

TENTATIVE

TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

T B 6 5 2 6 F

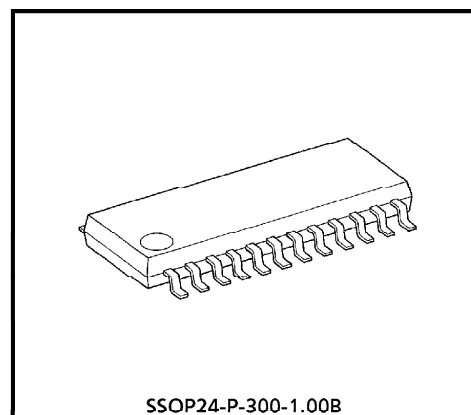
CHOPPER-TYPE BIPOLAR STEPPING MOTOR CONTROL DRIVER IC

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.

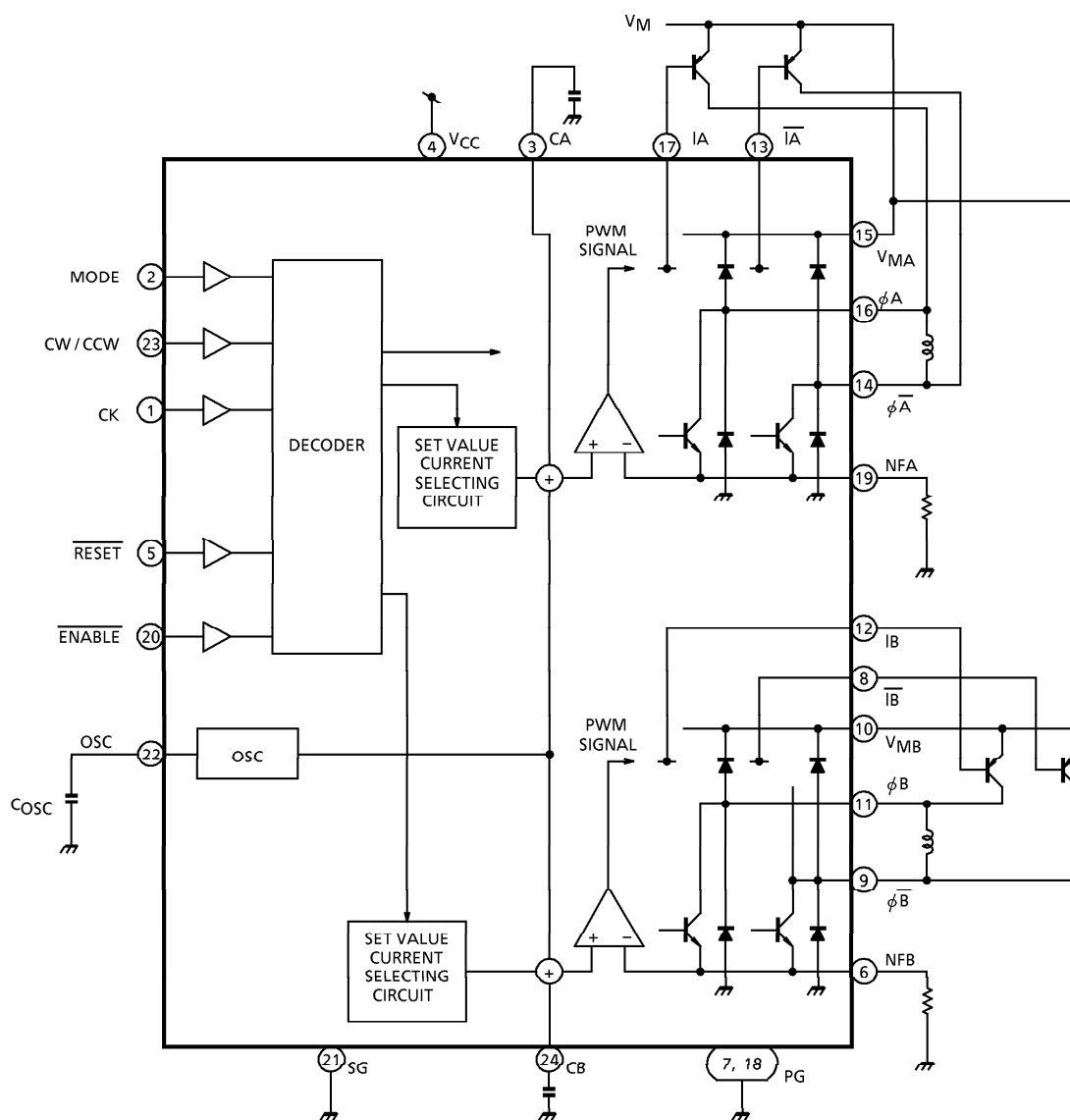


Weight : 0.27g (Typ.)

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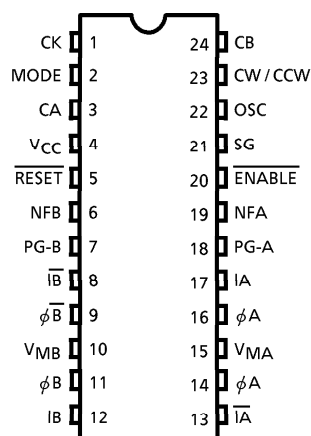
BLOCK DIAGRAM



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	$\bar{I}\bar{A}$	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.

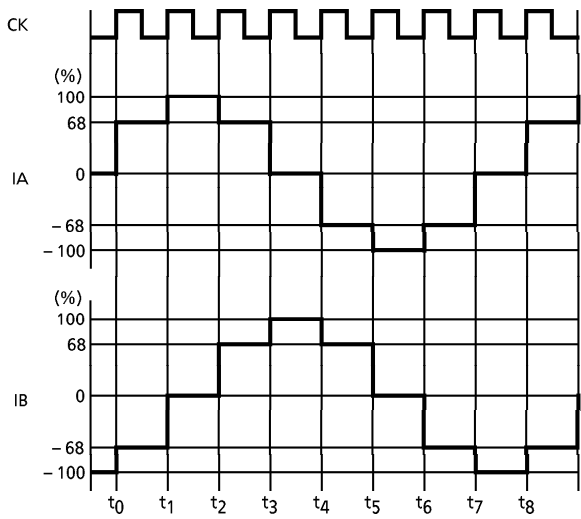
TRUTH TABLE B

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

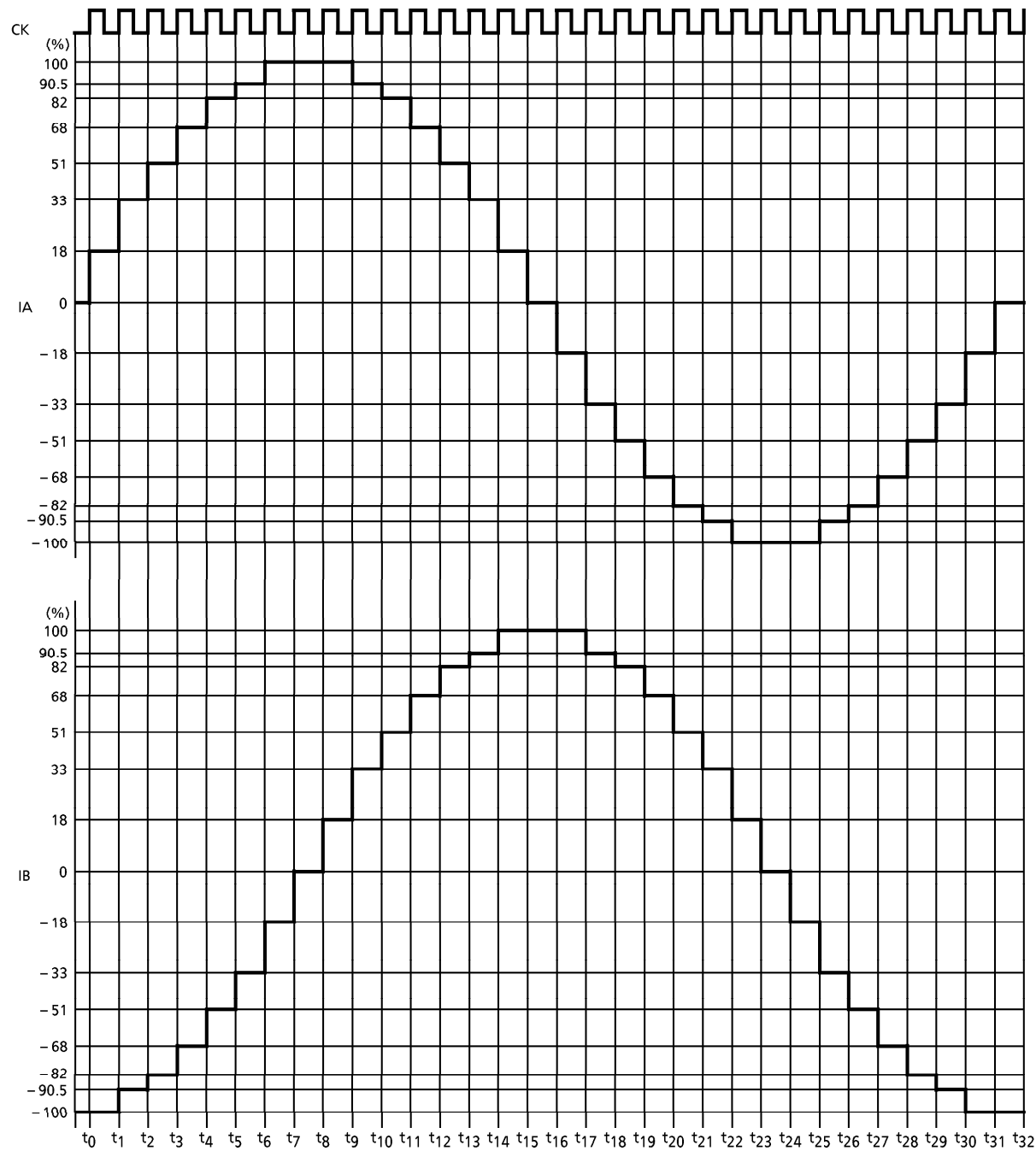
INITIAL MODE

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, V_{CC} = 3V, V_M = 5V, load inductance : L = 8mH / R = 50Ω,
with outer PNP)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Input Voltage	High	V _{IN} (H)	1	MODE, CW / CCW, $\overline{\text{ENABLE}}$ CK, $\overline{\text{RESET}}$	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, $\overline{\text{RESET}}$: H, $\overline{\text{ENABLE}}$: L, (1-2 phase excitation)	—	7	9	mA
		I _{CC2}		Output open, $\overline{\text{RESET}}$: H, $\overline{\text{ENABLE}}$: L, (2W1-2 phase excitation)	—	7	9	
		I _{CC3}		$\overline{\text{RESET}}$: L, $\overline{\text{ENABLE}}$: H	—	1.3	—	
		I _{CC4}		$\overline{\text{RESET}}$: H, $\overline{\text{ENABLE}}$: 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

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with outer PNP)

OUTPUT SECTION

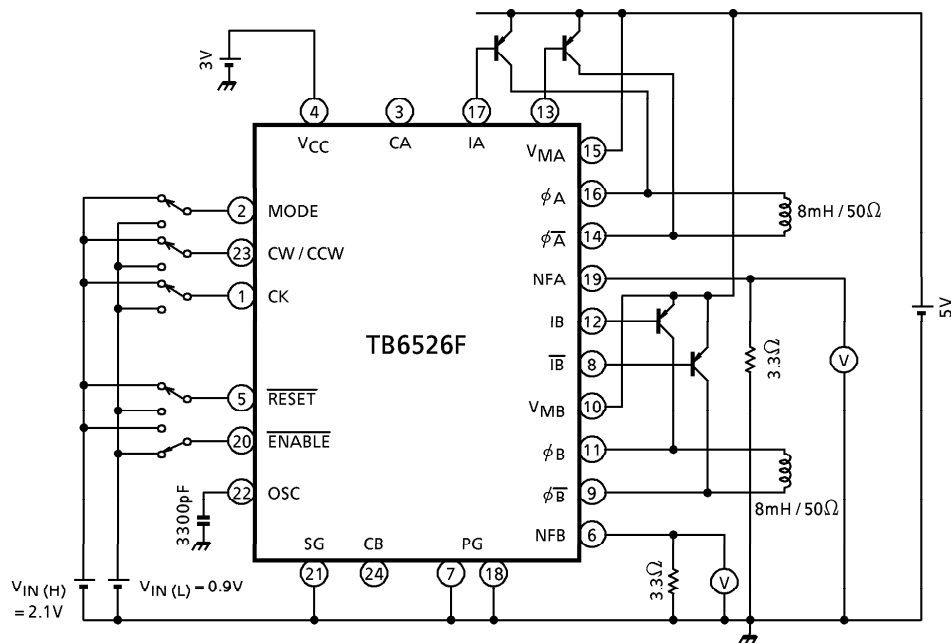
CHARACTERISTIC			SYMBOL	TEST CIRCUIT	TEST CONDITION		MIN	TYP.	MAX	UNIT
Upper Side Driving Current			I _U	6	V _C = 3V		—	1.5	1.6	mA
Lower Side Saturation Voltage			V _{SAT} L1	7	I _{OUT} = 0.06A		—	0.10	—	V
			V _{SAT} L2		I _{OUT} = 0.12A		—	0.16	0.43	
Diode Forward Voltage	Upper Side	V _F U		8	I _{OUT} = 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	mA
NF Dark Current (1 channel)			I _{NF}		ENABLE : "L" level 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.

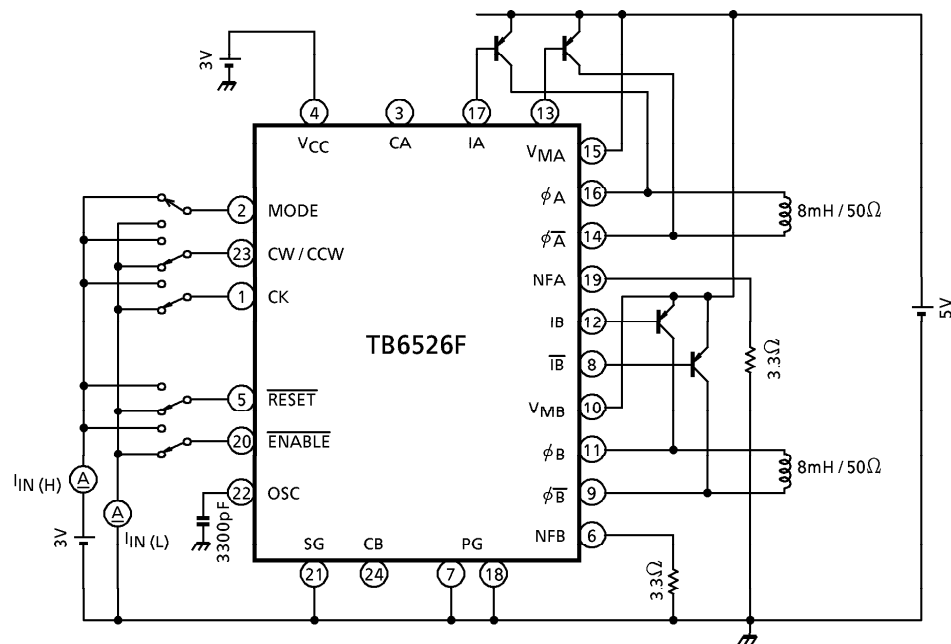
ELECTRICAL CHARACTERISTICS

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

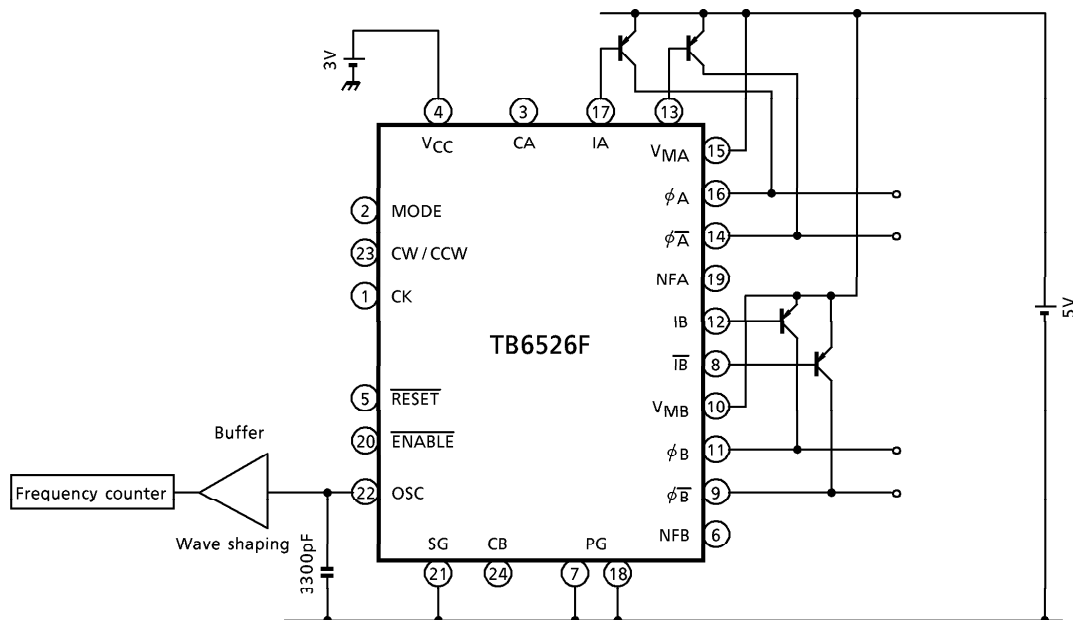
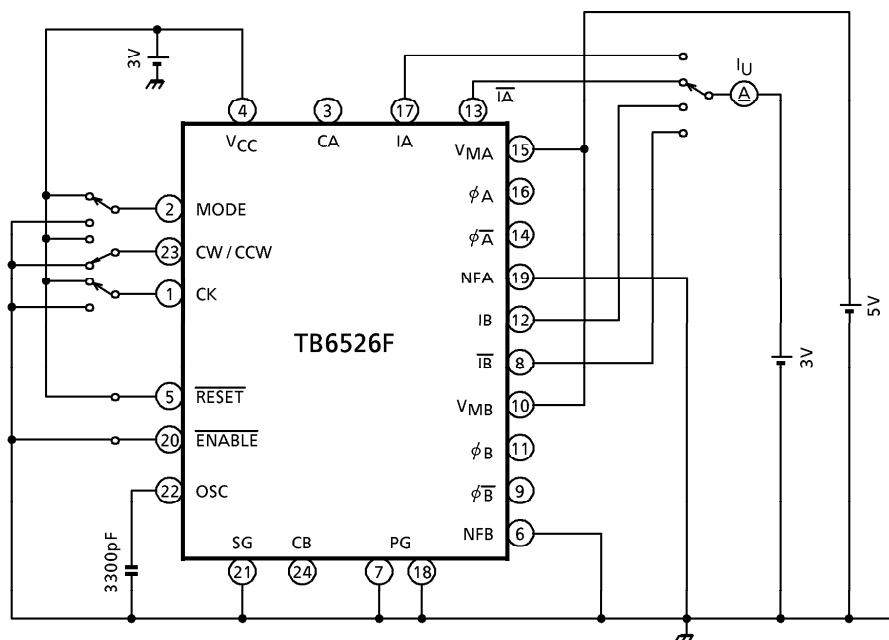
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Reference Voltage	ΔV_{NF}	9	$\Delta\theta = 0/8 - 1/8$	—	0	—	mV
			$\Delta\theta = 1/8 - 2/8$	10	17	35	
			$\Delta\theta = 2/8 - 3/8$	5	16	30	
			$\Delta\theta = 3/8 - 4/8$	16.25	21	41.25	
			$\Delta\theta = 4/8 - 5/8$	25	32	50	
			$\Delta\theta = 5/8 - 6/8$	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}		RESET~output	—	2.0	—	
	t _{pHL}			—	2.5	—	
	t _{pLH}		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

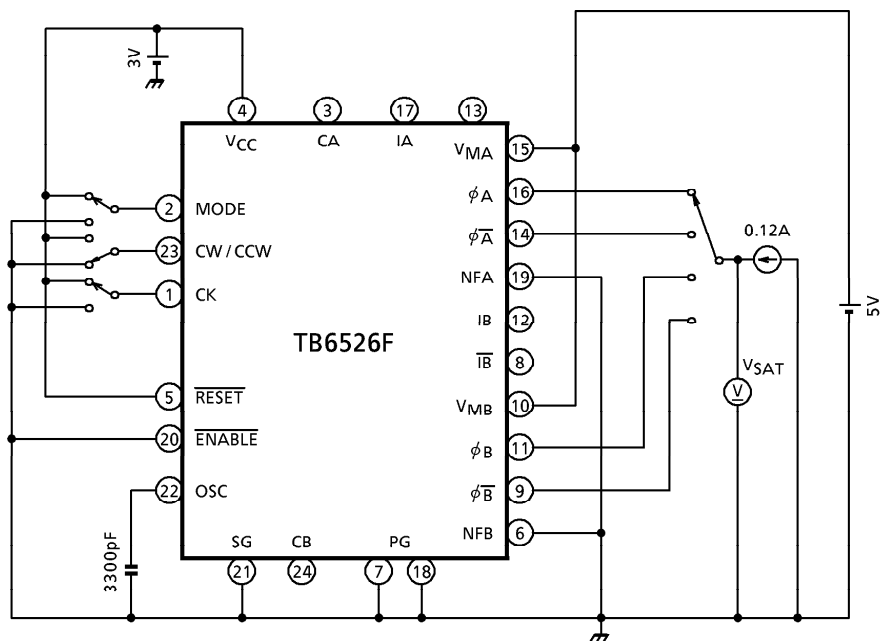
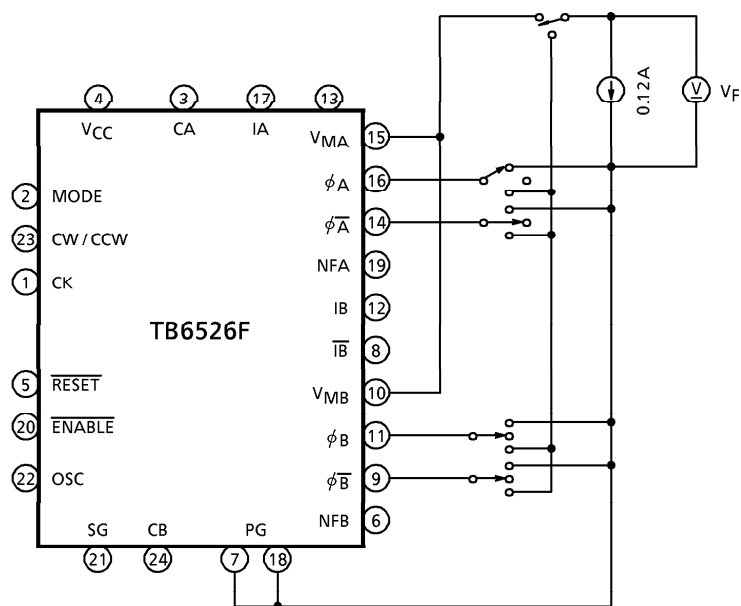
TEST CIRCUIT 1 : $V_{IN}(H)$, $V_{IN}(L)$ 

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

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

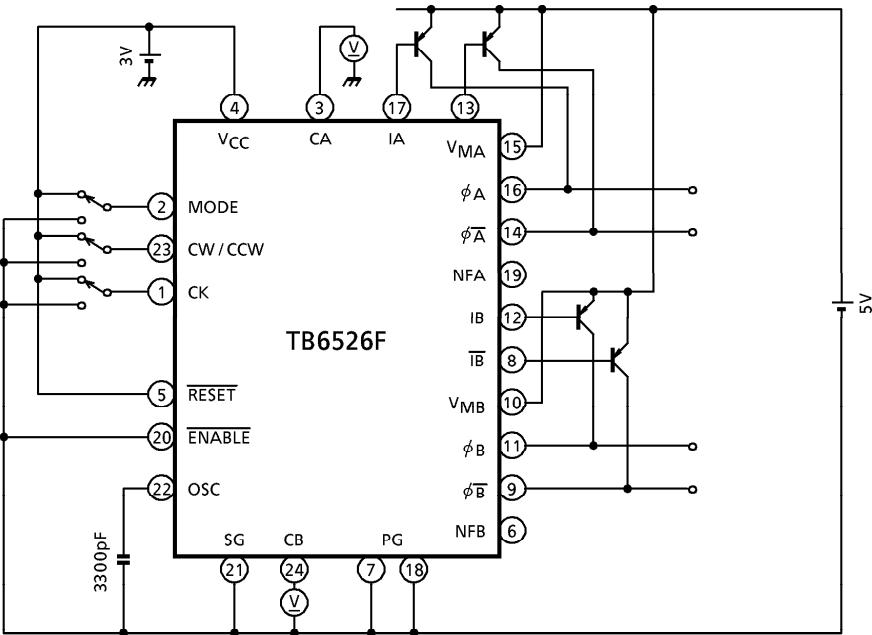
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TEST CIRCUIT 5 : f_{OSC} TEST CIRCUIT 6 : I_U 

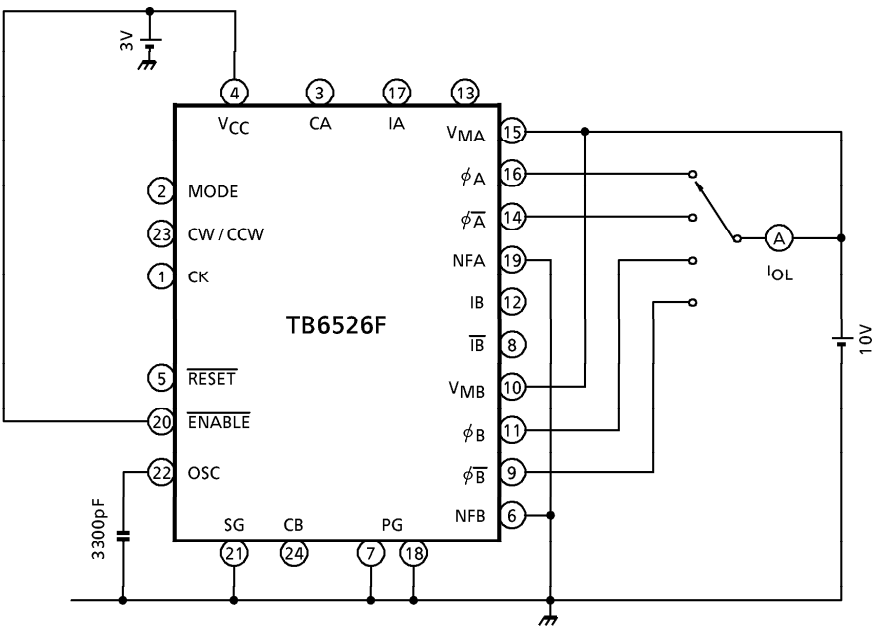
TEST CIRCUIT 7 : V_{SAT} TEST CIRCUIT 8 : V_{F-U} , V_{F-L} 

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

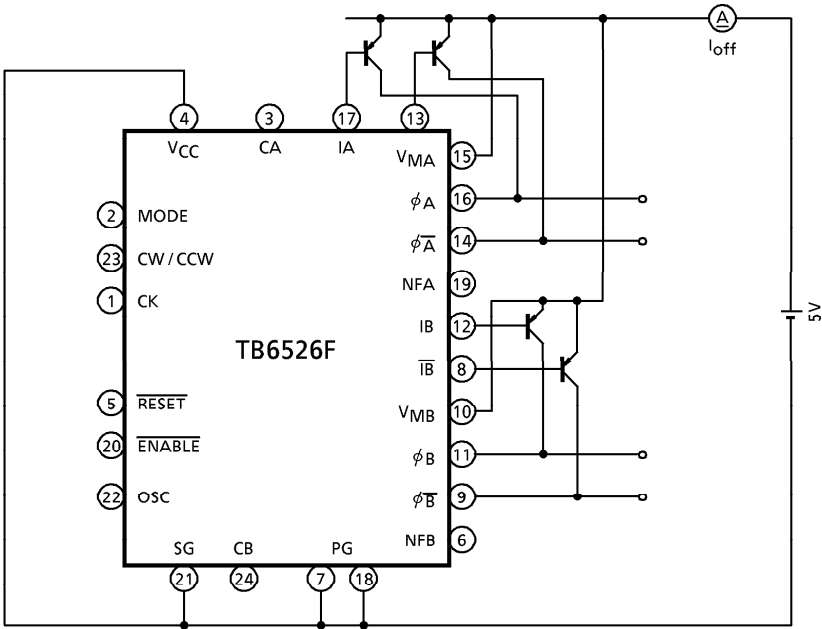
TEST CIRCUIT 9 : V_{NF1} , ΔV_{NF}



TEST CIRCUIT 10 : I_{OL}

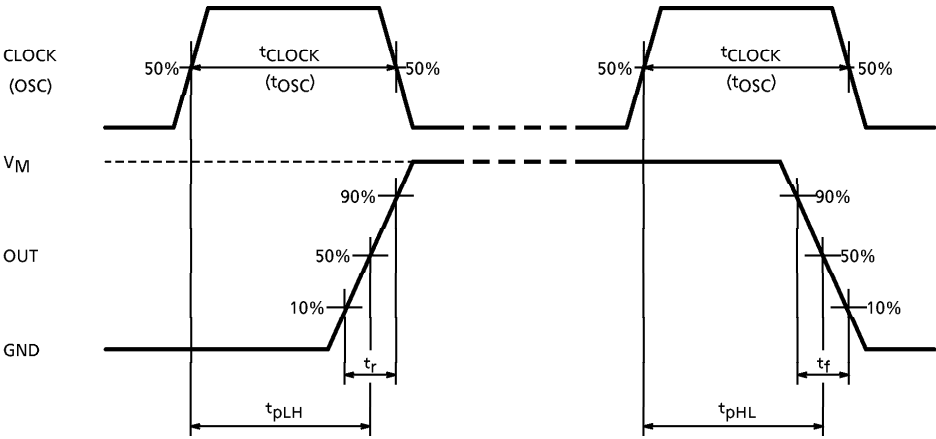


TEST CIRCUIT 11



AC ELECTRICAL CHARACTERISTICS, TEST CIRCUIT 12

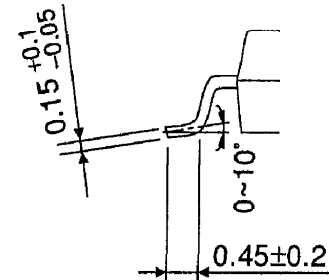
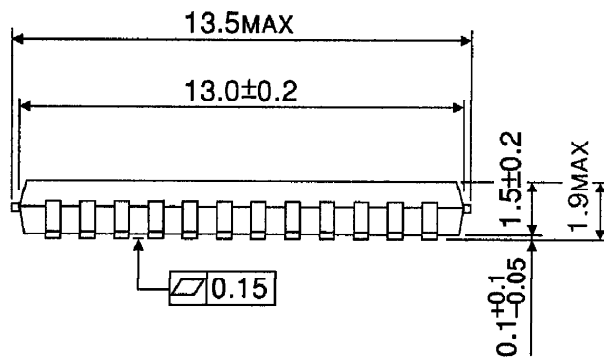
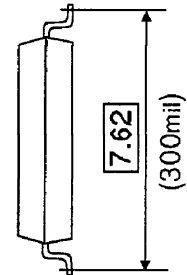
CK (OSC) - OUT



SSOP24-P-300-1.00B

The drawing shows a rectangular chip with pins numbered 1 through 12 along the bottom edge and 13 through 24 along the top edge. A circular feature is located in the bottom-left corner. Dimensions are specified as follows:

- Pin pitch: 1.0 (indicated by a dimension line between pins 1 and 2).
- Pin 1 offset: 1.0 (indicated by a dimension line from the left edge to the center of pin 1).
- Pin 12 offset: 0.4 ± 0.1 (indicated by a dimension line from the center of pin 12 to the right edge).
- Chip width: 6.0 ± 0.2 (indicated by a dimension line across the top).
- Chip height: 8.0 ± 0.3 (indicated by a dimension line along the right side).
- Pin 13 offset: 0.2 (indicated by a dimension line from the right edge to the center of pin 13, with a circled 'M' symbol).



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