

OVERVIEW

The CF5029A is crystal oscillator module IC with divide-by-512 frequency output. It employs a 16.777216MHz fundamental frequency crystal source oscillator to generate a 32.768kHz output crystal oscillator with excellent temperature characteristics.

FEATURES

- 2.25 to 3.6V operating supply voltage range
- 16.777216MHz reference source oscillator frequency
- Output frequency: oscillation frequency divided by 512
- - 40 to 85°C operating temperature range
- Oscillation capacitors C_G , C_D built-in
- Standby function
 - High impedance in standby mode, oscillator stops
- Power-saving pull-up resistor built-in
- 2mA output drive capability (min. $V_{DD} = 2.25V$)
- CMOS output duty level (1/2VDD)
- Molybdenum-gate CMOS process
- Chip form (CF5029A)

APPLICATIONS

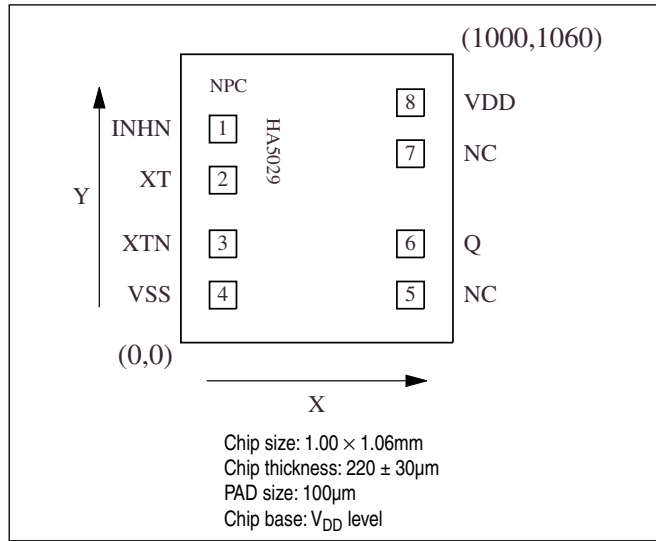
- 32.768kHz output crystal oscillator modules

ORDERING INFORMATION

Device	Package
CF5029A-2	Chip form

PAD LAYOUT

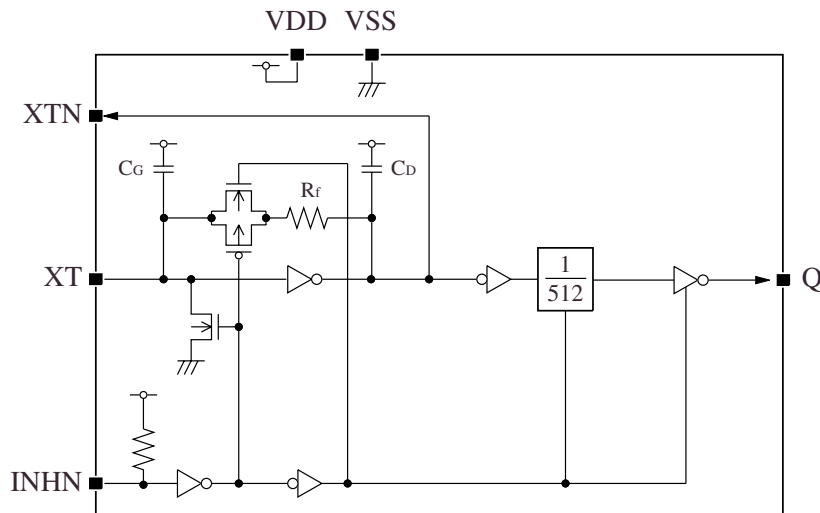
(Unit: μm)



PIN DESCRIPTION and PAD DIMENSIONS

No.	Name	I/O	Description	Pad dimensions [μm]	
				X	Y
1	INHN	I	Output state control input. High impedance when LOW, oscillator stops. Power-saving pull-up resistor built-in.	155	785
2	XT	I	Oscillator input	155	597
3	XTN	O	Oscillator output		
Crystal connection pins. Crystal is connected between XT and XTN.				155	363
4	VSS	-	(-) ground	155	175
5	NC	-	No connection (leave open)	844	175
6	Q	O	Output. Source oscillator divided-by-512 frequency output	844	363
7	NC	-	No connection (leave open)	844	694
8	VDD	-	(+) supply voltage	844	882

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

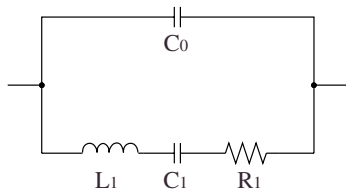
Parameter	Symbol	Condition	Rating	Unit
Supply voltage range	V_{DD}		$V_{SS} - 0.3$ to $V_{SS} + 5.0$	V
Input voltage range	V_{IN}		$V_{SS} - 0.3$ to $V_{DD} + 0.3$	V
Output voltage range	V_{OUT}		$V_{SS} - 0.3$ to $V_{DD} + 0.3$	V
Storage temperature range	T_{STG}	Chip form	-65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

$f_O = 16.777216\text{MHz}$ unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Supply voltage	V_{DD}		2.25	–	3.6	V
Input voltage	V_{IN}		V_{SS}	–	V_{DD}	V
Operating temperature	T_{OPR}		-40	+25	+85	°C

Current consumption and Output waveform with NPC's standard crystal



R_1 [Ω]	L_1 [mH]	C_1 [fF]	C_0 [pF]
5.6	7.45	12.67	3.40

ELECTRICAL CHARACTERISTICS

DC Characteristics

$V_{DD} = 2.25$ to 3.6V , $V_{SS} = 0\text{V}$, $T_a = -40$ to $+85^\circ\text{C}$ unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit	
			min	typ	max		
Operating current consumption	I_{DD}	Measurement cct 1, INHN = open or HIGH, $C_L = 15\text{pF}$	$V_{DD} = 2.25$ to 2.75V	–	0.24	0.6	mA
			$V_{DD} = 2.75$ to 3.6V	–	0.42	1	mA
Standby current	I_{ST}	Measurement cct 1, INHN = LOW	–	–	10	μA	
HIGH-level output voltage	V_{OH}	Measurement cct 3, $V_{DD} = 2.25$ to 3.6V , $I_{OH} = 2\text{mA}$	$V_{DD} - 0.4$	$V_{DD} - 0.15$	–	V	
LOW-level output voltage	V_{OL}	Measurement cct 3, $V_{DD} = 2.25$ to 3.6V , $I_{OL} = 2\text{mA}$	–	0.15	0.4	V	
Output leakage current	I_Z	Measurement cct 4, INHN = LOW	$V_{OH} = V_{DD}$	–	–	10	μA
			$V_{OL} = V_{SS}$	–	–	-10	μA
HIGH-level input voltage	V_{IH}	Measurement cct 5	$0.7V_{DD}$	–	–	V	
LOW-level input voltage	V_{IL}	Measurement cct 5	–	–	$0.3V_{DD}$	V	
INHN pull-up resistance	R_{PU1}	Measurement cct 6	INHN = V_{SS}	0.4	–	4	M Ω
	R_{PU2}		INHN = $0.7V_{DD}$	40	–	200	k Ω
Built-in capacitance	C_G	Design value. A monitor pattern on a wafer is tested. $T_a = 25^\circ\text{C}$	5	6	7	pF	
	C_D		5	6	7	pF	

AC Characteristics

$V_{DD} = 2.25$ to $3.6V$, $V_{SS} = 0V$, $T_a = -40$ to $+85^\circ C$ unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Output duty cycle	Duty	Measurement cct 1, $C_L = 15pF$, $V_{DD} = 2.5V, 3.3V$, $T_a = 25^\circ C$	45	50	55	%
Rise time	t_r	Measurement cct 1, $0.1V_{DD}$ to $0.9V_{DD}$, $C_L = 15pF$	-	0.2	1	μs
Fall time	t_f	Measurement cct 1, $0.9V_{DD}$ to $0.1V_{DD}$, $C_L = 15pF$	-	0.2	1	μs
Output enable delay time ¹	t_{OE}	Measurement cct 2, $V_{DD} = 2.5V, 3.3V$, $T_a = 25^\circ C$	-	-	2	μs
Output disable delay time	t_{OD}	Measurement cct 2, $V_{DD} = 2.5V, 3.3V$, $T_a = 25^\circ C$	-	-	2	μs

1. Oscillator stop function is built-in. When INHN goes LOW, normal output stops. When INHN goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.

Timing chart

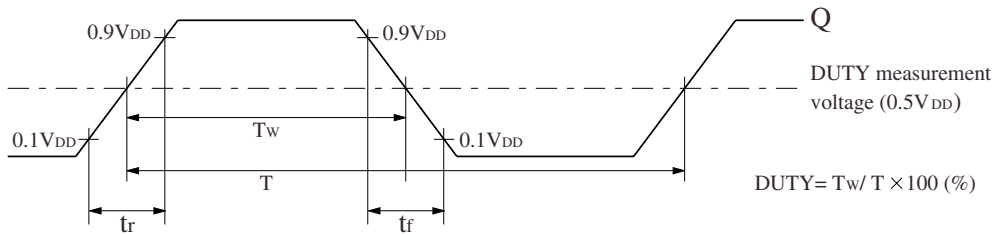


Figure 1. Output switching waveform

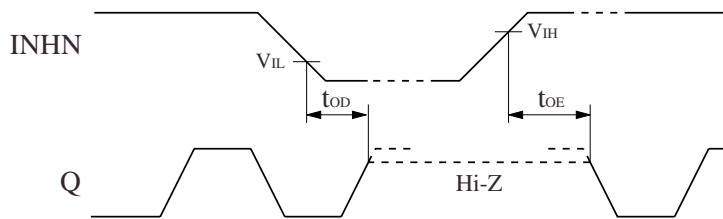


Figure 2. Output disable/enable timing chart

FUNCTIONAL DESCRIPTION

Standby Function

When INHN goes LOW, the device is in standby mode. The Q output becomes high impedance and the oscillator circuit stops.

INHN	Q	Oscillator
HIGH (or open)	$f_C/512$	Normal operation
LOW	High impedance	Stopped

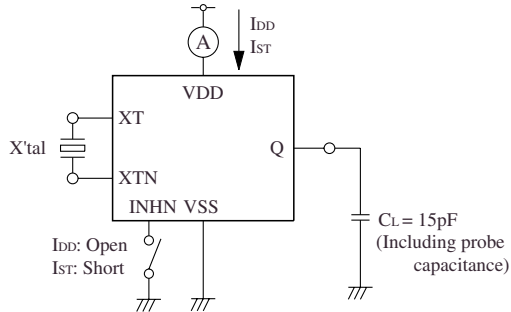
Power-saving Pull-up Resistor

The INHN pin pull-up resistance changes in response to the input level (HIGH or LOW). When INHN is tied LOW, the pull-up resistance becomes large, reducing the current consumed by the resistance. When INHN is open circuit, the pull-up resistance becomes small, decreasing the susceptibility to the effects of external noise.

MEASUREMENT CIRCUITS

Measurement cct 1

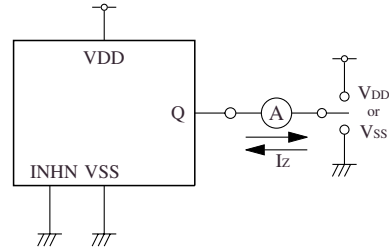
Measurement parameter: I_{DD} , I_{ST} , Duty, t_r , t_f



Note: The AC characteristics are observed with an oscilloscope on pin Q.
X'tal: NPC's standard crystal

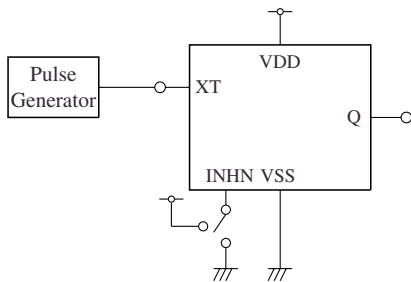
Measurement cct 4

Measurement parameter: I_Z



Measurement cct 2

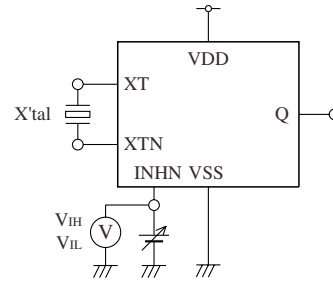
Measurement parameter: t_{OE} , t_{OD}



< 16MHz
HIGH-level: V_{DD} , LOW-level: V_{SS}
Note: Observed with an oscilloscope on pin Q. Does not include the oscillator start time.

Measurement cct 5

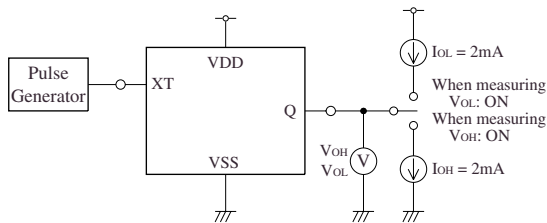
Measurement parameter: V_{IH} , V_{IL}



V_{IH} : Voltage in V_{SS} to V_{DD} transition that changes the output state.
 V_{IL} : Voltage in V_{DD} to V_{SS} transition that changes the output state.
INHN is an output state control pin.
Note: X'tal: NPC's standard crystal

Measurement cct 3

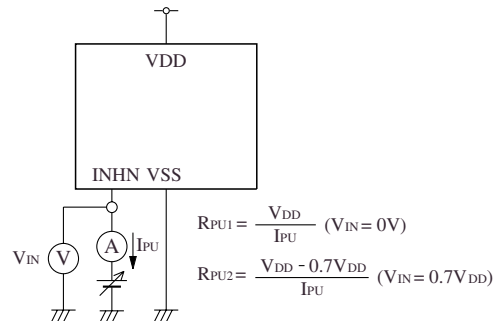
Measurement parameter: V_{OH} , V_{OL}



< 16MHz
HIGH-level: V_{DD} , LOW-level: V_{SS}
Note: Q HIGH-level and LOW-level voltages V_{OH} and V_{OL} are measured with pulse input stopped.

Measurement cct 6

Measurement parameter: R_{PU1} , R_{PU2}



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