CF5012 series

Low-current Consumption Crystal Oscillator Module ICs

OVERVIEW

The CF5012 series are low-current consumption 3rd overtone crystal oscillator module ICs. Internal circuit optimization means these devices have reduced current consumption in comparison with our existing 3rd overtone oscillator devices. The crystal oscillator circuit has a built-in thin-film feedback resistor with good temperature characteristics and built-in capacitors with excellent frequency response, resulting in a stable 3rd overtone oscillator with only the connection of a crystal element.

FEATURES

- 3rd overtone oscillation
- 2.7 to 3.6V operating supply voltage range
- 30 to 45MHz recommended operating frequency range
- Inverter amplifier feedback resistor built-in
- Oscillator capacitors C_G , C_D built-in
- Output three-state function (high impedance in standby mode)
- f_O output frequency (oscillator frequency)
- 8mA output drive capability (V_{DD} = 2.7V)
- 6.5mA (typ) low current consumption (V_{DD} = 3V, C_L = 15pF, f = 40MHz)
- CMOS output duty level
- Chip form (CF5012×××)

SERIES CONFIGURATION

Version	Recommended operating frequency range[1] [MHz]	gm ratio	Built-in capacitance [pF]		R_f [kΩ]
			C_G	C_D	
CF5012ANB	30 to 45	1.0	8	15	3.1

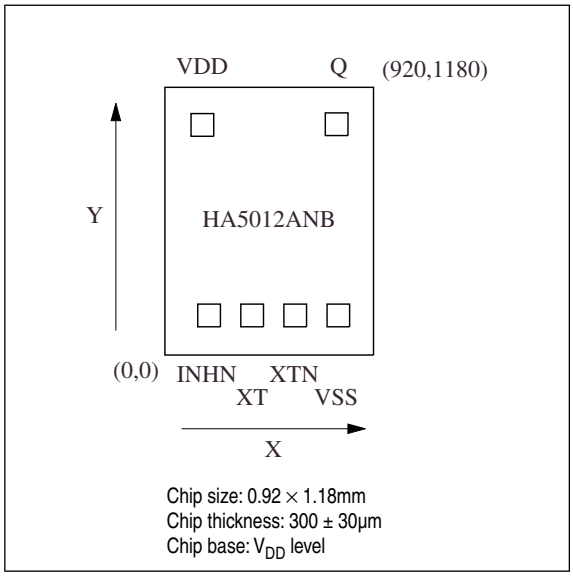
1. The recommended operating frequency is a yardstick value derived from the crystal used for NPC characteristics authentication. However, the oscillator frequency band is not guaranteed. Specifically, the characteristics can vary greatly due to crystal characteristics and mounting conditions, so the oscillation characteristics of components must be carefully evaluated.

ORDERING INFORMATION

Device	Package
CF5012×××–1	Chip form

PAD LAYOUT

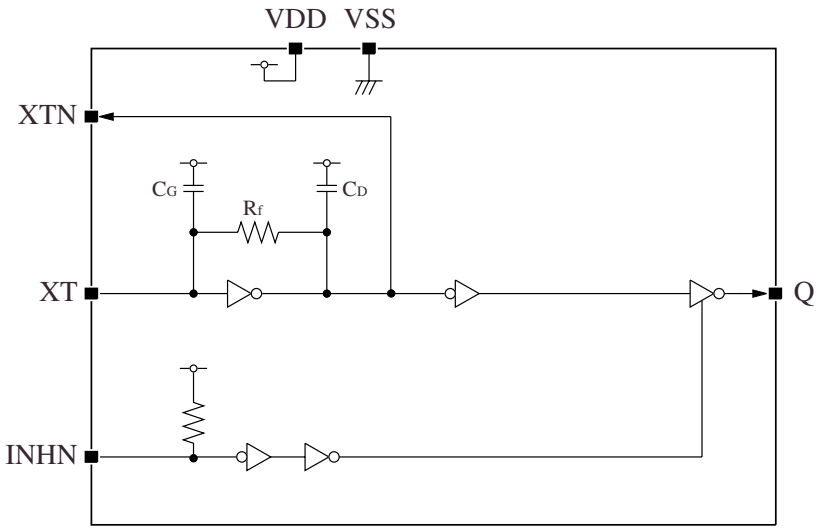
(Unit: µm)



PIN DESCRIPTION and PAD DIMENSIONS

Name	I/O	Description		Pad dimensions [µm]	
				X	Y
INHN	I	Output state control input. High impedance when LOW. Pull-up resistor built in		195	174.4
XT	I	Amplifier input	Crystal oscillator connection pins. Crystal oscillator connected between XT and XTN	385	174.4
XTN	O	Amplifier output		575	174.4
VSS	–	Ground		765	174.4
Q	O	Output. Output frequency. High impedance in standby mode		757.6	1017.6
VDD	–	Supply voltage		165.4	1014.6

BLOCK DIAGRAM



Substrate potential: V_{DD}

SPECIFICATIONS

Absolute Maximum Ratings

V_{SS} = 0V

Parameter	Symbol	Condition	Rating	Unit
Supply voltage range	V_{DD}		–0.5 to +7.0	V
Input voltage range	V_{IN}		–0.5 to V_{DD} + 0.5	V
Output voltage range	V_{OUT}		–0.5 to V_{DD} + 0.5	V
Operating temperature range	T_{opr}		–40 to +85	°C
Storage temperature range	T_{stg}		–65 to +150	°C
Output current	I_{OUT}		25	mA

Recommended Operating Conditions

V_{SS} = 0V, f ≤ 45MHz, C_L = 15pF unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Supply voltage	V_{DD}		2.7	–	3.6	V
Input voltage	V_{IN}		V_{SS}	–	V_{DD}	V
Operating temperature	T_{OPR}		–20	–	+80	°C

Electrical Characteristics

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = –20 to +80°C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 2.7V, I_{OH} = 8mA		2.2	2.4	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 2.7V, I_{OL} = 8mA		–	0.3	0.4	V
Output leakage current	I_Z	Q: Measurement cct 2, INHN = LOW, V_{DD} = 3.6V	V_{OH} = V_{DD}	–	–	10	µA
			V_{OL} = V_{SS}	–	–	10	µA
HIGH-level input voltage	V_{IH}	INHN		0.7V_{DD}	–	–	V
LOW-level input voltage	V_{IL}	INHN		–	–	0.3V_{DD}	V
Current consumption	I_{DD}	Measurement cct 3, load cct 1, INHN = open, C_L = 15pF, f = 40MHz		–	6.5	13	mA
INHN pull-up resistance	R_{UP}	Measurement cct 4		40	100	250	kΩ
Feedback resistance	R_f	Measurement cct 5		2.63	3.1	3.57	kΩ
Built-in capacitance	C_G	Design value. A monitor pattern on a wafer is tested.		7	8	9	pF
	C_D			13	15	17	pF

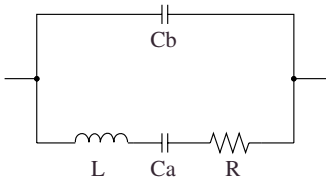
Switching Characteristics

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = –20 to +80°C unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Output rise time	t_r	Measurement cct 3, load cct 1, 0.1V_{DD} to 0.9V_{DD} , C_L = 15pF	–	2.0	4.0	ns
Output fall time	t_f	Measurement cct 3, load cct 1, 0.9V_{DD} to 0.1V_{DD} , C_L = 15pF	–	2.0	4.0	ns
Output duty cycle[1]	Duty	Measurement cct 3, load cct 1, Ta = 25°C, V_{DD} = 3.0V, C_L = 15pF, f = 40MHz	40	–	60	%
Output disable delay time	t_{PLZ}	Measurement cct 3, load cct 1, Ta = 25°C, V_{DD} = 3.0V, C_L = 15pF	–	–	100	ns
Output enable delay time	t_{PZL}		–	–	100	ns

1. The duty cycle characteristic is checked the sample chips of each production lot.

Current consumption and Output waveform with NPC's standard crystal



f [MHz]	R [Ω]	L [mH]	Ca [fF]	Cb [pF]
40	20.53	11.34	1.396	3.989

FUNCTIONAL DESCRIPTION

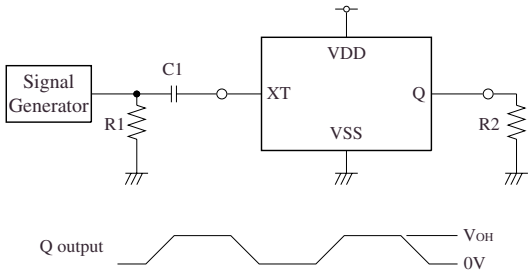
Standby Function

When INHN goes LOW, the oscillator output on Q goes high impedance.

INHN	Q	Oscillator
HIGH (or open)	f_O output frequency	Normal operation
LOW	High impedance	Normal operation

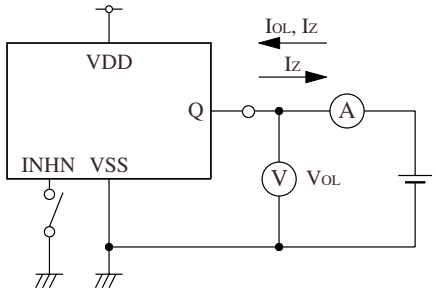
MEASUREMENT CIRCUITS

Measurement cct 1

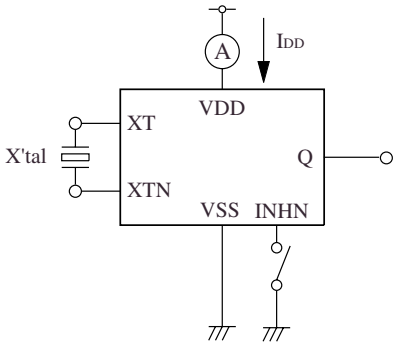


$2.0V_{P-P}$, 10MHz sine wave input signal
C1 : 0.001µF
R1 : 50Ω
R2 : 275Ω

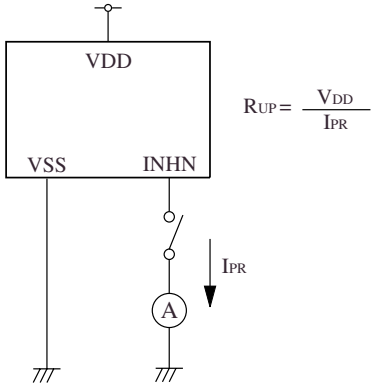
Measurement cct 2



Measurement cct 3

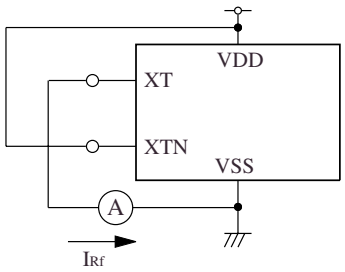


Measurement cct 4



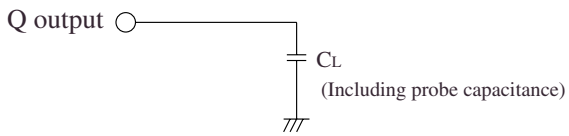
$$R_{UP} = \frac{V_{DD}}{I_{PR}}$$

Measurement cct 5



$$R_f = \frac{V_{DD}}{I_{Rf}}$$

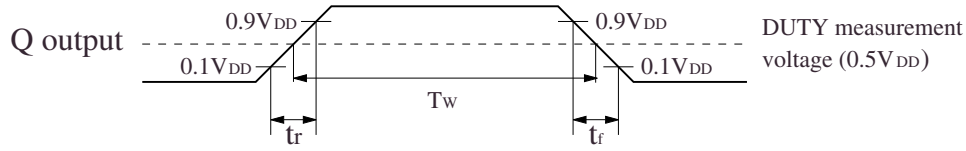
Load cct 1



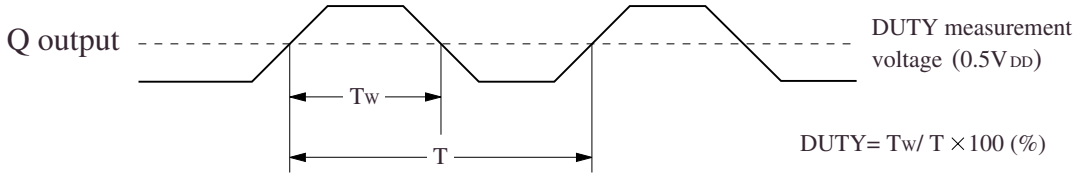
C_L = 15pF

Switching Time Measurement Waveform

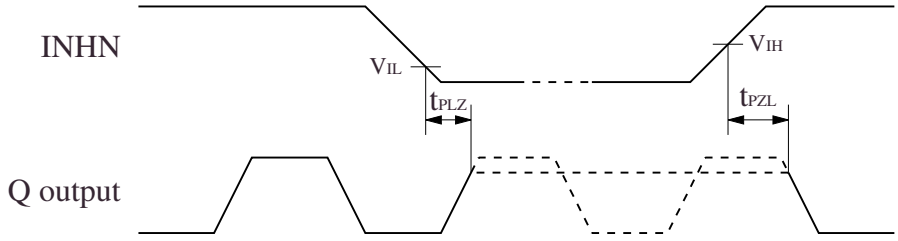
t_r , t_f , Duty



Output duty cycle



Output Enable/Disable Delay



INHN input waveform tr = tf ≤ 10ns

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