GND − 0.4	—	V_{CC} × 0.3	
Input Current		$I_{IN\ (H)}$	2	V_{IN} = 3.0V	—	—	100	nA
		$I_{IN\ (L)}$		V_{IN} = 0V	—	—	100	
Current Consumption V_{CC} Pin		I_{CC1}	3	Output open, $\overline{RESET}$: H, $\overline{ENABLE}$: L, (1-2 phase excitation)	—	7	9	mA
		I_{CC2}		Output open, $\overline{RESET}$: H, $\overline{ENABLE}$: L, (2W1-2 phase excitation)	—	7	9	
		I_{CC3}		$\overline{RESET}$: L, $\overline{ENABLE}$: H	—	1.3	—	
		I_{CC4}		$\overline{RESET}$: H, $\overline{ENABLE}$: H	—	1.3	—	
Comparator Reference Voltage Level		V_{NF1}	9	C_A, C_B	0.24	0.27	0.30	V
		V_{NF2}	4	R_{NF} = 3.3Ω, C_{OSC} = 3300pF	1.65	190	215	mV
		V_{NF3}	4	R_{NF} = 2.2Ω, C_{OSC} = 3300pF	145	167	185	mV
Output Inter-channel Differential		ΔV_O	4	$(V_{NFA}-V_{NFB}) / V_{NFA}$, C_{OSC} = 3300pF, R_{NF} = 3.3Ω	− 10	—	10	%
Maximum OSC Frequency		$f_{OSC\ (MAX.)}$	—		100	—	—	kHz
Minimum OSC Frequency		$f_{OSC\ (MIN.)}$	—		—	—	10	kHz
OSC Frequency		f_{OSC}	5	C_{OSC} = 3300pF	31	44	70	kHz

ELECTRICAL CHARACTERISTICS

Unless otherwise specified (Ta = 25°C, V_{CC} = 3V, V_M = 5V, load inductance : L = 8mH / R = 50Ω, with outer PNP)

OUTPUT SECTION

CHARACTERISTIC			SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN	TYP.	MAX	UNIT
Upper Side Driving Current			I_U	6	V_C = 3V		—	1.5	1.6	mA
Lower Side Saturation Voltage			$V_{SAT\ L1}$	7	I_{OUT} = 0.06A		—	0.10	—	V
			$V_{SAT\ L2}$		I_{OUT} = 0.12A		—	0.16	0.43	
Diode Forward Voltage	Upper Side		$V_{F\ U}$	8	I_{OUT} = 0.12A		—	1.24	1.8	V
	Lower Side		$V_{F\ L}$				—	0.95	1.6	
Output Dark Current (A + B channel)			I_{M1}	3	$\overline{ENABLE}$: "H" level $\overline{RESET}$: "L" level Output open		—	—	50	μA
			I_{M2}		$\overline{ENABLE}$: "L" level $\overline{RESET}$: "H" level Output open		—	17	28	mA
NF Dark Current (1 channel)			I_{NF}		$\overline{ENABLE}$: "L" level $\overline{RESET}$: "H" level Output open		1	2.5	7	
A·B Chopper Current (Note)	2W1-2 phase excitation	1-2 phase excitation	Vector	4	θ = 0	R_{NF} = 3.3Ω C_{OSC} = 3300pF V_{NF}	—	100	—	
	2W1-2 phase excitation	—			θ = 1 / 8		—	100	—	
	2W1-2 phase excitation	—			θ = 2 / 8		85.5	90.5	95.5	
	2W1-2 phase excitation	—			θ = 3 / 8		77	82	87	
	2W1-2 phase excitation	1-2 phase excitation			θ = 4 / 8		64	69	74	
	2W1-2 phase excitation	—			θ = 5 / 8		48	53	58	
	2W1-2 phase excitation	—			θ = 6 / 8		31	36	41	
	2W1-2 phase excitation	—			θ = 7 / 8		16	21	26	

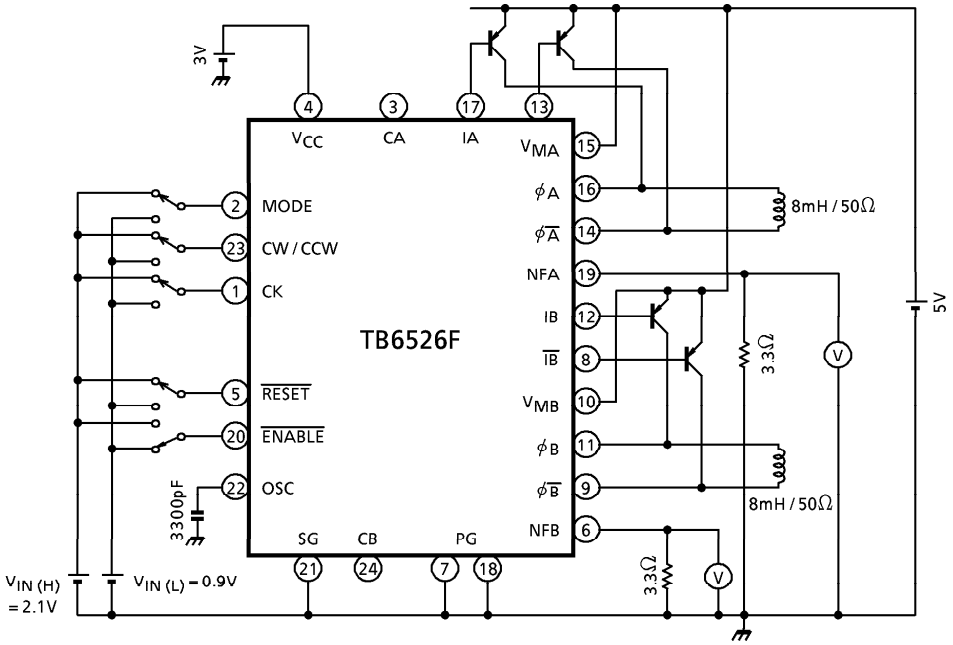
(Note) Maximum current θ = 0 is set at 100.

ELECTRICAL CHARACTERISTICS

Unless otherwise specified (Ta = 25°C, V_{CC} = 3V, V_M = 5V, load inductance : L = 8mH / R = 50Ω, with outer PNP)

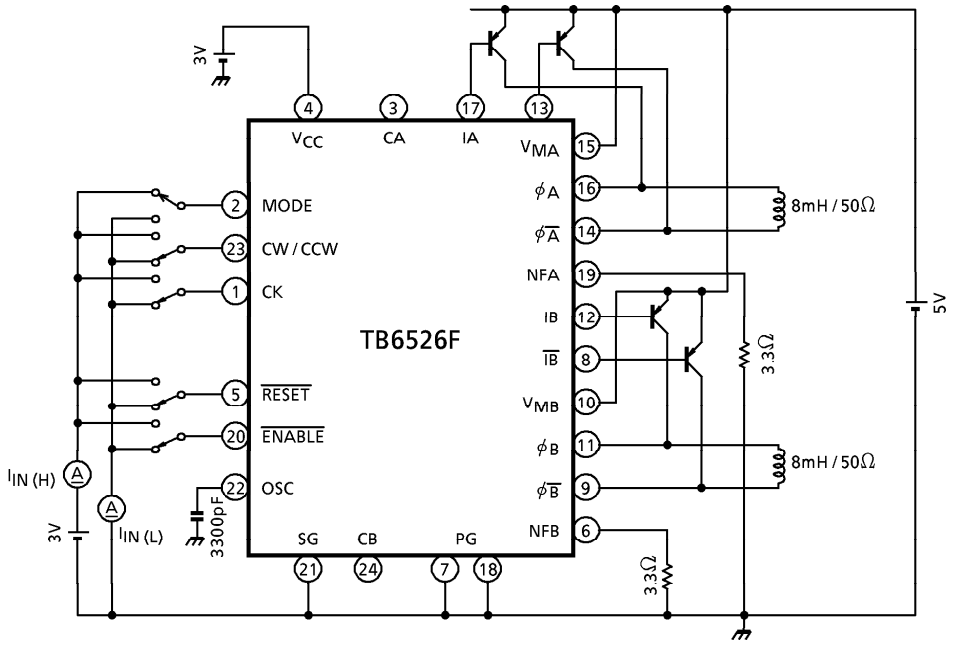
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN	TYP.	MAX	UNIT
Reference Voltage	ΔV_{NF}	9	$\Delta\theta$ = 0 / 8 – 1 / 8	Measured by CA and CB	—	0	—	mV
			$\Delta\theta$ = 1 / 8 – 2 / 8		10	17	35	
			$\Delta\theta$ = 2 / 8 – 3 / 8		5	16	30	
			$\Delta\theta$ = 3 / 8 – 4 / 8		16.25	21	41.25	
			$\Delta\theta$ = 4 / 8 – 5 / 8		25	32	50	
			$\Delta\theta$ = 5 / 8 – 6 / 8		26.25	31	51.25	
			$\Delta\theta$ = 6 / 8 – 7 / 8		15	28	45	
Output Tr Switching	t_r	12	R_L = 2Ω, V_{NF} = 0V, C_L = 15pF		—	0.3	—	μs
	t_f				—	2.2	—	
	t_{pLH}		CK~output		—	1.5	—	
	t_{pHL}				—	2.7	—	
	t_{pLH}		OSC~output		—	5.4	—	
	t_{pHL}				—	6.3	—	
	t_{pLH}		$\overline{\text{RESET}}$~output		—	2.0	—	
	t_{pHL}				—	2.5	—	
	t_{pLH}		$\overline{\text{ENABLE}}$~output		—	5.0	—	
	t_{pHL}				—	6.0	—	
Output Leakage Current	I_{OL}	10	V_M = 10V		—	—	50	μA
V_{MA} / V_{MB} Off Current	I_{off}	11	V_{CC} = 0, V_M = 5V		—	—	1	μA

TEST CIRCUIT 1 : $V_{IN\,(H)}$, $V_{IN\,(L)}$

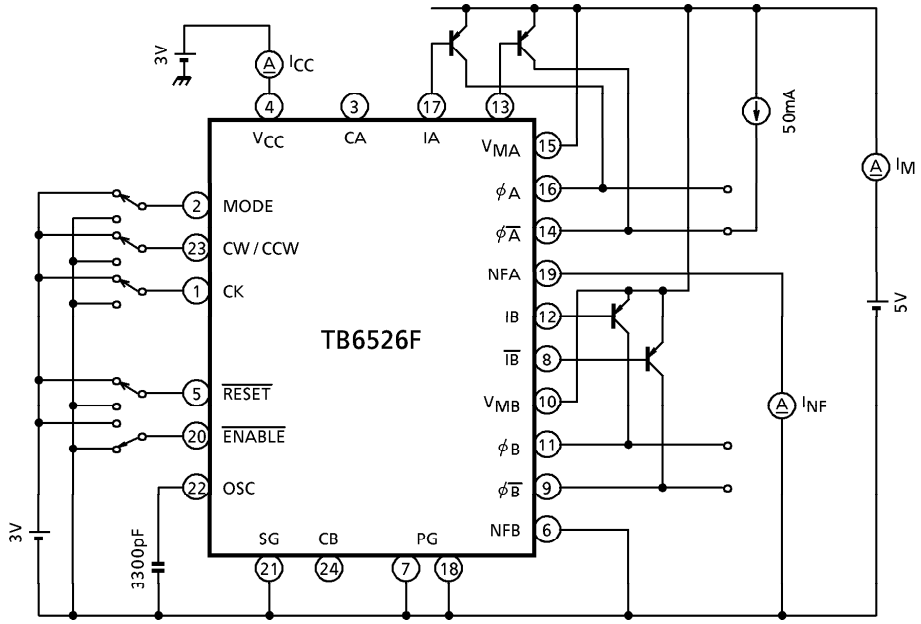


(Note) When input voltage $V_{IN\,(H)}$, $V_{IN\,(L)}$ is applied, verify the output function (NF voltage measurement).

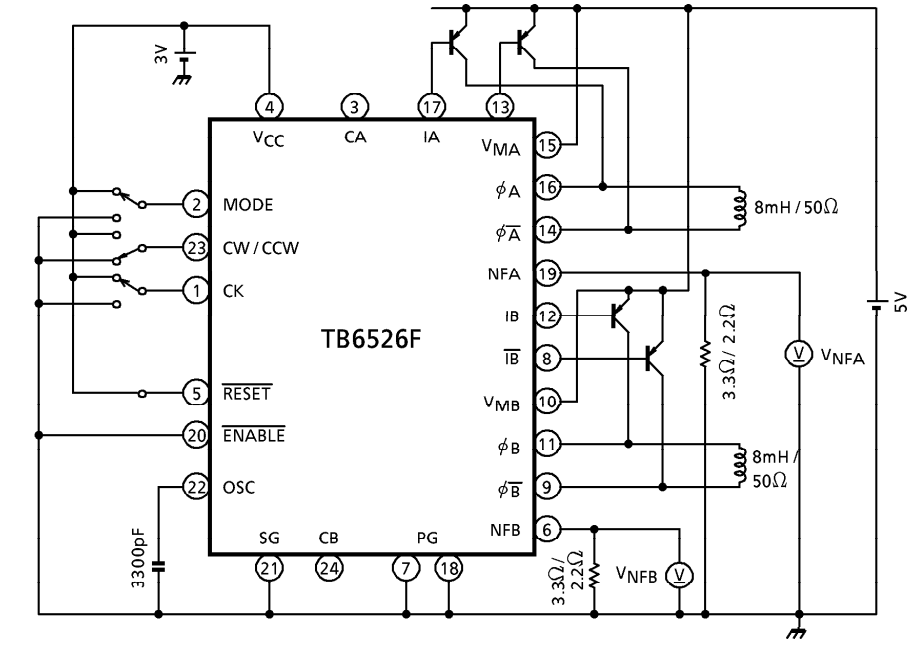
TEST CIRCUIT 2 : $I_{IN\,(H)}$, $I_{IN\,(L)}$



TEST CIRCUIT 3 : I_{CC}, I_M, I_{NF}

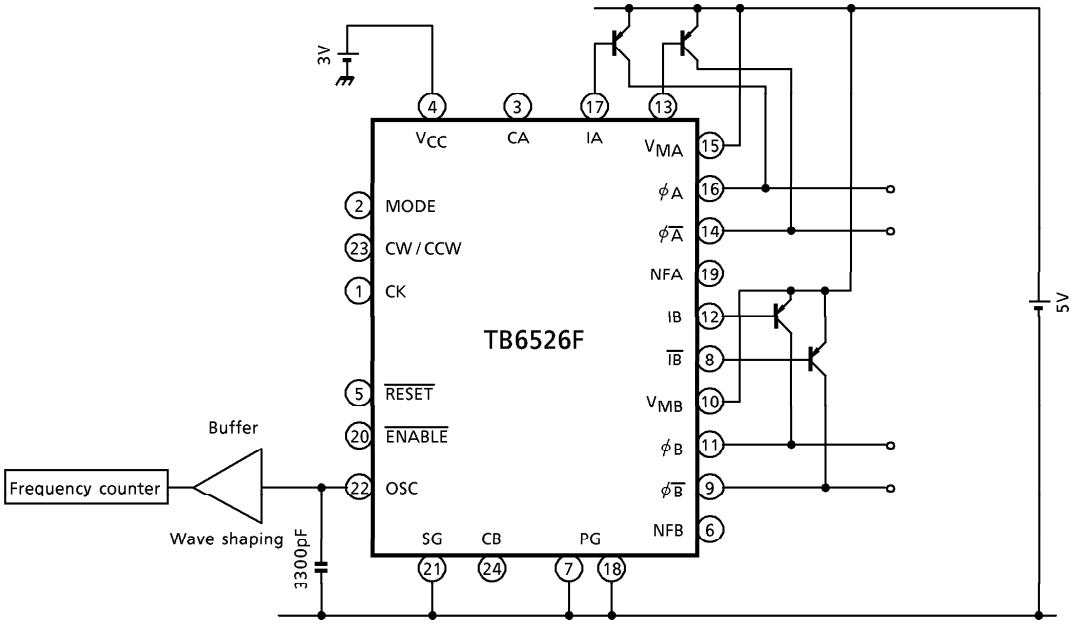


TEST CIRCUIT 4 : V_{NF2}, V_{NF3}, ΔV_O

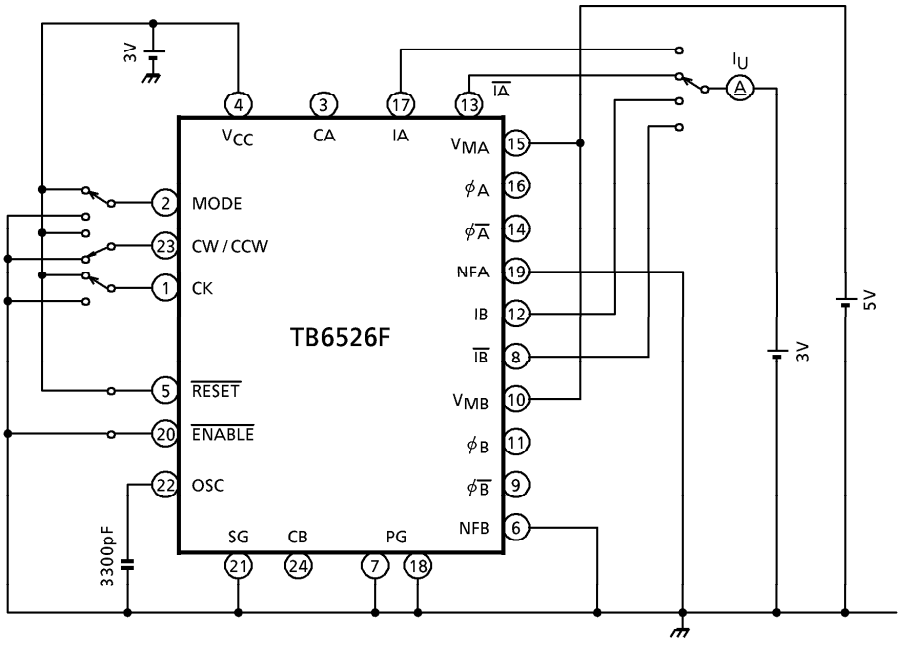


(Note) V_{NF2} : V_{NFA} (100%), V_{NFB} (100%) when $R_{NF} = 3.3\Omega$
V_{NF3} : V_{NFA} (100%), V_{NFB} (100%) when $R_{NF} = 2.2\Omega$

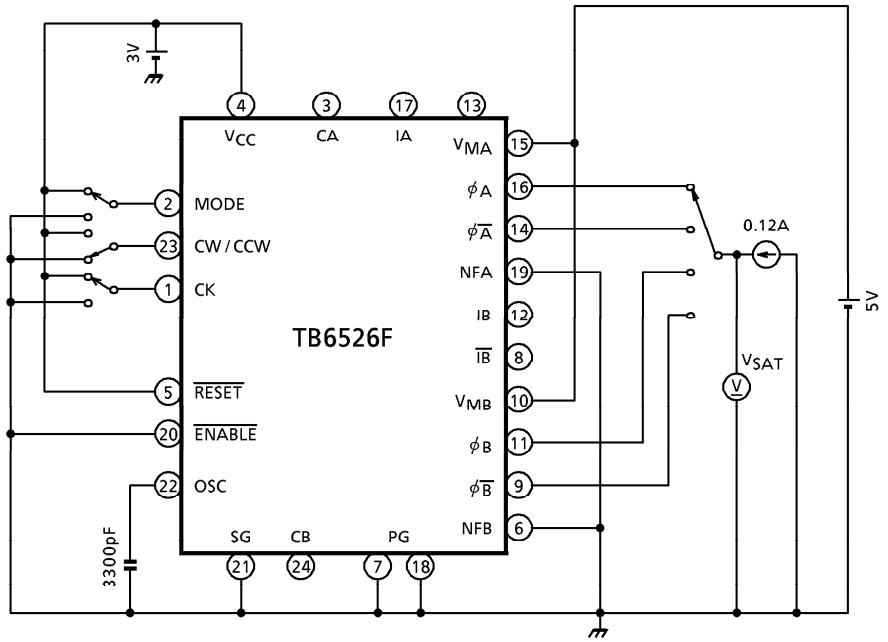
TEST CIRCUIT 5 : f_{OSC}



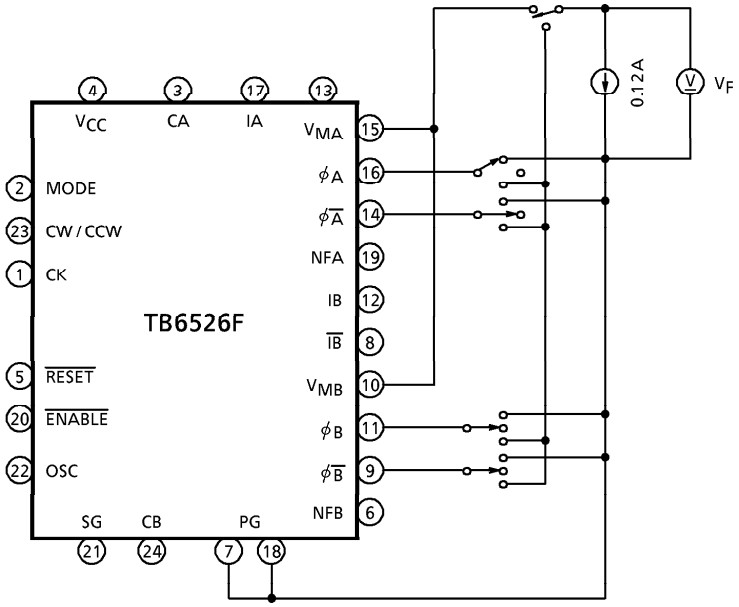
TEST CIRCUIT 6 : I_U



TEST CIRCUIT 7 : V_{SAT}

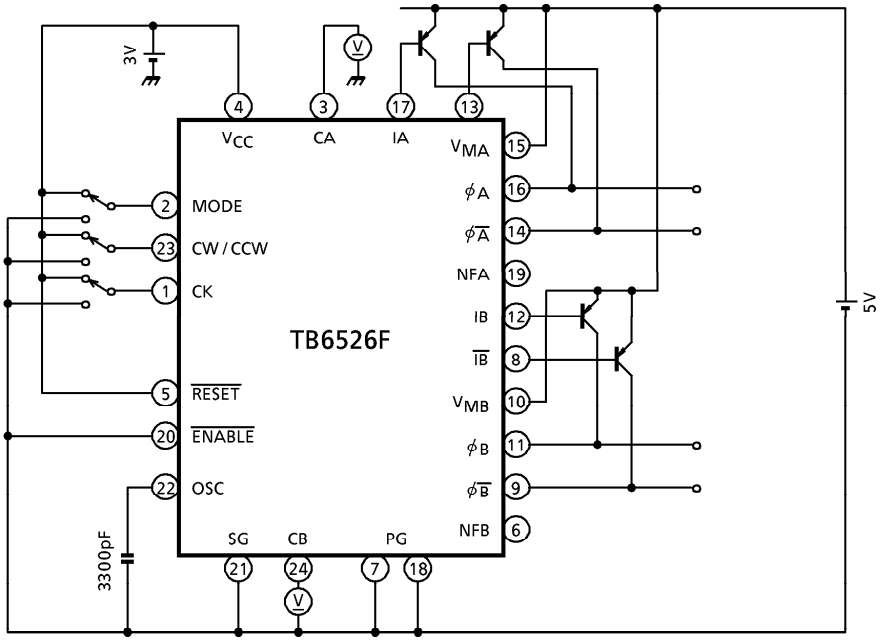


TEST CIRCUIT 8 : V_{F-U}, V_{F-L}

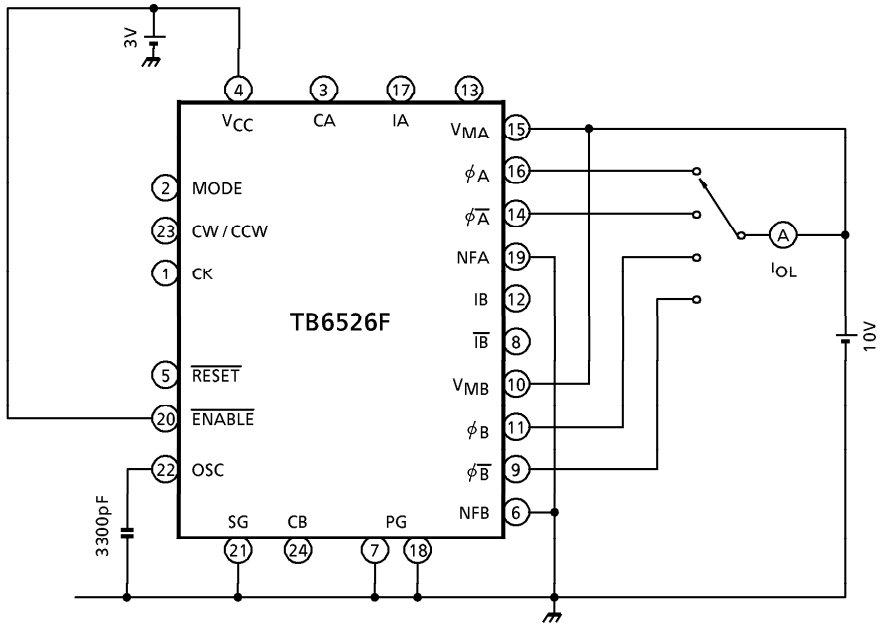


(Note) Not to take GND with any non-connecting pins.

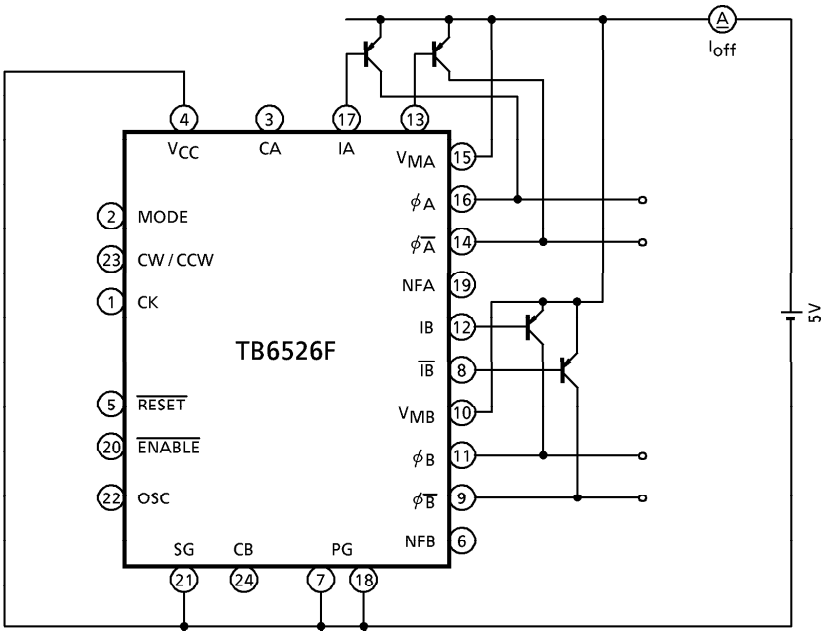
TEST CIRCUIT 9 : V_{NF1}, ΔV_{NF}



TEST CIRCUIT 10 : I_{OL}

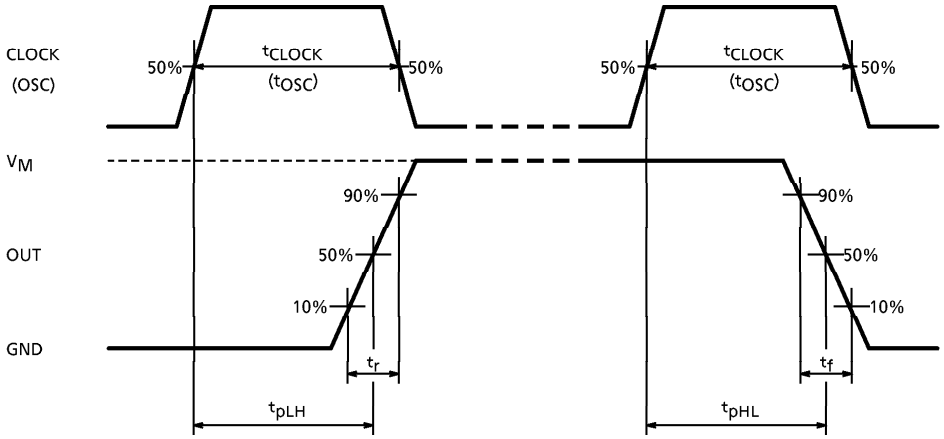


TEST CIRCUIT 11



AC ELECTRICAL CHARACTERISTICS, TEST CIRCUIT 12

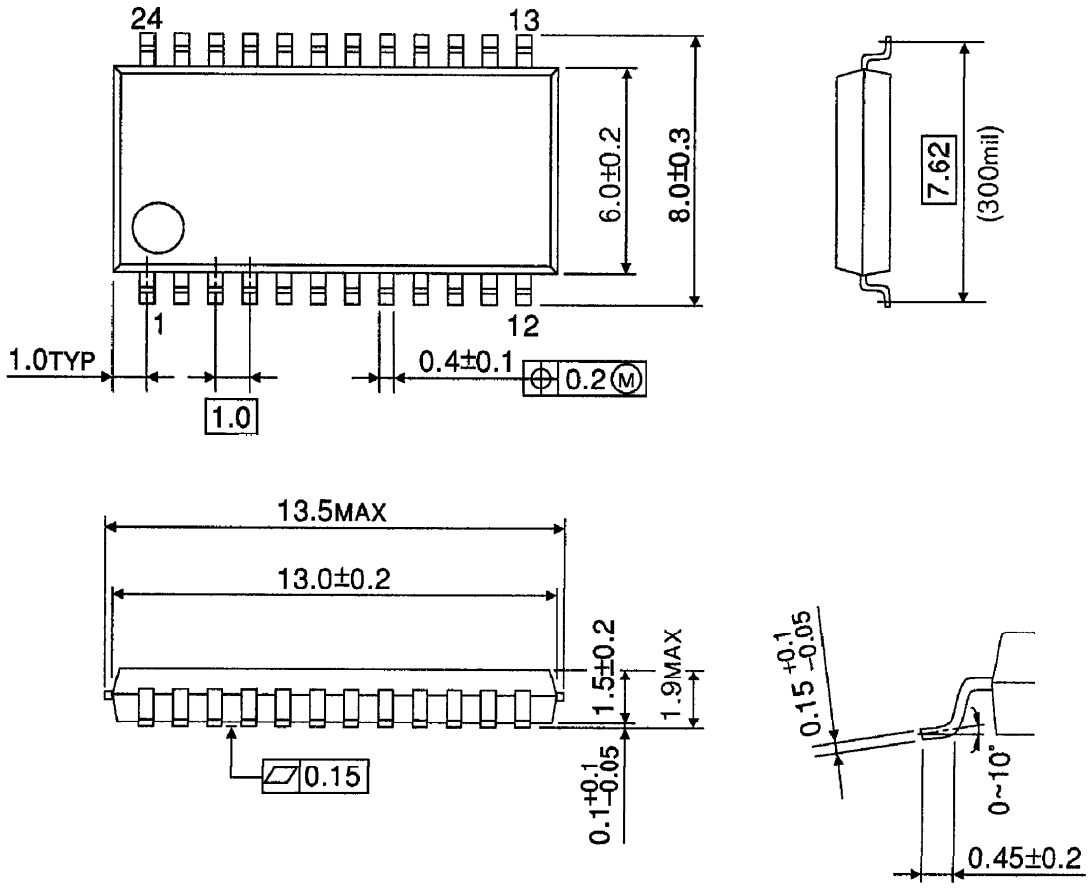
CK (OSC) - OUT



OUTLINE DRAWING

SSOP24-P-300-1.00B

Unit : mm



Weight : 0.27g (Typ.)