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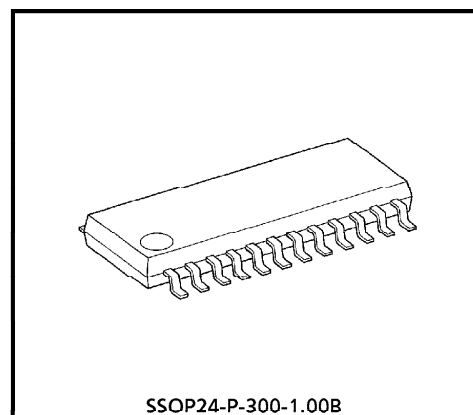
CHOPPER-TYPE BIPOLAR STEPPING MOTOR CONTROL DRIVER IC

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.

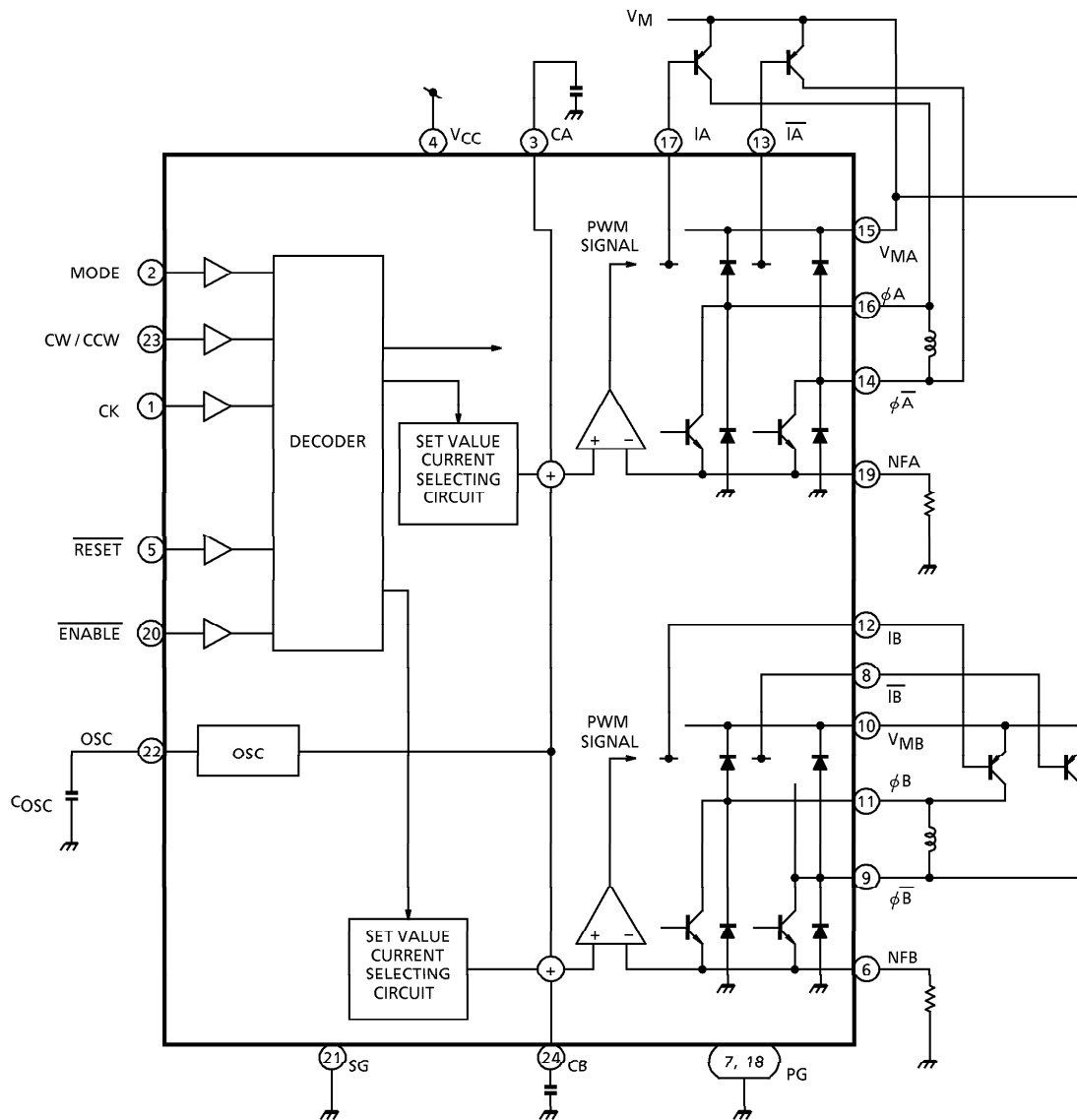


Weight : 0.27g (Typ.)

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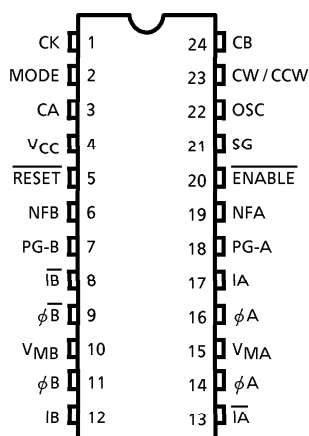
BLOCK DIAGRAM



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.

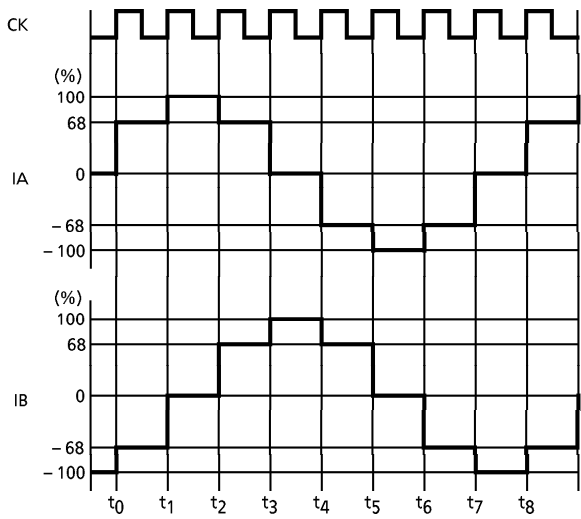
TRUTH TABLE B

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

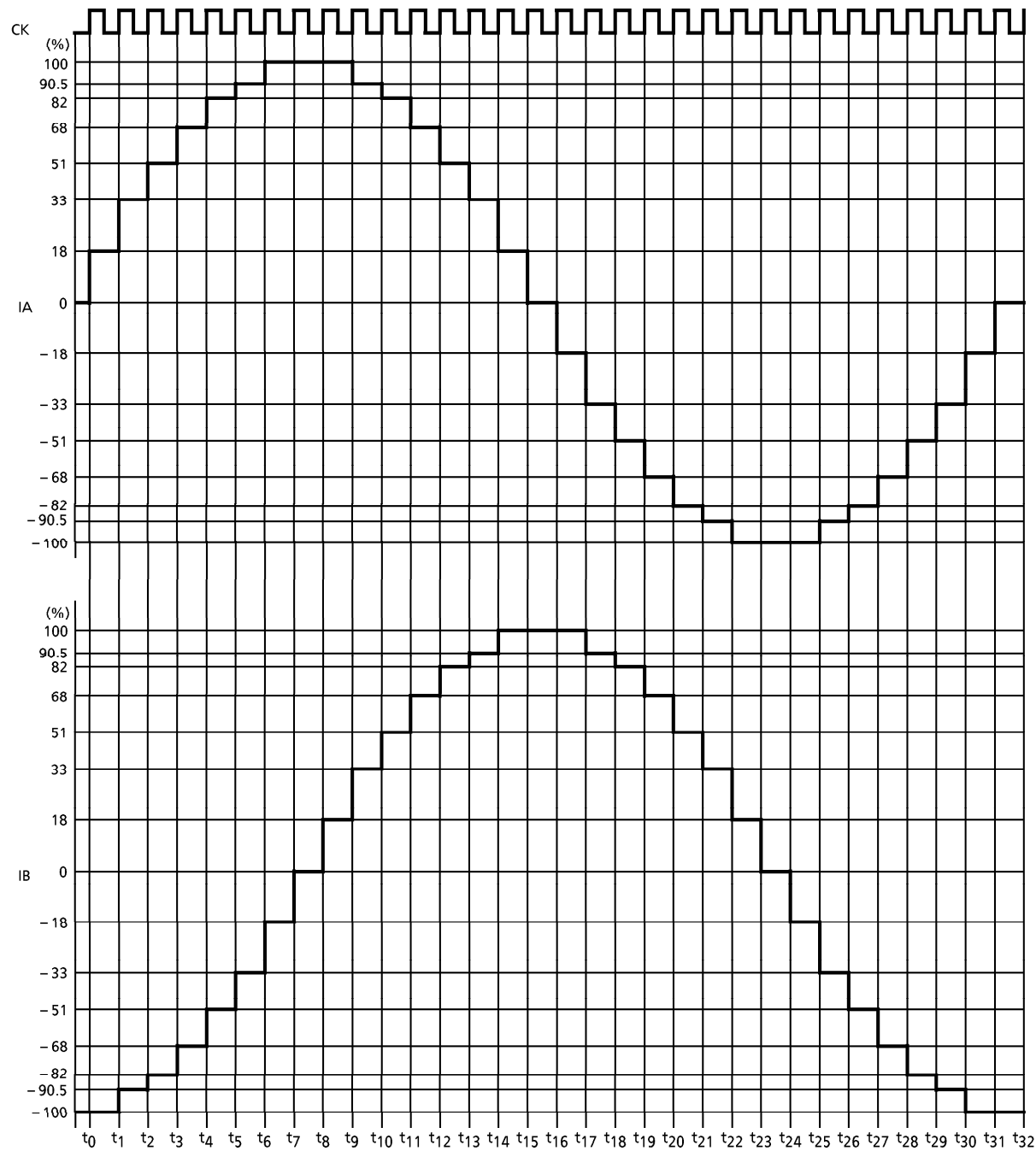
INITIAL MODE

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 CIR- CUIT	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

Unless otherwise specified ($T_a = 25^\circ\text{C}$, $V_{CC} = 3\text{V}$, $V_M = 5\text{V}$, load inductance : $L = 8\text{mH} / R = 50\Omega$,
with outer PNP)

OUTPUT SECTION

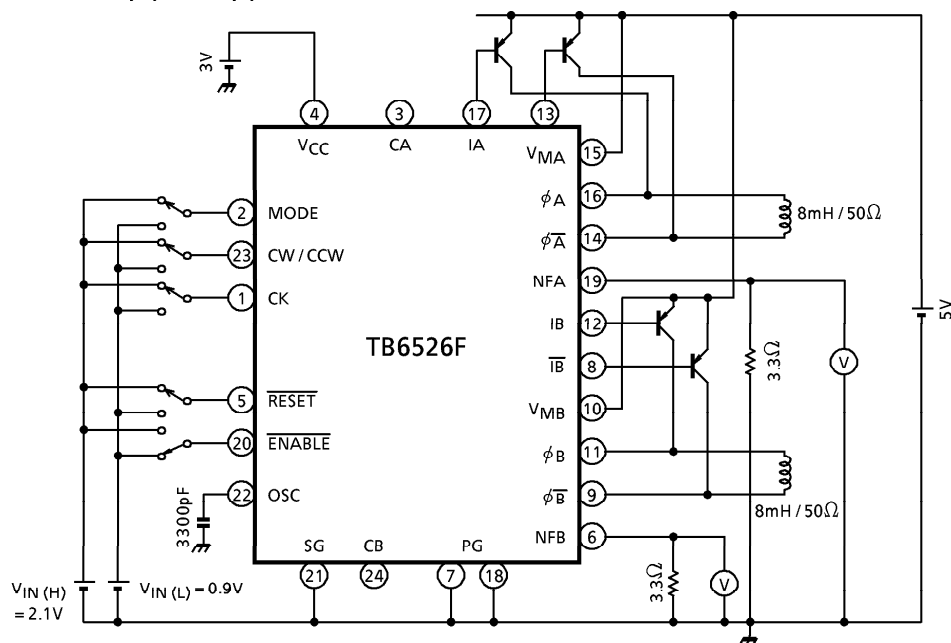
CHARACTERISTIC			SYMBOL	TEST CIR- CUIT	TEST CONDITION		MIN	TYP.	MAX	UNIT
Upper Side Driving Current			I _U	6	V _C = 3V		—	1.5	1.6	mA
Lower Side Saturation Voltage			V _{SAT} L1	7	I _{OUT} = 0.06A		—	0.10	—	V
			V _{SAT} L2		I _{OUT} = 0.12A		—	0.16	0.43	
Diode Forward Voltage	Upper Side	V _F U		8	I _{OUT} = 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	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 $\theta = 0$ is set at 100.

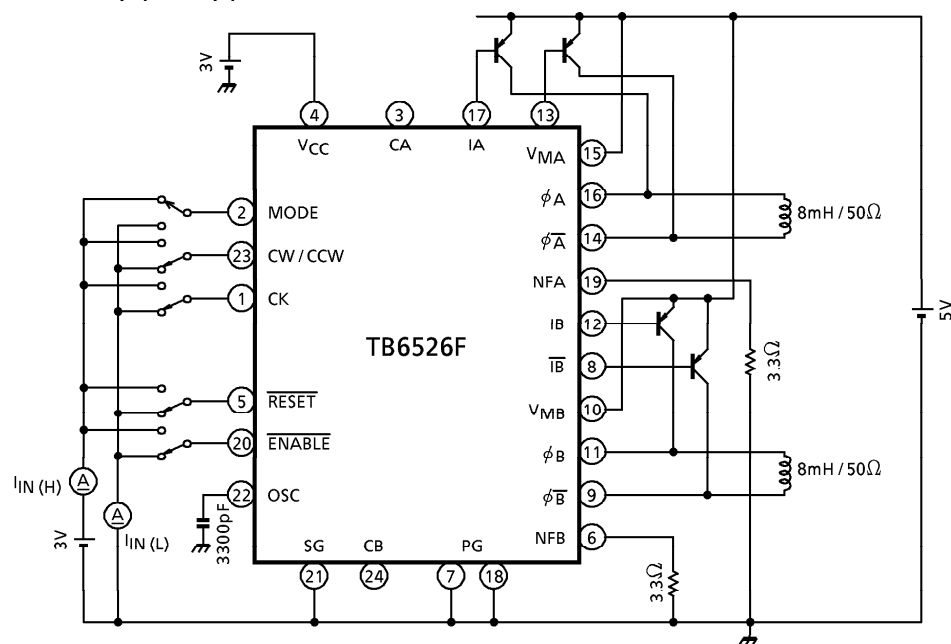
ELECTRICAL CHARACTERISTICS

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 : $V_{IN}(H)$, $V_{IN}(L)$ 

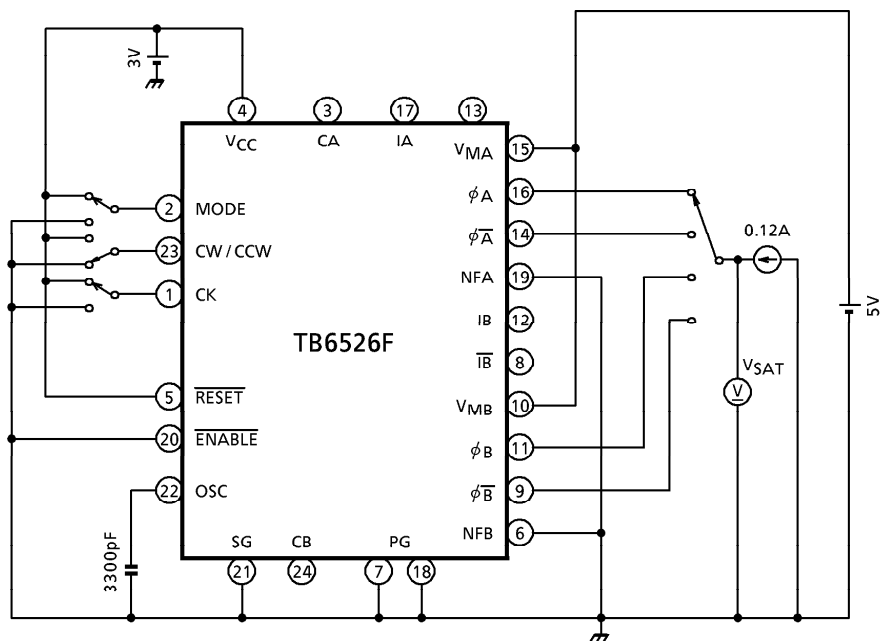
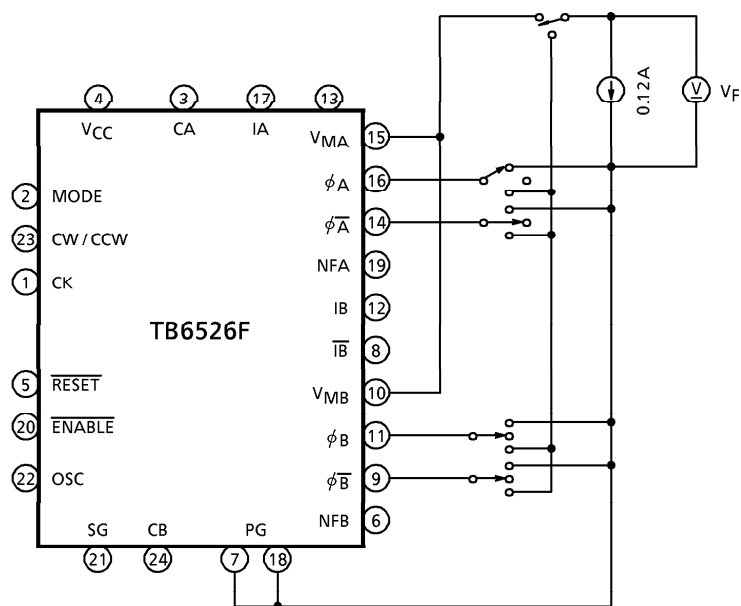
(Note) When input voltage $V_{IN}(H)$, $V_{IN}(L)$ is applied, verify the output function (NF voltage measurement).

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

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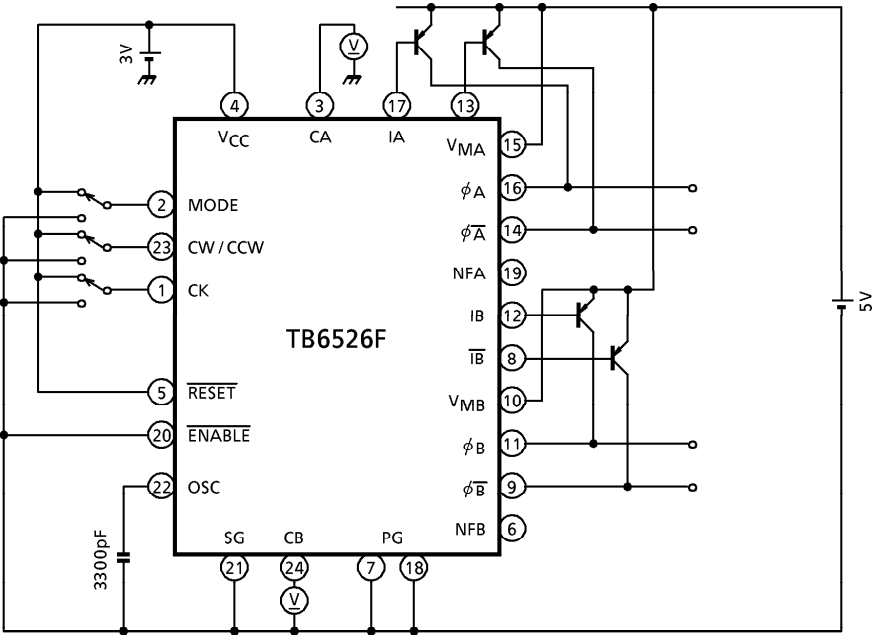
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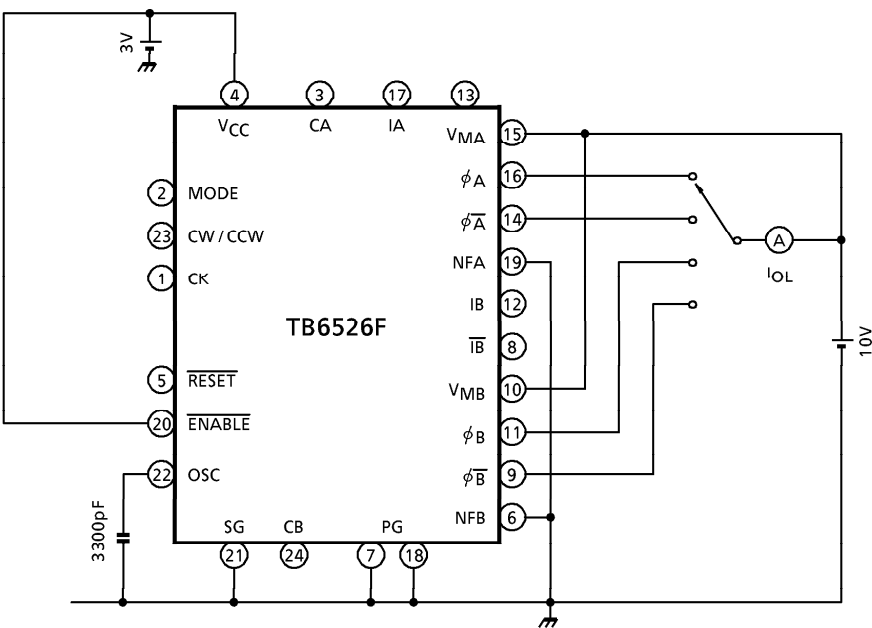
TEST CIRCUIT 7 : V_{SAT} TEST CIRCUIT 8 : V_{F-U} , V_{F-L} 

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

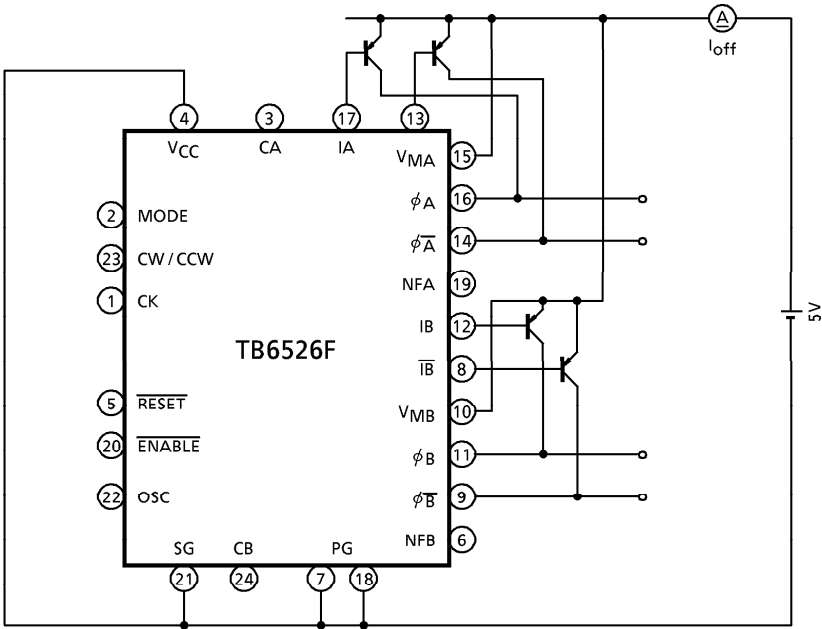
TEST CIRCUIT 9 : V_{NF1} , ΔV_{NF}



TEST CIRCUIT 10 : I_{OL}

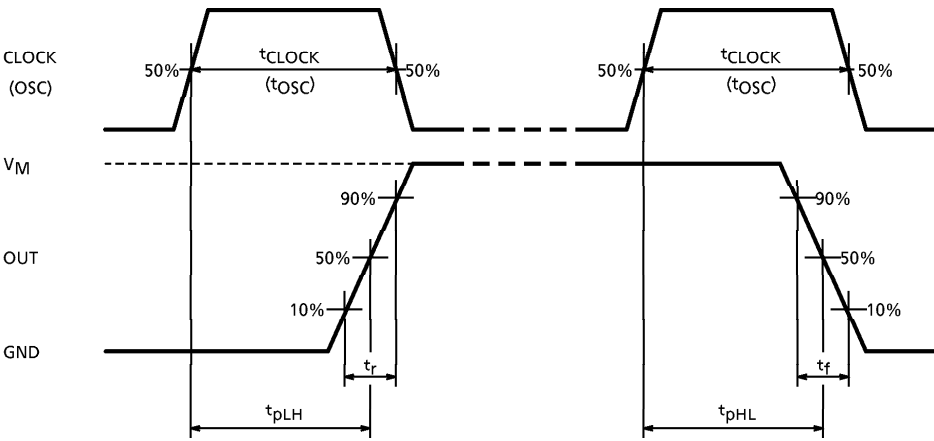


TEST CIRCUIT 11



AC ELECTRICAL CHARACTERISTICS, TEST CIRCUIT 12

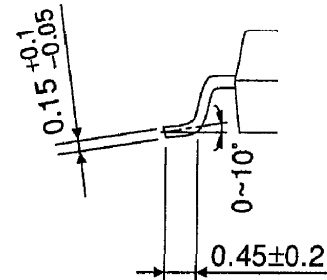
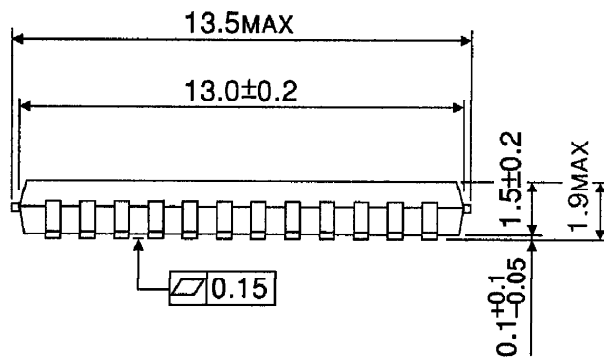
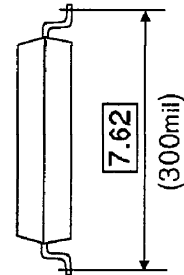
CK (OSC) - OUT



SSOP24-P-300-1.00B

The drawing shows a rectangular chip with pins numbered 1 through 24. The top edge has pins 24, 13, and 12. The bottom edge has pins 1, 12, and 13. The left edge has pins 1, 12, and 13. The right edge has pins 1, 12, and 13. Dimensions are given as follows:

- Overall width: 8.0 ± 0.3
- Overall height: 6.0 ± 0.2
- Pin pitch (center-to-center): 1.0
- Pin width: 0.4 ± 0.1
- Pin height: 0.2 (indicated by a circled M)
- Typical pin length: 1.0 TYP



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