

OVERVIEW

The CF5005B series are high-frequency crystal oscillator module ICs. They are comprised of an oscillator circuit and output buffer optimized for operation at 125 to 165MHz. The crystal oscillator circuit has a built-in thin-film feedback resistor with good temperature characteristics and built-in capacitors with excellent frequency response, making possible a stable 3rd overtone oscillator with only the addition of a crystal element.

FEATURES

- 3.0 to 3.6V operating supply voltage range
- 125 to 165MHz 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, oscillator stops)
- f_O output frequency (oscillator frequency)
- 8mA output drive capability ($V_{DD} = 3.0V$)
- CMOS output duty level
- Chip form (CF5005B××)

SERIES CONFIGURATION

Version	Recommended operating frequency range ¹ [MHz]	gm ratio	Built-in capacitance [pF]		R_f [kΩ]
			C_G	C_D	
CF5005BLA	125 to 150	1.0	1	6	2.2
CF5005BLB	140 to 165	1.0	1	3	2.2

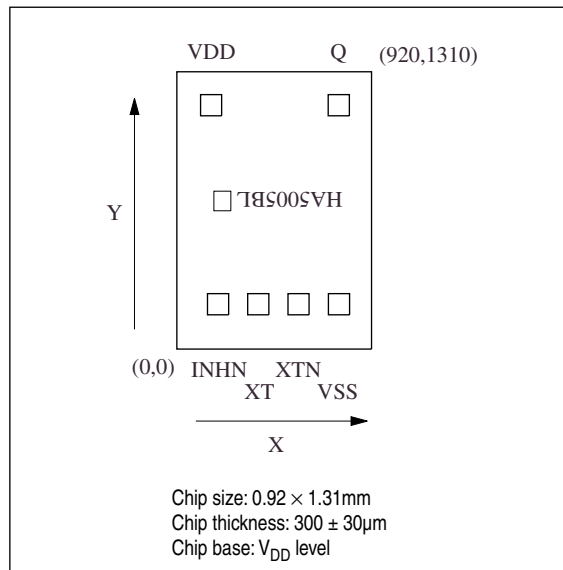
1. The recommended operating frequency is a yardstick value derived from the crystal used for NPC characteristics authentication. However, the oscillator frequency band is not guaranteed. Specifically, when used at high frequencies, the characteristics can vary greatly due to crystal characteristics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

ORDERING INFORMATION

Device	Package
CF5005B××-1	Chip form

PAD LAYOUT

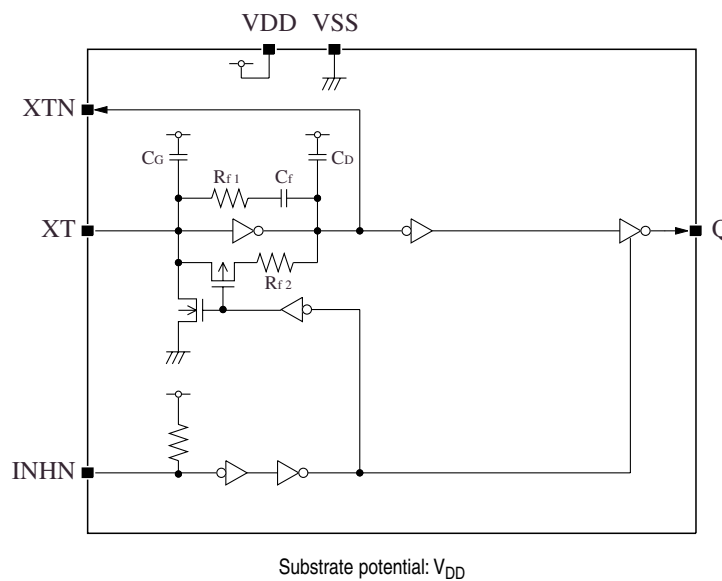
(Unit: μm)



PIN DESCRIPTION and PAD DIMENSIONS

Name	I/O	Description	Pad dimensions [μm]	
			X	Y
INHN	I	Output state control input. Oscillator stops when LOW. Pull-up resistor built in	195	212
XT	I	Amplifier input.	385	212
XTN	O	Amplifier output.		
VSS	-	Ground	766	212
Q	O	Output. Output frequency (f_O). High impedance in standby mode	765	1152
VDD	-	Supply voltage	162	1152

BLOCK DIAGRAM



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

$V_{SS} = 0V$, $f \leq 165MHz$, $C_L \leq 15pF$ unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Operating supply voltage	V_{DD}		3.0	-	3.6	V
Input voltage	V_{IN}		V_{SS}	-	V_{DD}	V
Operating temperature	T_{OPR}		-20	-	80	°C

Electrical Characteristics

$V_{DD} = 3.0$ to $3.6V$, $V_{SS} = 0V$, $T_a = -20$ to $80^\circ C$ unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit	
			min	typ	max		
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, $V_{DD} = 3.0V$, $I_{OH} = 8mA$	2.5	2.7	-	V	
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, $V_{DD} = 3.0V$, $I_{OL} = 8mA$	-	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	
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, $C_L = 15pF$	$f = 133MHz$	-	30	65	mA
			$f = 156MHz$	-	35	80	
Standby current	I_{ST}	Measurement cct 3, INHN = LOW	-	-	10	μA	
INHN pull-up resistance	R_{UP1}	Measurement cct 4	INHN = V_{SS}	0.4	-	4	$M\Omega$
	R_{UP2}		INHN = $0.7V_{DD}$	50	-	150	$k\Omega$
AC feedback resistance	R_{f1}	Design value. A monitor pattern on a wafer is tested.	1.76	2.2	2.64	$k\Omega$	
DC feedback resistance	R_{f2}	Measurement cct 5	50	-	150	$k\Omega$	
AC feedback capacitance	C_f	Design value. A monitor pattern on a wafer is tested.	9.3	10	10.7	pF	
Built-in capacitance	C_G	Design value. A monitor pattern on a wafer is tested.	CF5005BLA	0.93	1	1.07	pF
			CF5005BLB	0.93	1	1.07	
	C_D	Design value. A monitor pattern on a wafer is tested.	CF5005BLA	5.58	6	6.42	pF
			CF5005BLB	2.79	3	3.21	

Switching Characteristics

$V_{DD} = 3.0$ to $3.6V$, $V_{SS} = 0V$, $T_a = -20$ to $80\text{ }^{\circ}C$ 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 $0.9V_{DD}$, $C_L = 15pF$	–	1.5	2.5	ns
Output fall time	t_f	Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$, $C_L = 15pF$	–	1.5	2.5	ns
Output duty cycle ¹	Duty	Measurement cct 3, load cct 1, $T_a = 25^{\circ}C$, $V_{DD} = 3.3V$, $C_L = 15pF$, $f \leq 165MHz$	40	–	60	%
Output disable delay time ²	t_{PLZ}	Measurement cct 6, load cct 1, $T_a = 25^{\circ}C$, $V_{DD} = 3.0V$, $C_L \leq 15pF$	–	–	100	ns
Output enable delay time ²	t_{PZL}	Measurement cct 6, load cct 1, $T_a = 25^{\circ}C$, $V_{DD} = 3.0V$, $C_L \leq 15pF$	–	–	100	ns

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

2. 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.

FUNCTIONAL DESCRIPTION

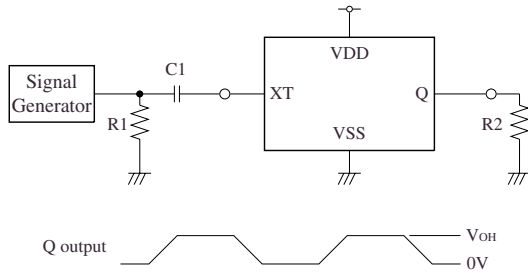
Standby Function

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

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

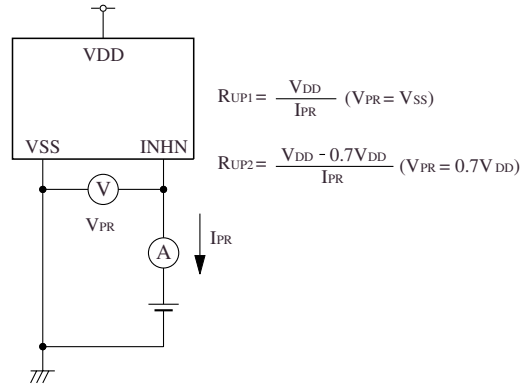
MEASUREMENT CIRCUITS

Measurement cct 1

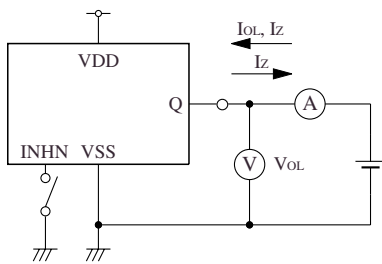


2.5V_{P-P}, 10MHz sine wave input signal
 C1 : 0.001μF
 R1 : 50Ω
 R2 : 312.5Ω

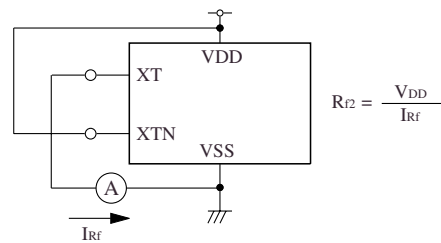
Measurement cct 4



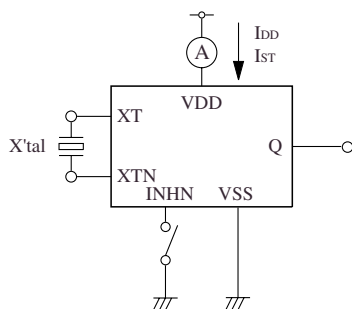
Measurement cct 2



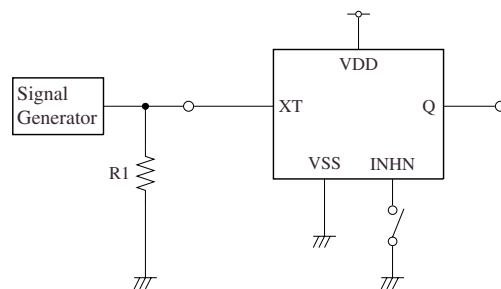
Measurement cct 5



Measurement cct 3

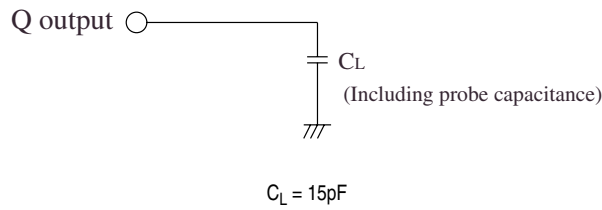


Measurement cct 6



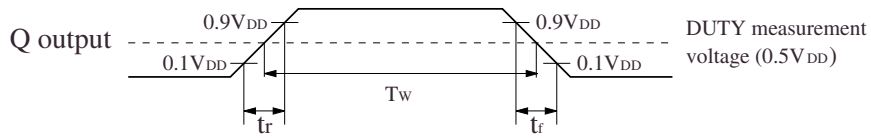
R1 : 50Ω

Load cct 1

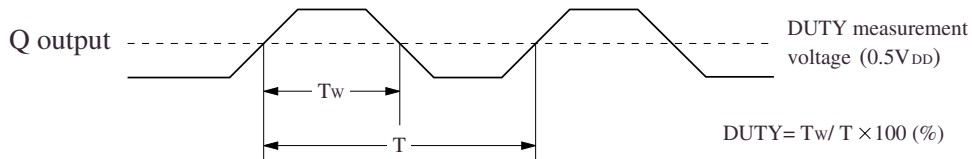


Switching Time Measurement Waveform

t_r , t_f , DUTY

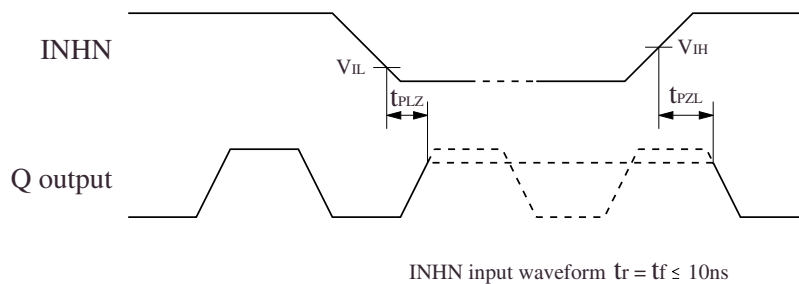


Output duty cycle



Output Enable/Disable Delay

The following figure shows the oscillator timing during normal operation. Note that when the device is in standby, the oscillator stops. When standby is released, the oscillator starts and stable oscillator output occurs after a short delay.



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