NIPPON PRECISION CIRCUITS INC.

CF5705 series

Analog Watch Stepping Motor Driver

OVERVIEW

The CF5705 series are low-current analog watch stepping motor driver CMOS ICs with built-in 32.768 kHz crystal oscillator circuit.

FEATURES

- 32.768 kHz crystal oscillator circuit
  C_G and C_D built-in
- −3.6 to −1.2 V operating supply voltage range
- Operating current consumption
  - V_{SS} = –1.55V, C_D = 16pF: 250 nA (max)
  - V_{SS} = –2.8V, C_D = 26pF: 1000 nA (max)

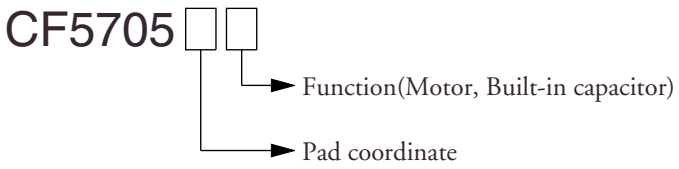
  Note: Current consumption depends on the built-in capacitor.
- Reset function
  4 Hz and subsequent frequency dividers are reset

SERIES LINEUP

Version	Pad coordinates								Motor			Built-in capacitor[1]	
	1	2	3	4	5	6	7	8	Cycle (Tcy/2) [sec]	Pulse (Tpw) [sec]	Test (Tcy) [sec]	C_G [pF]	C_D [pF]
CF5705AA	XT	XTN	RESET	VSS	TEST	OUT2	OUT1	VDD	1	4.9m	125m	4	16
CF5705AD	XT	XTN	RESET	VSS	TEST	OUT2	OUT1	VDD	1	23.4m	125m	4	30
CF5705AE	XT	XTN	RESET	VSS	TEST	OUT2	OUT1	VDD	20	5.9m	125m	4	16
CF5705AK	XT	XTN	RESET	VSS	TEST	OUT2	OUT1	VDD	62.5m	23.4m	125m	4	30
CF5705BC	VSS	RESET	XT	XTN	VDD	OUT2	OUT1	TEST	250m	23.4m	125m	4	26
CF5705BJ	VSS	RESET	XT	XTN	VDD	OUT2	OUT1	TEST	1	23.4m	125m	4	26
CF5705CF	VSS	TEST	XTN	XT	VDD	OUT2	OUT1	RESET	1	4.9m	62.5m	4	16
CF5705CG	VSS	TEST	XTN	XT	VDD	OUT2	OUT1	RESET	1	3.9m	62.5m	4	16

1. Parasitic capacitance is included. Parasitic capacitance: $C_G = C_D$ = 4pF

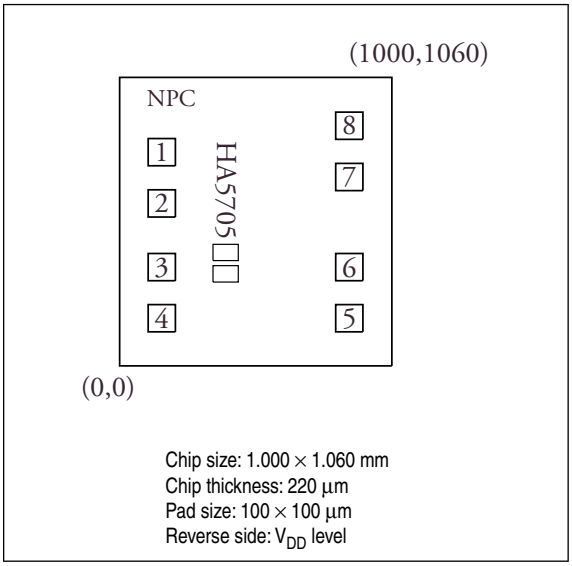
PART NUMBER GUIDE



ORDERING INFORMATION

Device	Package
CF5705××	Chip form

PAD DIMENSIONS (Top view)

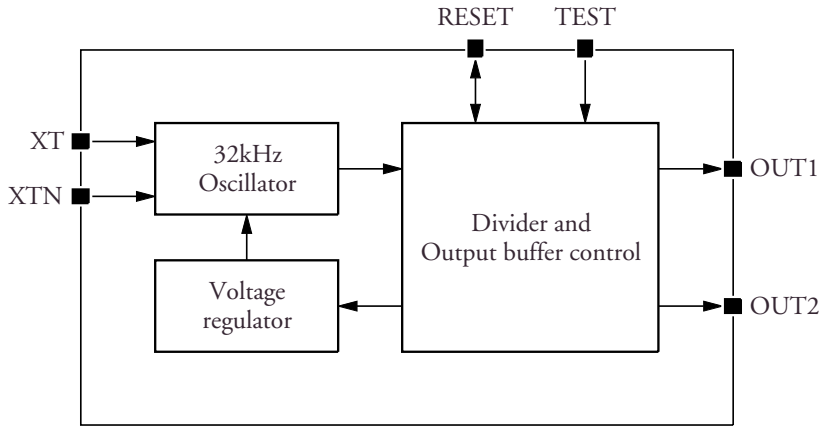


Chip size: 1.000 × 1.060 mm
Chip thickness: 220 μm
Pad size: 100 × 100 μm
Reverse side: V_{DD} level

PAD COORDINATES

Number	X (μm)	Y (μm)
1	155	785
2	155	597
3	155	363
4	155	175
5	844	175
6	844	363
7	844	694
8	844	882

BLOCK DIAGRAM



PAD DESCRIPTION

Name	Description
VSS	Negative supply voltage
VDD	Positive supply voltage
XT	Crystal oscillator circuit input
XTN	Crystal oscillator circuit output
OUT1	Stepping motor driver output 1
OUT2	Stepping motor driver output 2
RESET	Reset input
TEST	Test mode select. 512 Hz clock output

Pin number: Refer to Series lineup.

SPECIFICATIONS

Absolute Maximum Ratings

V_{DD} = 0 V

Parameter	Symbol	Rating	Unit
Supply voltage range	V_{SS}	–5.0 to 0.3	V
Input voltage range	V_{IN}	V_{SS} – 0.3 to 0.3	V
Storage temperature range	T_{stg}	–40 to 125	°C

Recommended Operating Conditions

Parameter	Symbol	Rating	Unit
Supply voltage	V_{SS}	–3.6 to –1.2	V
Operating temperature	T_{opg}	–20 to 75	°C

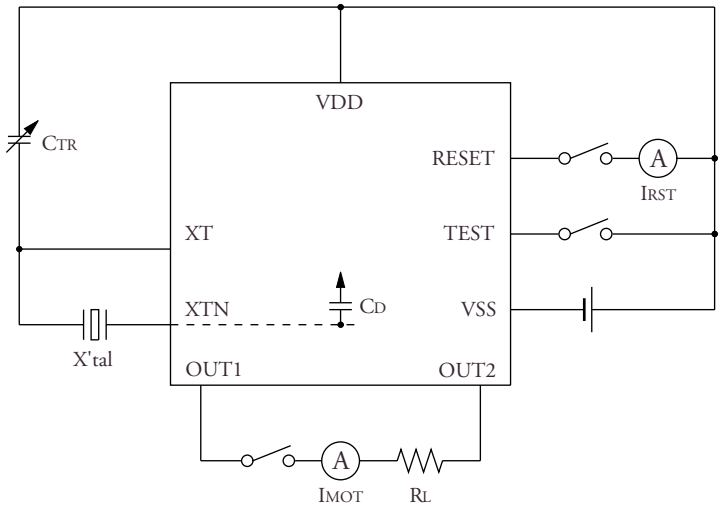
Electrical Characteristics

V_{DD} = 0 V, T_a = 25 °C, X'tal C_I = 55kΩ max

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Operating supply voltage	V_{SS}		–3.6	–	–1.2	V
Operating current consumption[1]	I_{DD}	No load, V_{SS} = –1.55V, (C_{TR} + C_G) = 15 pF, C_D = 16 pF	–	0.15	0.25	µA
		No load, V_{SS} = –2.8V, (C_{TR} + C_G) = 24 pF, C_D = 26 pF	–	0.40	1.00	µA
Reset input current	I_{RST}	RESET: V_{RST} = V_{DD} , V_{SS} = –1.55V	–	6	–	nA
		RESET: V_{RST} = V_{DD} , V_{SS} = –2.8V	–	25	100	nA
Reset input resistance	R_{RST}	V_{RST} = –1.35 V, V_{SS} = –1.55V	15	35	60	kΩ
		V_{RST} = –2.6 V, V_{SS} = –2.8V	5	15	50	kΩ
Motor output current	I_{MOT}	R_L = 2 kΩ, V_{SS} = –1.55 V	0.7	–	–	mA
		R_L = 1 kΩ, V_{SS} = –2.4 V	2.18	2.29	–	mA
Motor output cycle time[2] (normal mode)	T_{CY}		Refer to the SERIES LINEUP			s
Motor output cycle time[2] (test mode)	t_{CY}					ms
Motor output pulsewidth[2]	T_{PW}					ms
Oscillator start voltage[2]	V_{STA}		–1.3	–	–	V
Oscillator start time	T_{STA}	From supply ON to 512 Hz output on TEST	–	2	5	s
Frequency voltage deviation	Δf/f	V_{SS} = –1.2 → –3.6 V, C_{TR} = 5 pF	–	0.2	1	ppm/0.1V
Frequency deviation[3]	ε'	Built-in C_D	– 8	–	8	ppm
		Built-in C_D and C_G	– 16	–	16	ppm
Internal capacitance[2]	C_G, C_D	(C_G + C_D) < 62 pF	Refer to the SERIES LINEUP			pF

1. Current consumption is measured in the measurement circuit (see next page).
2. Refer to Series lineup.
3. ε' = [f (1.55V) – f'$_0$] / f'$_0$ (C_D = 16pF)
   ε' = [f (2.8V) – f'$_0$] / f'$_0$ (C_D = 26pF)
   f'$_0$: Oscillation frequency center value of Standard Deviation in the same measuring conditions

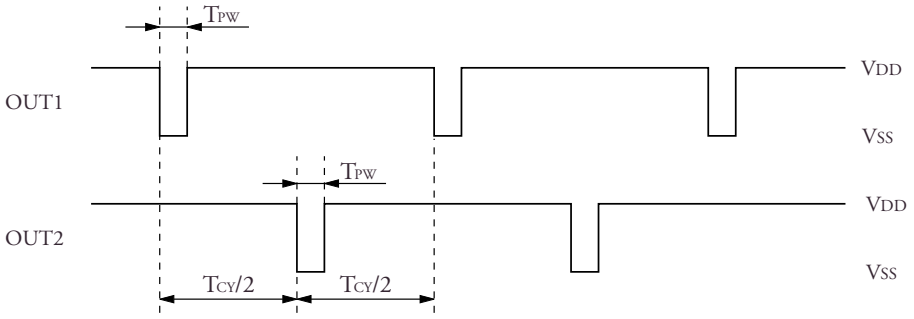
Measurement Circuit



Crystal: f = 32.768 kHz, CI = 20 kΩ, C0 = 1.3pF, C1 = 2.6fF

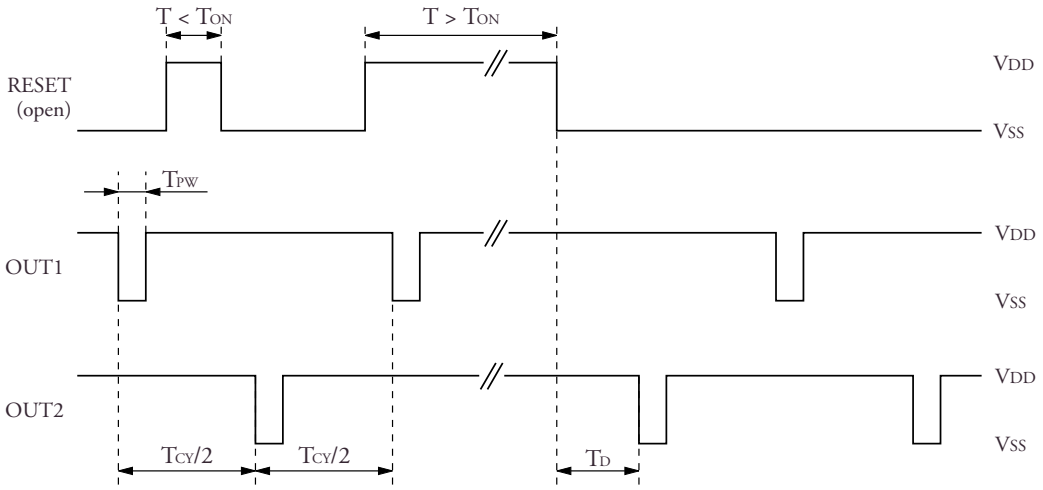
FUNCTIONAL DESCRIPTION

Motor Output Waveform



The motor output waveform cycle time and output pulsewidth are set by mask option.

Reset Function



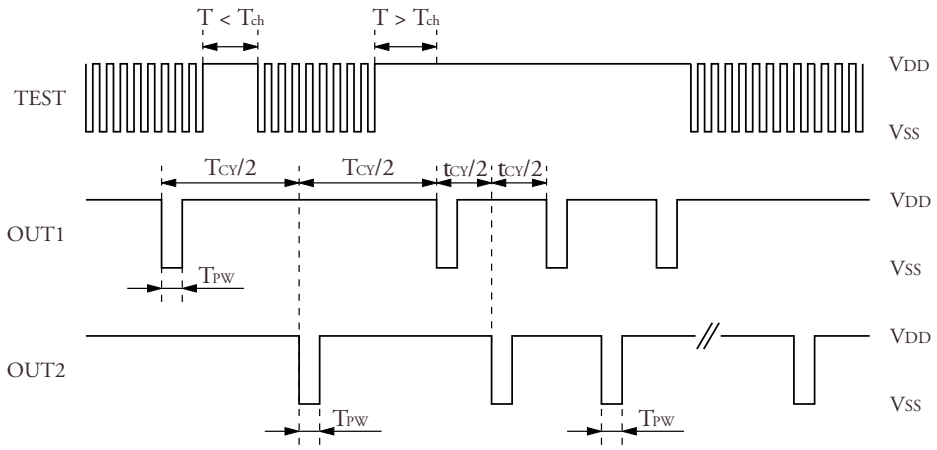
Reset operation

A reset operation occurs when RESET is held HIGH (V_{DD}) for a period of 93.75 ms or greater, otherwise the reset is ignored. When the reset pulse is valid, the 4 Hz and subsequent frequency dividers are reset.

Reset Release

When the reset is released, the first output pulse occurs on the output pin opposite the output pin where the preceding motor drive output pulse occurred; first pulse occurs on OUT1 if previous motor drive pulse occurred on OUT2, and vice versa. A delay of $T_{CY}/2 - 0.125$ to $T_{CY}/2$ takes place from when reset is released until the first output pulse occurs.

Test Function



Normal mode (TEST = open circuit)

In test mode, a 512 Hz rectangular wave is output on TEST. Note that the output load (probe) must be greater than 10 MΩ and less than 20 pF. The motor drive outputs on OUT1 and OUT2 continue to operate normally.

Test mode 1 (TEST = V_{DD})

Test mode 1 is invoked when TEST is held HIGH for a minimum of 2 cycles of the 512 Hz clock (T_{CH} > 3.9 ms), otherwise it is ignored. In test mode 1, high-speed motor output operation occurs, with the cycle time set by mask option to 62.5 or 125 ms.

Test mode 2 (TEST = V_{SS})

Test mode 2 is a dedicated IC test mode. In test mode 2, the device operates at 32-times speed, with the supply voltage connected directly to the oscillator circuit. Note that if a reset input occurs, the internal operation is reset and device output stops. Once operation stops, normal operation is not restored until TEST is either open circuit or goes LOW.

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