

TENTATIVE

TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

T B 6 5 2 6 F

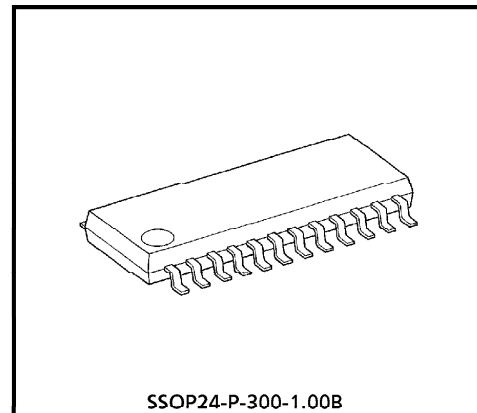
CHOPPER-TYPE BIPOLAR STEPPING MOTOR CONTROL DRIVER IC

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.

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.



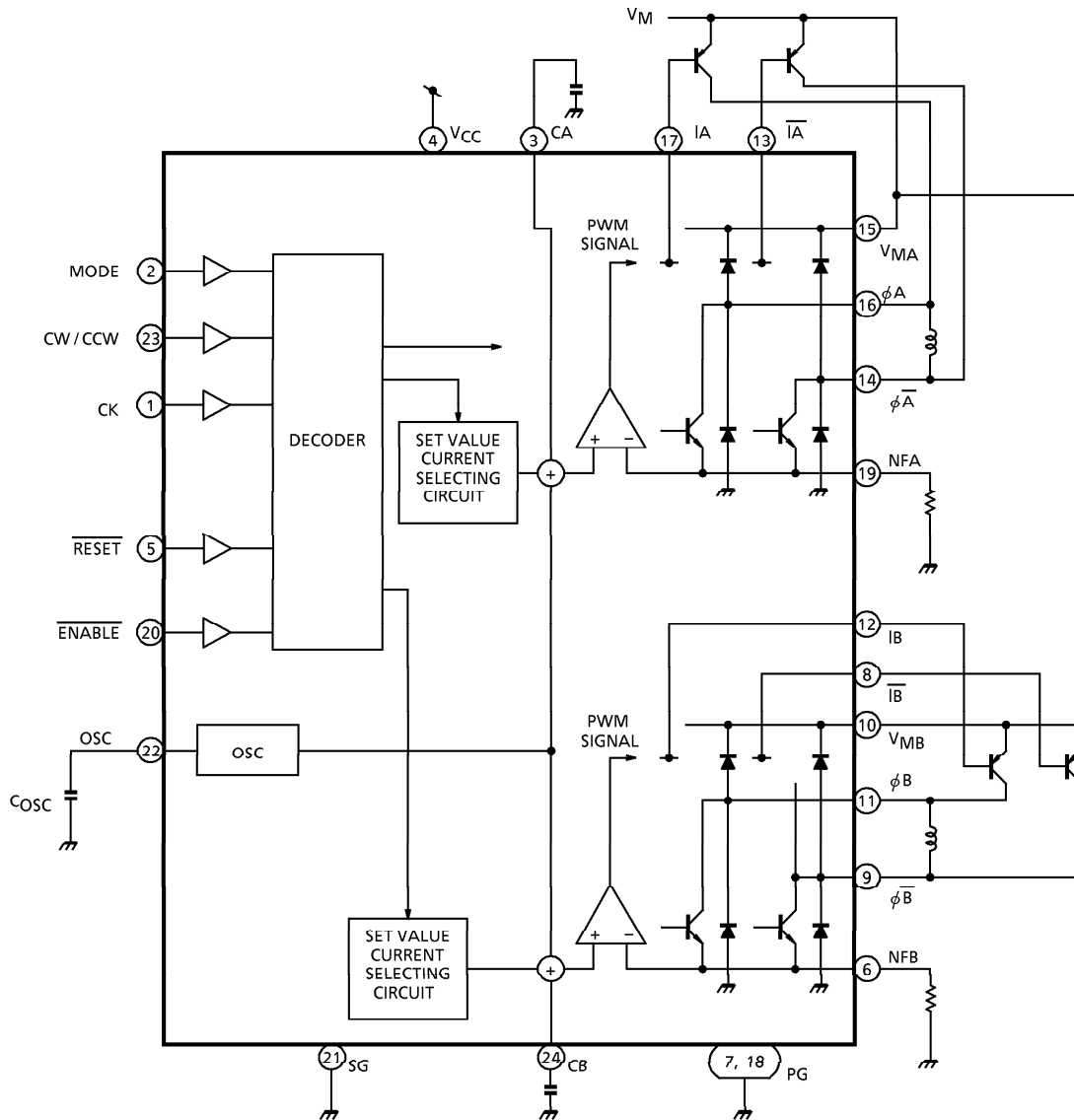
SSOP24-P-300-1.00B

Weight : 0.27g (Typ.)

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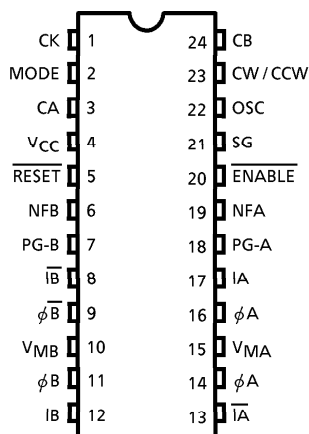
BLOCK DIAGRAM





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	RESET	RESET Signal Input terminal Truth table A
6	NFB	B Channel current detective terminal
7	PG-B	Power GND B terminal
8	IB	Upper PNP Transistor Base terminal (\bar{B} phase)
9	$\phi\bar{B}$	\bar{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	$\bar{I}A$	Upper PNP Transistor Base terminal (\bar{A} phase)
14	$\phi\bar{A}$	Output \bar{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	ENABLE	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	RESET	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.

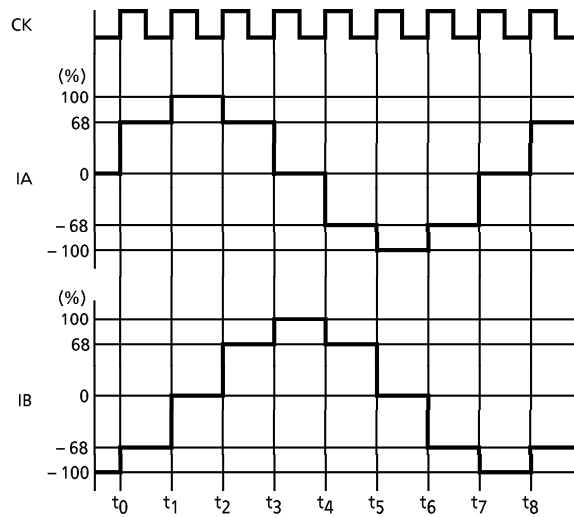
TRUTH TABLE B

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

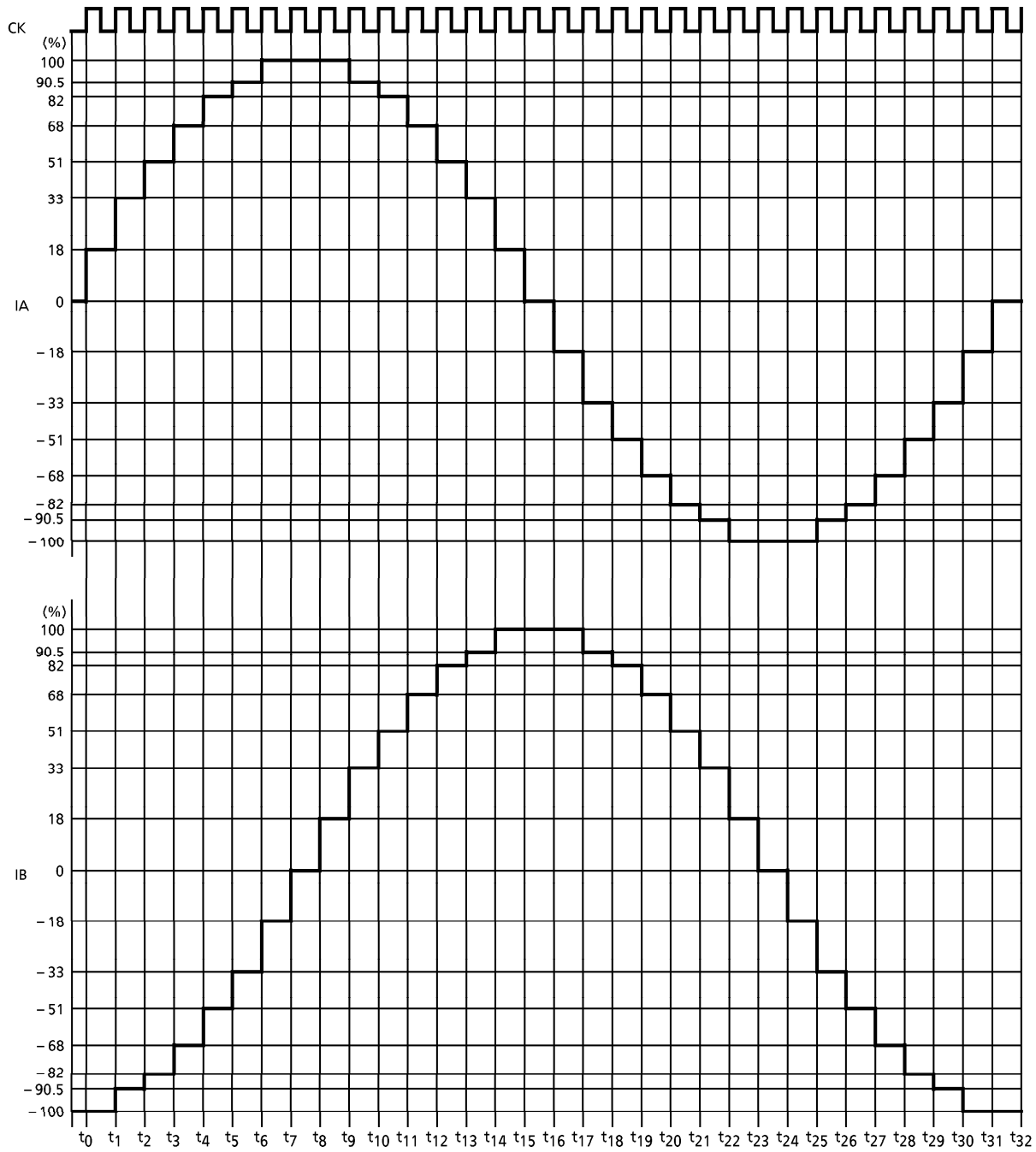
INITIAL MODE

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, VCC = 3V, VM = 5V, load inductance : L = 8mH / R = 50Ω, with outer PNP)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Input Voltage	High	VIN (H)	1	MODE, CW / CCW, $\overline{\text{ENABLE}}$ CK, RESET	VCC × 0.7	—	VCC + 0.4	V
	Low	VIN (L)			GND - 0.4	—	VCC × 0.3	
Input Current		IIN (H)	2	VIN = 3.0V	—	—	100	nA
		IIN (L)		VIN = 0V	—	—	100	
Current Consumption VCC Pin		ICC1	3	Output open, RESET : H, $\overline{\text{ENABLE}}$: L, (1-2 phase excitation)	—	7	9	mA
		ICC2		Output open, RESET : H, $\overline{\text{ENABLE}}$: L, (2W1-2 phase excitation)	—	7	9	
		ICC3		RESET : L, $\overline{\text{ENABLE}}$: H	—	1.3	—	
		ICC4		RESET : H, $\overline{\text{ENABLE}}$: H	—	1.3	—	
Comparator Reference Voltage Level		VNF1	9	CA, CB	0.24	0.27	0.30	V
		VNF2	4	RNF = 3.3Ω, COSC = 3300pF	1.65	190	215	mV
		VNF3	4	RNF = 2.2Ω, COSC = 3300pF	145	167	185	mV
Output Inter-channel Differential		ΔVO	4	(VNFA - VNFB) / VNFA, COSC = 3300pF, RNF = 3.3Ω	- 10	—	10	%
Maximum OSC Frequency		fOSC (MAX.)	—		100	—	—	kHz
Minimum OSC Frequency		fOSC (MIN.)	—		—	—	10	kHz
OSC Frequency		fOSC	5	COSC = 3300pF	31	44	70	kHz

ELECTRICAL CHARACTERISTICS

Unless otherwise specified (Ta = 25°C, VCC = 3V, VM = 5V, load inductance : L = 8mH / R = 50Ω, with outer PNP)

OUTPUT SECTION

CHARACTERISTIC			SYMBOL	TEST CIRCUIT	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	ENABLE : "H" level RESET : "L" level Output open	—	—	50	μA	
			I _{M2}		ENABLE : "L" level RESET : "H" level Output open	—	17	28		
NF Dark Current (1 channel)			I _{NF}		ENABLE : "L" level RESET : "H" level Output open	1	2.5	7	mA	
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	

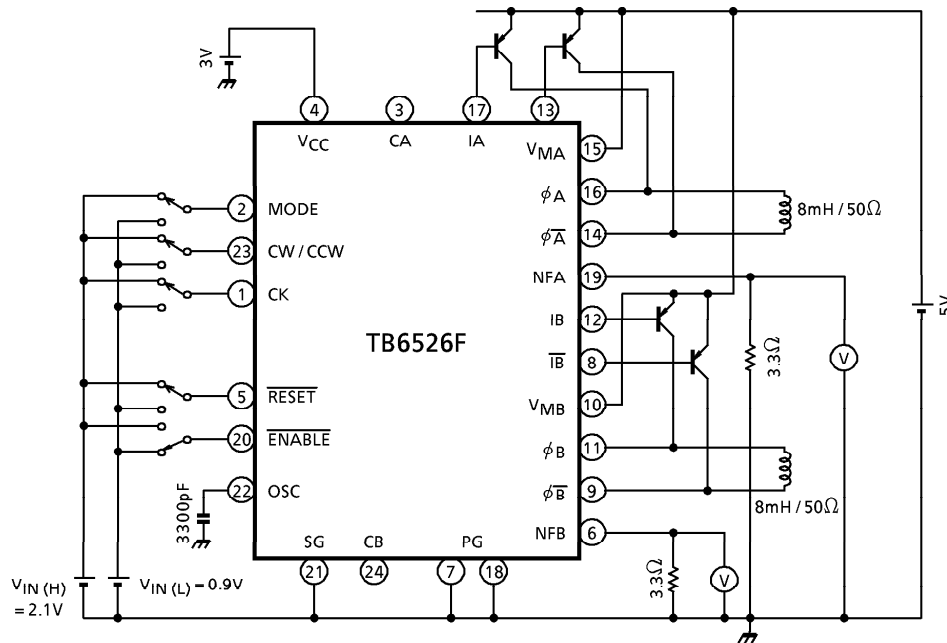
(Note) Maximum current θ = 0 is set at 100.

ELECTRICAL CHARACTERISTICS

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

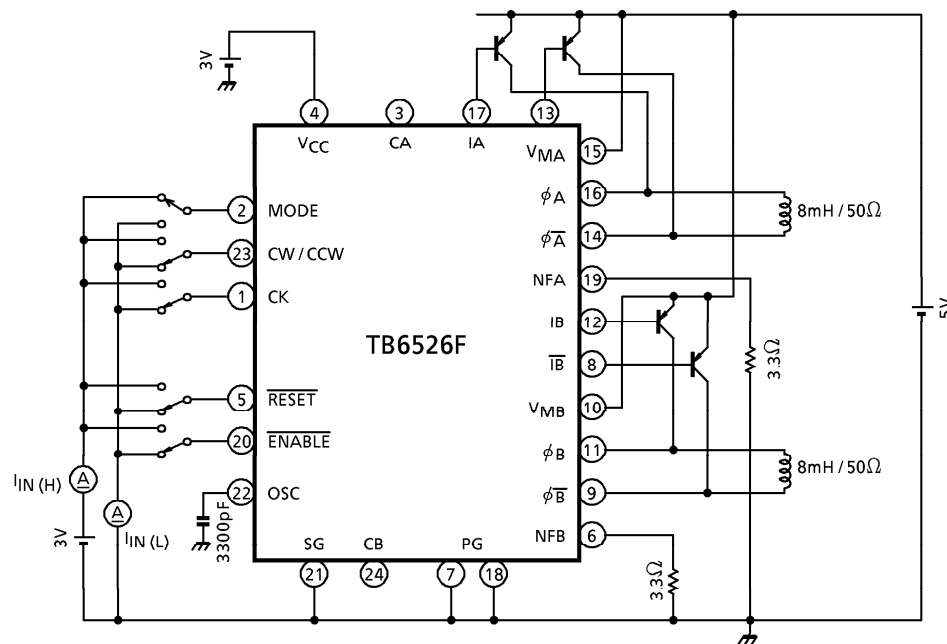
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT		
Reference Voltage	ΔV_{NF}	9	$\Delta\theta = 0/8 - 1/8$	Measured by CA and CB	—	0	—	mV	
			$\Delta\theta = 1/8 - 2/8$		10	17	35		
			$\Delta\theta = 2/8 - 3/8$		5	16	30		
			$\Delta\theta = 3/8 - 4/8$		16.25	21	41.25		
			$\Delta\theta = 4/8 - 5/8$		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	$R_L = 2\Omega, V_{NF} = 0V, C_L = 15pF$		—	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{RESET} ~output	—	2.0		—
	t_{pHL}					—	2.5		—
	t_{pLH}				\overline{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 : $V_{IN(H)}$, $V_{IN(L)}$

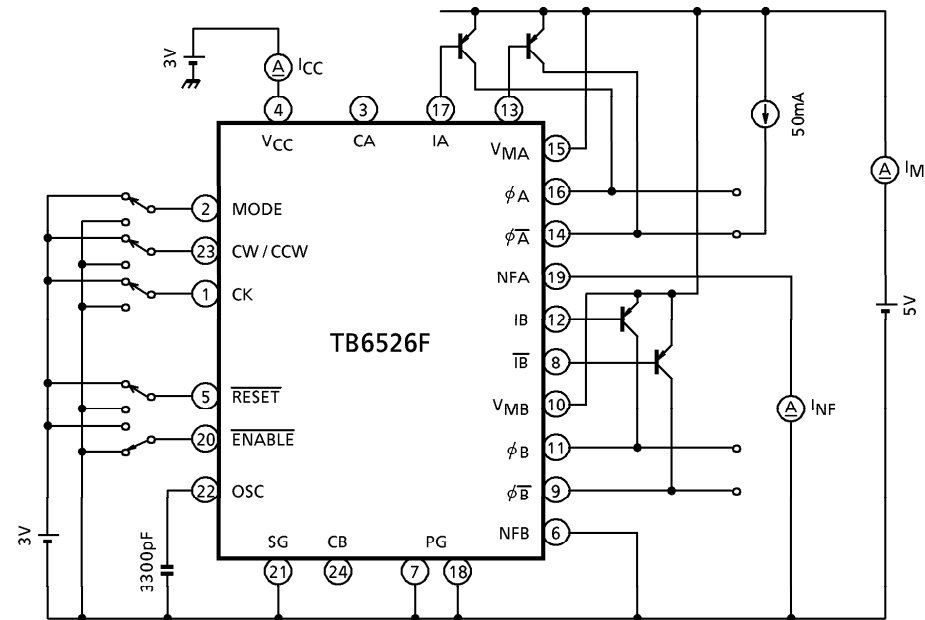


(Note) When input voltage $V_{IN(H)}$, $V_{IN(L)}$ is applied, verify the output function (NF voltage measurement).

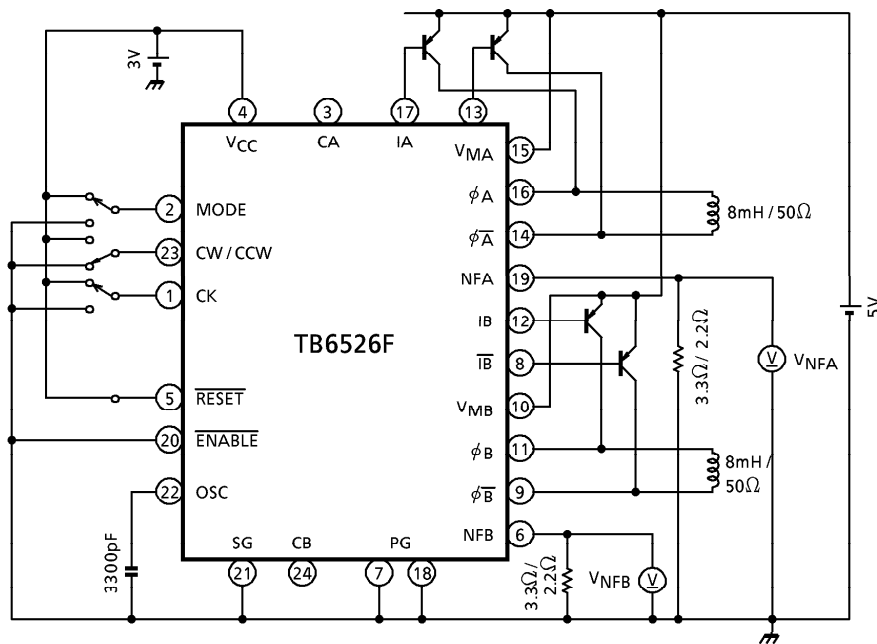
TEST CIRCUIT 2 : $I_{IN(H)}$, $I_{IN(L)}$



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

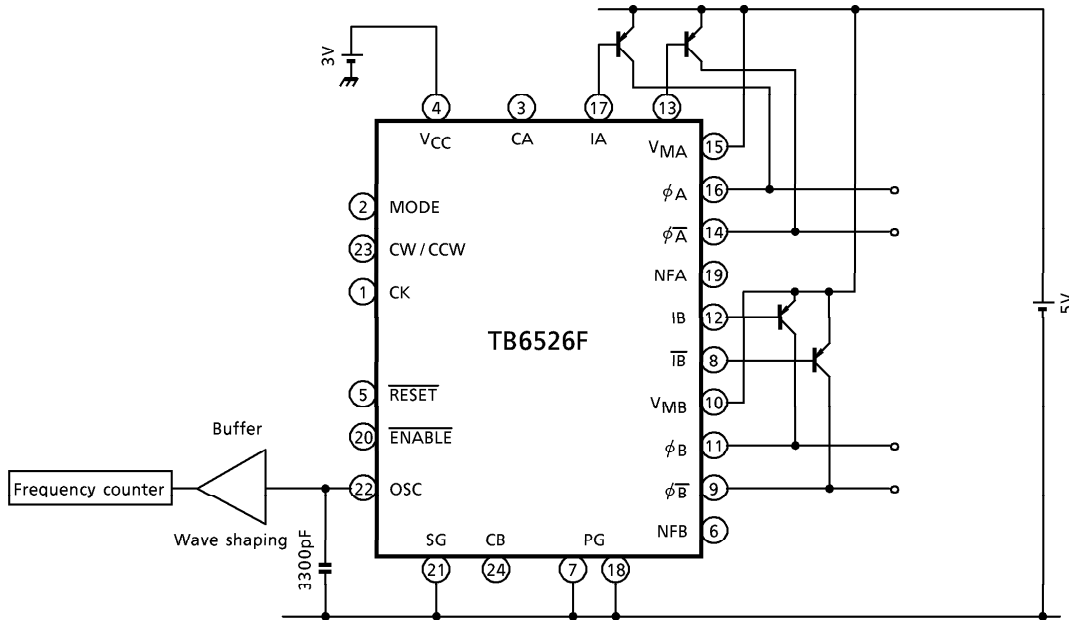


TEST CIRCUIT 4 : V_{NF2} , V_{NF3} , ΔV_O

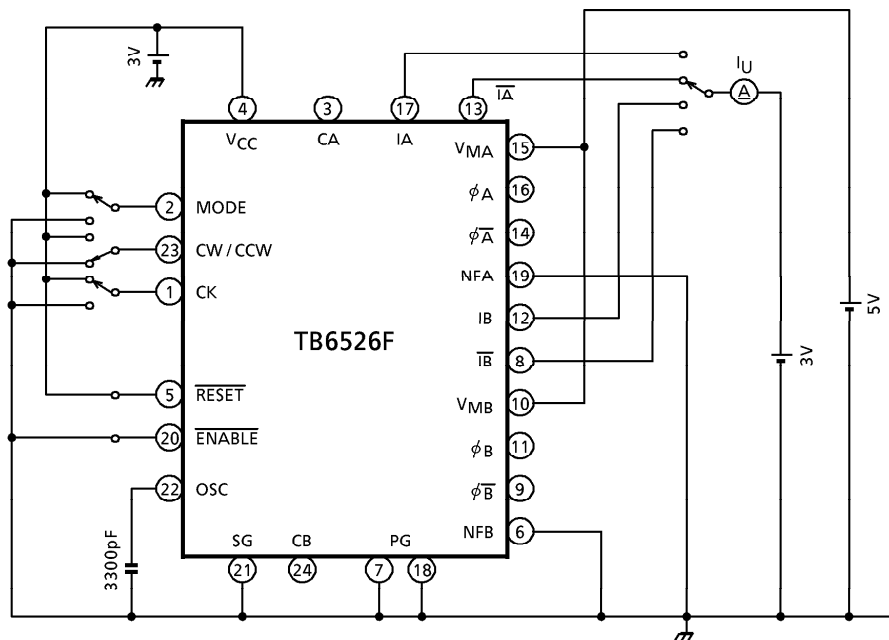


(Note) V_{NF2} : V_{NFA} (100%), V_{NFB} (100%) when $R_{NF} = 3.3\Omega$
 V_{NF3} : V_{NFA} (100%), V_{NFB} (100%) when $R_{NF} = 2.2\Omega$

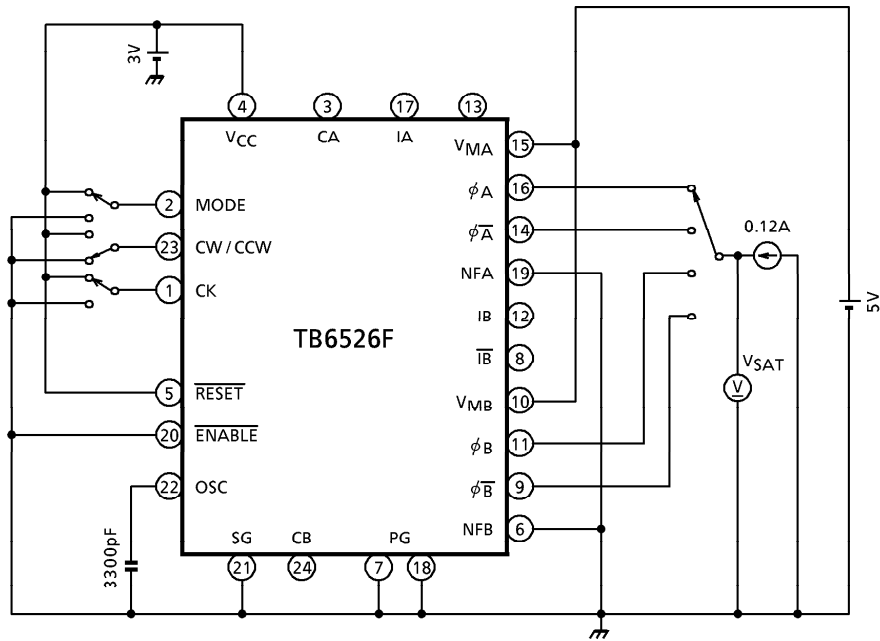
TEST CIRCUIT 5 : f_{OSC}



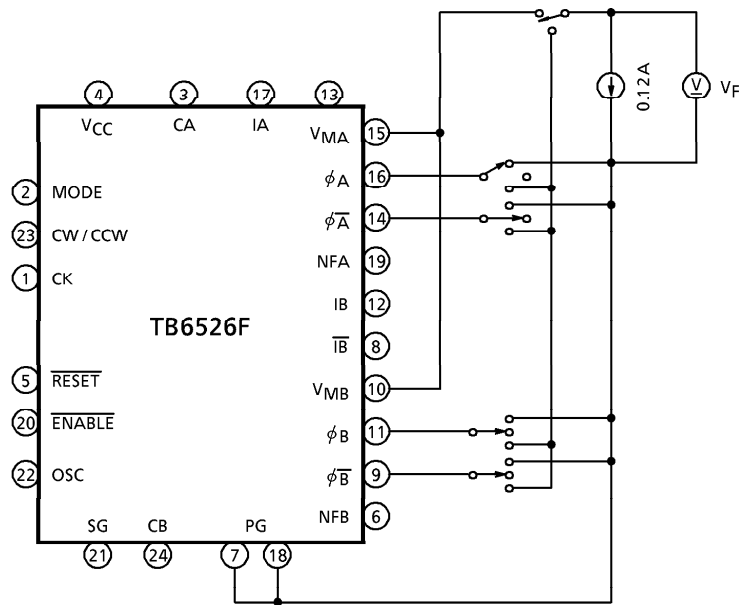
TEST CIRCUIT 6 : I_U



TEST CIRCUIT 7 : V_{SAT}

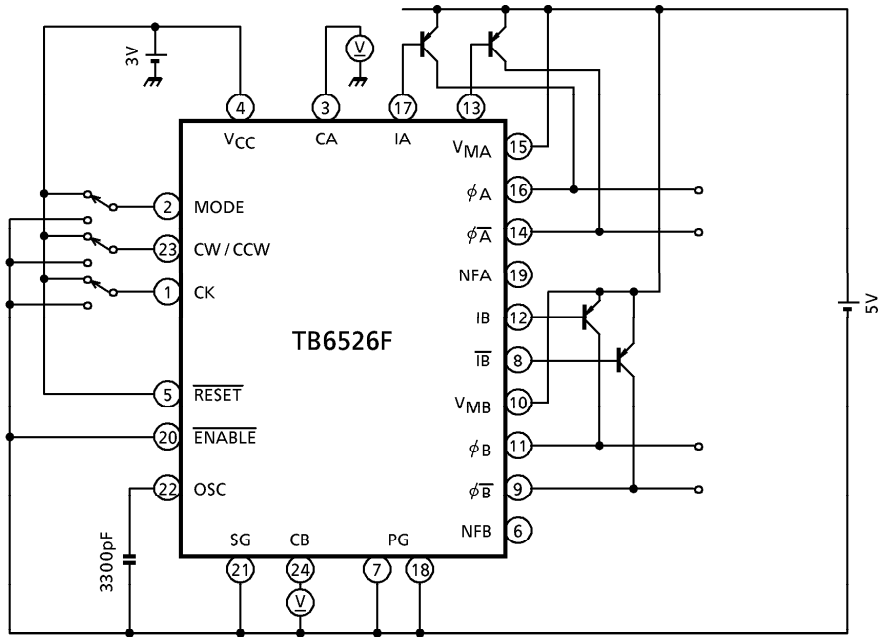


TEST CIRCUIT 8 : V_{F-U} , V_{F-L}

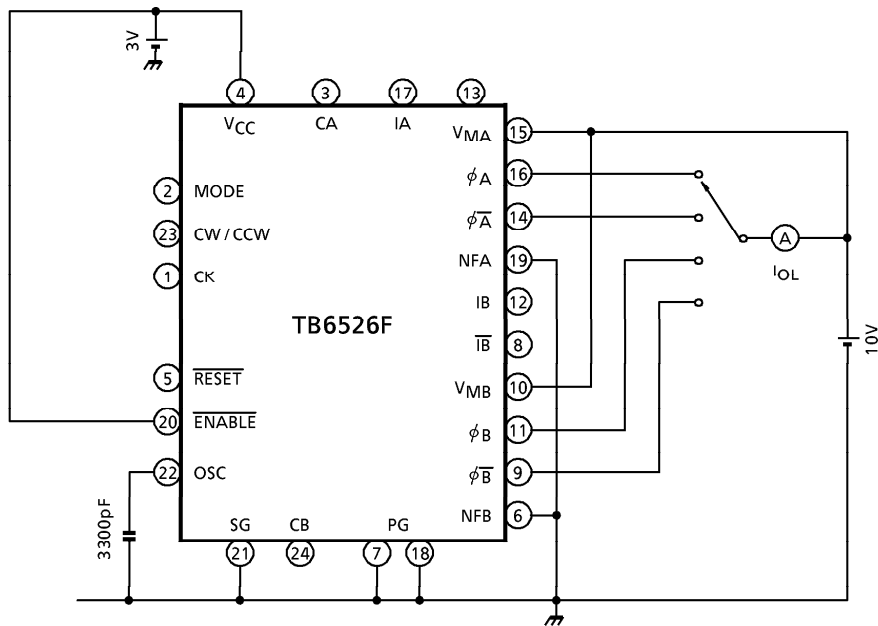


(Note) Not to take GND with any non-connecting pins.

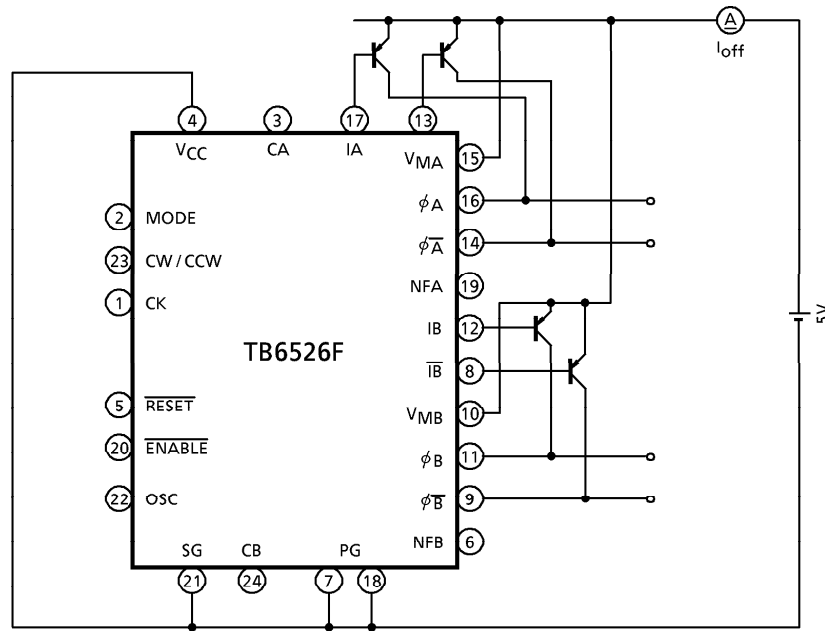
TEST CIRCUIT 9 : V_{NF1} , ΔV_{NF}



TEST CIRCUIT 10 : I_{OL}

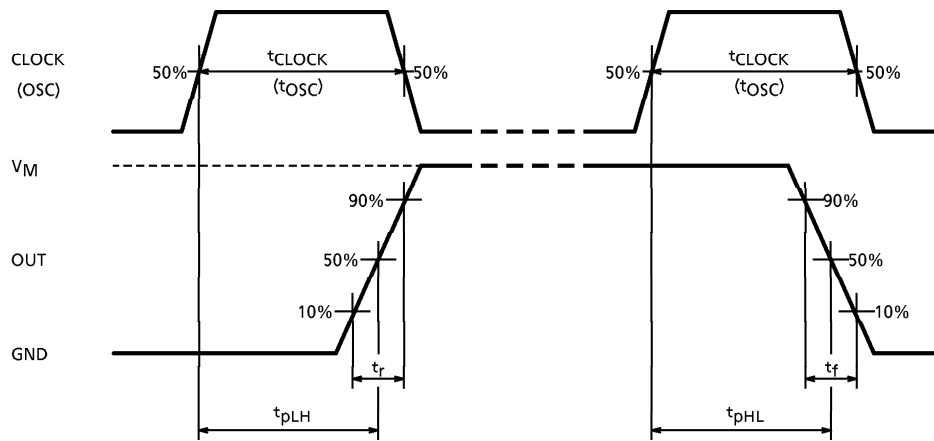


TEST CIRCUIT 11



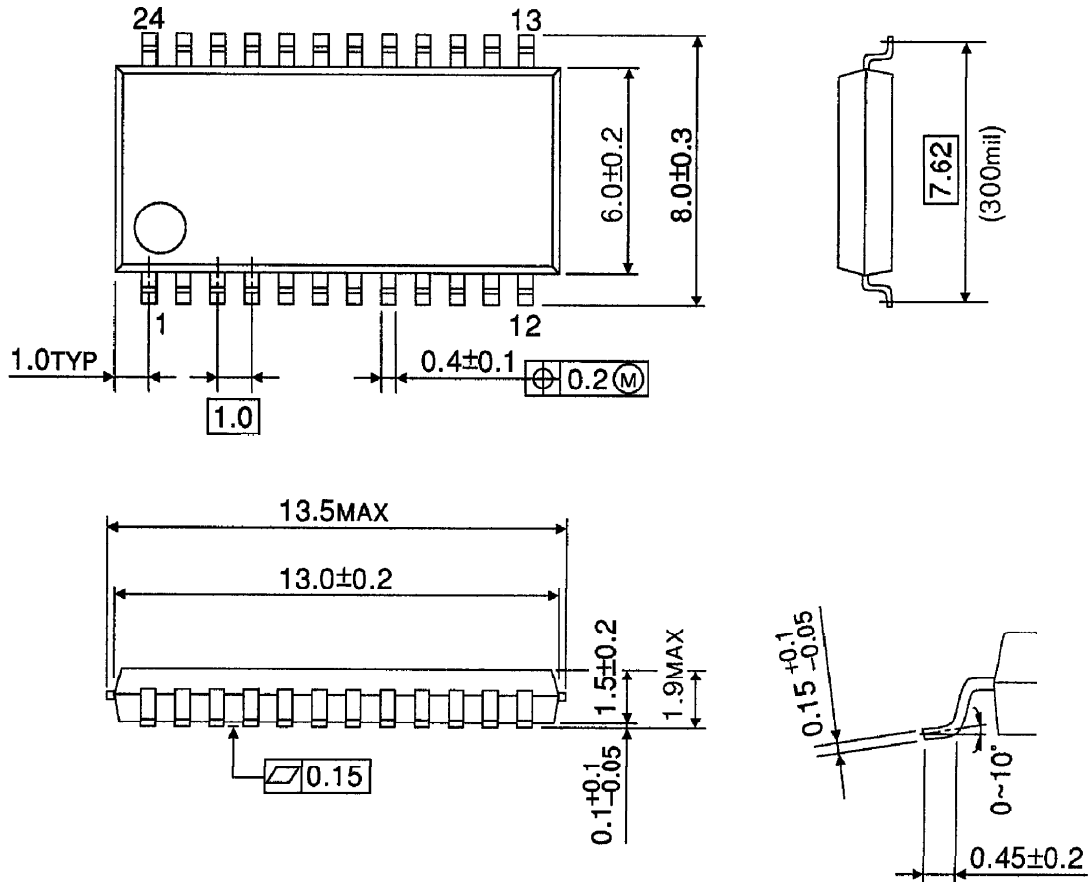
AC ELECTRICAL CHARACTERISTICS, TEST CIRCUIT 12

CK (OSC) - OUT



OUTLINE DRAWING
SSOP24-P-300-1.00B

Unit : mm



Weight : 0.27g (Typ.)