NIPPON PRECISION CIRCUITS INC.

WF5025 series

Crystal Oscillator Module ICs

OVERVIEW

The WF5025 series are miniature crystal oscillator module ICs. They feature a damping resistor R_D matched to the crystal's characteristics to reduce crystal current. The pad layout is arranged for flip chip mounting, which gives the pattern design more flexibility, even for mounting ultra-miniature crystal oscillators that provide almost no space for wiring patterns. They support fundamental oscillation and 3rd overtone oscillation modes. The WF5025 series can be used to correspond to wide range of applications.

FEATURES

- Pad layout optimized for flip chip mounting
- Miniature-crystal matched oscillator characteristics
- Operating supply voltage range
  - 2.5V operation: 2.25 to 2.75V
  - 3.0V operation: 2.7 to 3.6V
- Recommended operating frequency range
  - For fundamental oscillator
    - WF5025AL×: 20MHz to 50MHz
    - WF5025BL1: 20MHz to 100MHz
  - For 3rd overtone oscillator
    - WF5025ML×: 70MHz to 133MHz
- –40 to 85°C operating temperature range
- Oscillator capacitor with excellent frequency characteristics built-in
- Oscillator circuit with damping resistor R_D built-in for reduced crystal current
- Standby function
  - High impedance in standby mode, oscillator stops
- Low standby current
  - Power-saving pull-up resistor built-in
- Oscillation detector function
- Frequency divider built-in (WF5025AL×)
  - varies with version: f_O, $f_O/2$, $f_O/4$, $f_O/8$, $f_O/16$, $f_O/32$
- CMOS output duty level (1/2VDD)
- 50 ± 5% output duty @ 1/2VDD
- 30pF output load
- Molybdenum-gate CMOS process

SERIES CONFIGURATION

Version	Operating supply voltage [V]	Oscillation mode	Recommended operating frequency range (fundamental oscillation)*1 [MHz]	Output current (V_{DD} = 2.5V) [mA]	Output frequency	Output duty level	Standby mode	
							Oscillator stop function	Output state
WF5025AL1	2.25 to 3.6	Fundamental	20 to 50	4	f_O	CMOS	Yes	Hi-Z
WF5025AL2					$f_O/2$			
WF5025AL3					$f_O/4$			
WF5025AL4					$f_O/8$			
WF5025AL5					$f_O/16$			
WF5025AL6					$f_O/32$			
WF5025BL1*2	2.25 to 3.6	Fundamental	20 to 100	8	f_O	CMOS	Yes	Hi-Z
WF5025MLA	2.25 to 3.6	3rd overtone	70 to 80	8	f_O	CMOS	Yes	Hi-Z
(WF5025MLB)			80 to 100					
WF5025MLC			90 to 133					

*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.

*2. The WF5025BL1 has a higher maximum operating frequency, hence the negative resistance is also larger than in the WF5025AL× devices.

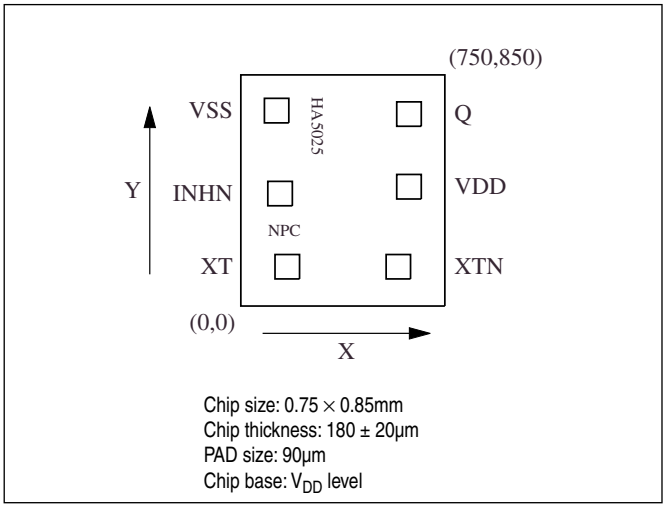
Note. These versions in parentheses ( ) are under development. Please ask our Sales & Marketing section for further detail.

ORDERING INFORMATION

Device	Package
WF5025×××–3	Wafer form

PAD LAYOUT

(Unit: µm)

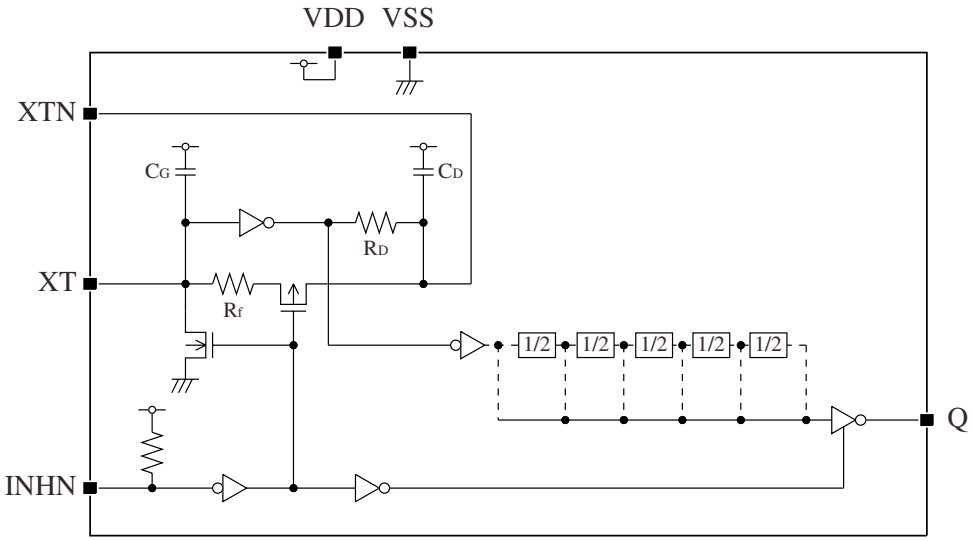


PIN DESCRIPTION and PAD DIMENSIONS

Name	I/O	Description		Pad dimensions [µm]	
				X	Y
INHN	I	Output state control input. High impedance when LOW (oscillator stops). Power-saving pull-up resistor built-in.		144.6	413.4
XT	I	Amplifier input	Crystal connection pins. Crystal is connected between XT and XTN.	171.0	144.6
XTN	O	Amplifier output		579.0	144.6
VDD	–	Supply voltage		618.2	438.6
Q	O	Output. Output frequency determined by internal circuit to one of f_O, $f_O/2$, $f_O/4$, $f_O/8$, $f_O/16$, $f_O/32$. High impedance in standby mode		618.2	705.4
VSS	–	Ground		131.8	718.2

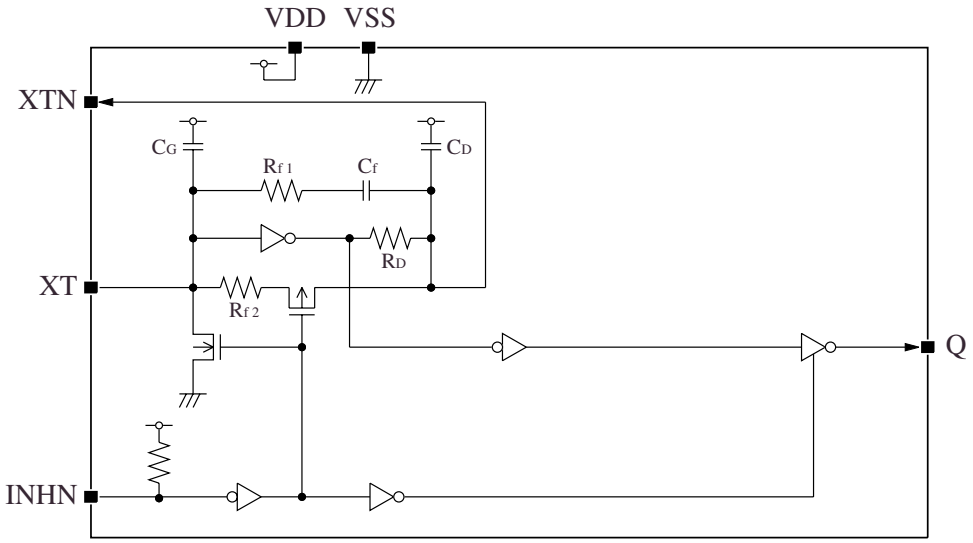
BLOCK DIAGRAM

For Fundamental Oscillator (WF5025AL×, WF5025BL1)



INHN = LOW active

For 3rd Overtone Oscillator (WF5025ML×)



INHN = LOW active

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}		20	mA

Recommended Operating Conditions

V_{SS} = 0V

Parameter	Symbol	Condition		Rating*1			Unit
				min	typ	max	
Operating supply voltage	V_{DD}	WF5025AL×	CL ≤ 30pF	2.25	–	3.6	V
		WF5025BL1	CL ≤ 30pF	2.25	–	3.6	V
		WF5025MLA	f ≤ 80MHz, CL ≤ 30pF	2.25	–	3.6	V
		WF5025MLB	f ≤ 100MHz, CL ≤ 30pF	(2.25)	–	(3.6)	V
		WF5025MLC	f ≤ 100MHz, CL ≤ 30pF	2.25	–	3.6	V
			f ≤ 133MHz, CL ≤ 15pF	2.25	–	3.6	V
Input voltage	V_{IN}			V_{SS}	–	V_{DD}	V
Operating temperature	T_{OPR}			–40	–	+85	°C
Operating frequency*2	f_O	WF5025AL×		20	–	50	MHz
		WF5025BL1*3		20	–	100	MHz
		WF5025MLA		70	–	80	MHz
		WF5025MLB*3		(80)	–	(100)	MHz
		WF5025MLC*3		90	–	133	MHz

*1. Values in parentheses ( ) are provisional only.

*2. The 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.

*3. When 2.5V operation, the ratings of switching characteristics are difference by the frequency or output load. Refer to “Switching Characteristics”.

Electrical Characteristics

WF5025AL× (2.5V operation)

V_{DD} = 2.25 to 2.75V, V_{SS} = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 2.25V, I_{OH} = 4mA		1.65	1.95	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 2.25V, I_{OL} = 4mA		–	0.3	0.4	V
HIGH-level input voltage	V_{IH}	INHN		$0.7V_{DD}$	–	–	V
LOW-level input voltage	V_{IL}	INHN		–	–	$0.3V_{DD}$	V
Output leakage current	I_Z	Q: Measurement cct 2, INHN = LOW	$V_{OH} = V_{DD}$	–	–	10	µA
			$V_{OL} = V_{SS}$	–	–	10	µA
Current consumption	I_{DD2}	Measurement cct 3, load cct 1, INHN = open, C_L = 30pF, f = 50MHz	WF5025AL1	–	7	14	mA
			WF5025AL2	–	4.5	9	mA
			WF5025AL3	–	3.5	7	mA
			WF5025AL4	–	2.9	5.8	mA
			WF5025AL5	–	2.5	5	mA
			WF5025AL6	–	2.4	4.8	mA
Standby current	I_{ST}	Measurement cct 3, INHN = LOW		–	–	3	µA
INHN pull-up resistance	R_{UP1}	Measurement cct 4		2	6	12	MΩ
	R_{UP2}			20	100	200	kΩ
Feedback resistance	R_f	Measurement cct 5		50	–	150	kΩ
Oscillator amplifier output resistance	R_D	Design value. A monitor pattern on a wafer is tested.		340	400	460	Ω
Built-in capacitance	C_G	Design value. A monitor pattern on a wafer is tested.		6.8	8	9.2	pF
	C_D			8.5	10	11.5	pF

WF5025AL× (3.0V operation)

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = –40 to +85°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} = 4mA		2.3	2.4	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 2.7V, I_{OL} = 4mA		–	0.3	0.4	V
HIGH-level input voltage	V_{IH}	INHN		0.7V_{DD}	–	–	V
LOW-level input voltage	V_{IL}	INHN		–	–	0.3V_{DD}	V
Output leakage current	I_Z	Q: Measurement cct 2, INHN = LOW	V_{OH} = V_{DD}	–	–	10	µA
			V_{OL} = V_{SS}	–	–	10	µA
Current consumption	I_{DD2}	Measurement cct 3, load cct 1, INHN = open, C_L = 30pF, f = 50MHz	WF5025AL1	–	8.5	17	mA
			WF5025AL2	–	5.5	11	mA
			WF5025AL3	–	4	8	mA
			WF5025AL4	–	3.3	6.6	mA
			WF5025AL5	–	2.9	5.8	mA
			WF5025AL6	–	2.7	5.4	mA
Standby current	I_{ST}	Measurement cct 3, INHN = LOW		–	–	5	µA
INHN pull-up resistance	R_{UP1}	Measurement cct 4		2	4	8	MΩ
	R_{UP2}			15	75	150	kΩ
Feedback resistance	R_f	Measurement cct 5		50	–	150	kΩ
Oscillator amplifier output resistance	R_D	Design value. A monitor pattern on a wafer is tested.		340	400	460	Ω
Built-in capacitance	C_G	Design value. A monitor pattern on a wafer is tested.		6.8	8	9.2	pF
	C_D			8.5	10	11.5	pF

WF5025BL1 (2.5V operation)

V_{DD} = 2.25 to 2.75V, V_{SS} = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 2.25V, I_{OH} = 8mA		1.65	1.95	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 2.25V, I_{OL} = 8mA		–	0.3	0.4	V
HIGH-level input voltage	V_{IH}	INHN		0.7V_{DD}	–	–	V
LOW-level input voltage	V_{IL}	INHN		–	–	0.3V_{DD}	V
Output leakage current	I_Z	Q: Measurement cct 2, INHN = LOW	V_{OH} = V_{DD}	–	–	10	µA
			V_{OL} = V_{SS}	–	–	10	µA
Current consumption	I_{DD2}	Measurement cct 3, load cct 1, INHN = open, C_L = 30pF, f = 100MHz		–	14	28	mA
Standby current	I_{ST}	Measurement cct 3, INHN = LOW		–	–	3	µA
INHN pull-up resistance	R_{UP1}	Measurement cct 4		2	6	12	MΩ
	R_{UP2}			20	100	200	kΩ
Feedback resistance	R_f	Measurement cct 5		50	–	150	kΩ
Oscillator amplifier output resistance	R_D	Design value. A monitor pattern on a wafer is tested.		170	200	230	Ω
Built-in capacitance	C_G	Design value. A monitor pattern on a wafer is tested.		6.8	8	9.2	pF
	C_D			8.5	10	11.5	pF

WF5025BL1 (3.0V operation)

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = –40 to +85°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		2.3	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
HIGH-level input voltage	V_{IH}	INHN		0.7V_{DD}	–	–	V
LOW-level input voltage	V_{IL}	INHN		–	–	0.3V_{DD}	V
Output leakage current	I_Z	Q: Measurement cct 2, INHN = LOW	V_{OH} = V_{DD}	–	–	10	µA
			V_{OL} = V_{SS}	–	–	10	µA
Current consumption	I_{DD2}	Measurement cct 3, load cct 1, INHN = open, C_L = 30pF, f = 100MHz		–	19	38	mA
Standby current	I_{ST}	Measurement cct 3, INHN = LOW		–	–	5	µA
INHN pull-up resistance	R_{UP1}	Measurement cct 4		2	4	8	MΩ
	R_{UP2}			15	75	150	kΩ
Feedback resistance	R_f	Measurement cct 5		50	–	150	kΩ
Oscillator amplifier output resistance	R_D	Design value. A monitor pattern on a wafer is tested.		170	200	230	Ω
Built-in capacitance	C_G	Design value. A monitor pattern on a wafer is tested.		6.8	8	9.2	pF
	C_D			8.5	10	11.5	pF

WF5025ML× (2.5V operation)

V_{DD} = 2.25 to 2.75V, V_{SS} = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Condition			Rating*1 min	Rating*1 typ	Rating*1 max	Unit
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 2.25V, I_{OH} = 8mA			1.65	1.95	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 2.25V, I_{OL} = 8mA			–	0.3	0.4	V
HIGH-level input voltage	V_{IH}	INHN			$0.7V_{DD}$	–	–	V
LOW-level input voltage	V_{IL}	INHN			–	–	$0.3V_{DD}$	V
Output leakage current	I_Z	Q: Measurement cct 2, INHN = LOW		$V_{OH} = V_{DD}$	–	–	10	µA
				$V_{OL} = V_{SS}$	–	–	10	µA
Current consumption	I_{DD1}	Measurement cct 3, load cct 1, INHN = open, C_L = 15pF	f = 100MHz	WF5025MLB	–	TBD	TBD	mA
			f = 133MHz	WF5025MLC	–	15	30	mA
	I_{DD2}	Measurement cct 3, load cct 1, INHN = open, C_L = 30pF	f = 72MHz	WF5025MLA	–	11	22	mA
			f = 100MHz	WF5025MLB	–	TBD	TBD	mA
			f = 100MHz	WF5025MLC	–	15	30	mA
Standby current	I_{ST}	Measurement cct 3, INHN = LOW			–	–	3	µA
INHN pull-up resistance	R_{UP1}	Measurement cct 4			2	6	12	MΩ
	R_{UP2}				20	100	200	kΩ
AC feedback resistance	R_{f1}	Design value. A monitor pattern on a wafer is tested.		WF5025MLA	3.99	4.7	5.41	kΩ
				WF5025MLB	TBD	TBD	TBD	kΩ
				WF5025MLC	2.97	3.5	4.03	kΩ
DC feedback resistance	R_{f2}	Measurement cct 5			50	–	150	kΩ
Oscillator amplifier output resistance	R_D	Design value. A monitor pattern on a wafer is tested.			85	100	115	Ω
AC feedback capacitance	C_f	Design value. A monitor pattern on a wafer is tested.			8.5	10	11.5	pF
Built-in capacitance	C_G	Design value. A monitor pattern on a wafer is tested.		WF5025MLA	1.70	2	2.30	pF
				WF5025MLB	(1.70)	(2)	(2.30)	pF
				WF5025MLC	0.85	1	1.15	pF
	C_D	Design value. A monitor pattern on a wafer is tested.		WF5025MLA	3.40	4	4.60	pF
				WF5025MLB	(3.40)	(4)	(4.60)	pF
				WF5025MLC	3.40	4	4.60	pF

*1. Values in parentheses ( ) are provisional only.

WF5025ML× (3.0V operation)

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Condition			Rating*1 min	Rating*1 typ	Rating*1 max	Unit
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 2.7V, I_{OH} = 8mA			2.3	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
HIGH-level input voltage	V_{IH}	INHN			0.7V_{DD}	–	–	V
LOW-level input voltage	V_{IL}	INHN			–	–	0.3V_{DD}	V
Output leakage current	I_Z	Q: Measurement cct 2, INHN = LOW		V_{OH} = V_{DD}	–	–	10	µA
				V_{OL} = V_{SS}	–	–	10	µA
Current consumption	I_{DD1}	Measurement cct 3, load cct 1, INHN = open, C_L = 15pF	f = 100MHz	WF5025MLB	–	TBD	TBD	mA
			f = 133MHz	WF5025MLC	–	20	40	mA
	I_{DD2}	Measurement cct 3, load cct 1, INHN = open, C_L = 30pF	f = 72MHz	WF5025MLA	–	15	30	mA
			f = 100MHz	WF5025MLB	–	TBD	TBD	mA
			f = 100MHz	WF5025MLC	–	20	40	mA
Standby current	I_{ST}	Measurement cct 3, INHN = LOW			–	–	5	µA
INHN pull-up resistance	R_{UP1}	Measurement cct 4			2	4	8	MΩ
	R_{UP2}				15	75	150	kΩ
AC feedback resistance	R_{f1}	Design value. A monitor pattern on a wafer is tested.		WF5025MLA	3.99	4.7	5.41	kΩ
				WF5025MLB	TBD	TBD	TBD	kΩ
				WF5025MLC	2.97	3.5	4.03	kΩ
DC feedback resistance	R_{f2}	Measurement cct 5			50	–	150	kΩ
Oscillator amplifier output resistance	R_D	Design value. A monitor pattern on a wafer is tested.			85	100	115	Ω
AC feedback capacitance	C_f	Design value. A monitor pattern on a wafer is tested.			8.5	10	11.5	pF
Built-in capacitance	C_G	Design value. A monitor pattern on a wafer is tested.		WF5025MLA	1.70	2	2.30	pF
				WF5025MLB	(1.70)	(2)	(2.30)	pF
				WF5025MLC	0.85	1	1.15	pF
	C_D	Design value. A monitor pattern on a wafer is tested.		WF5025MLA	3.40	4	4.60	pF
				WF5025MLB	(3.40)	(4)	(4.60)	pF
				WF5025MLC	3.40	4	4.60	pF

*1. Values in parentheses ( ) are provisional only.

Switching Characteristics

WF5025AL× (2.5V operation)

V_{DD} = 2.25 to 2.75V, V_{SS} = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
Output rise time	t_{r1}	Measurement cct 3, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$	C_L = 15pF	–	3	6	ns
	t_{r2}		C_L = 30pF	–	5	10	ns
Output fall time	t_{f1}	Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$	C_L = 15pF	–	3	6	ns
	t_{f2}		C_L = 30pF	–	5	10	ns
Output duty cycle*1	Duty1	Measurement cct 3, load cct 1, V_{DD} = 2.5V, Ta = 25°C, f = 50MHz	C_L = 15pF	45	–	55	%
	Duty2		C_L = 30pF	45	–	55	%
Output disable delay time*2	t_{PLZ}	Measurement cct 6, load cct 1, V_{DD} = 2.5V, Ta = 25°C, C_L = 15pF		–	–	100	ns
Output enable delay time*2	t_{PZL}			–	–	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.

WF5025AL× (3.0V operation)

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
Output rise time	t_{r1}	Measurement cct 3, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$	C_L = 15pF	–	2.5	5	ns
	t_{r2}		C_L = 30pF	–	4.5	9	ns
Output fall time	t_{f1}	Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$	C_L = 15pF	–	2.5	5	ns
	t_{f2}		C_L = 30pF	–	4.5	9	ns
Output duty cycle*1	Duty1	Measurement cct 3, load cct 1, V_{DD} = 3.0V, Ta = 25°C, f = 50MHz	C_L = 15pF	45	–	55	%
	Duty2		C_L = 30pF	45	–	55	%
Output disable delay time*2	t_{PLZ}	Measurement cct 6, load cct 1, V_{DD} = 3.0V, Ta = 25°C, C_L = 15pF		–	–	100	ns
Output enable delay time*2	t_{PZL}			–	–	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.

WF5025BL1 (2.5V operation)

V_{DD} = 2.25 to 2.75V, V_{SS} = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
Output rise time	t_{r1}	Measurement cct 3, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$	C_L = 15pF	–	2	4	ns
	t_{r2}		C_L = 30pF	–	3	6	ns
	t_{r3}	Measurement cct 3, load cct 1, $0.2V_{DD}$ to $0.8V_{DD}$	C_L = 30pF	–	2.5	5	ns
Output fall time	t_{f1}	Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$	C_L = 15pF	–	2	4	ns
	t_{f2}		C_L = 30pF	–	3	6	ns
	t_{f3}	Measurement cct 3, load cct 1, $0.8V_{DD}$ to $0.2V_{DD}$	C_L = 30pF	–	2.5	5	ns
Output duty cycle*1	Duty1	Measurement cct 3, load cct 1, V_{DD} = 2.5V, Ta = 25°C	C_L = 15pF f = 100MHz	45	–	55	%
	Duty2		C_L = 30pF f = 80MHz	45	–	55	%
	Duty3		C_L = 30pF f = 100MHz	40	–	60	%
Output disable delay time*2	t_{PLZ}	Measurement cct 6, load cct 1, V_{DD} = 2.5V, Ta = 25°C, C_L = 15pF		–	–	100	ns
Output enable delay time*2	t_{PZL}			–	–	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.

WF5025BL1 (3.0V operation)

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
Output rise time	t_{r1}	Measurement cct 3, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$	C_L = 15pF	–	1.5	3	ns
	t_{r2}		C_L = 30pF	–	2.5	5	ns
Output fall time	t_{f1}	Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$	C_L = 15pF	–	1.5	3	ns
	t_{f2}		C_L = 30pF	–	2.5	5	ns
Output duty cycle*1	Duty1	Measurement cct 3, load cct 1, V_{DD} = 3.0V, Ta = 25°C, f = 100MHz	C_L = 15pF	45	–	55	%
	Duty2		C_L = 30pF	45	–	55	%
Output disable delay time*2	t_{PLZ}	Measurement cct 6, load cct 1, V_{DD} = 3.0V, Ta = 25°C, C_L = 15pF		–	–	100	ns
Output enable delay time*2	t_{PZL}			–	–	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.

WF5025ML× (2.5V operation)

V_{DD} = 2.25 to 2.75V, V_{SS} = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Condition			Rating*1 min	Rating*1 typ	Rating*1 max	Unit
Output rise time	t_{r1}	Measurement cct 3, load cct 1, 0.1V_{DD} to 0.9V_{DD}		C_L = 15pF	–	2	4	ns
	t_{r2}			C_L = 30pF	–	3	6	ns
Output fall time	t_{f1}	Measurement cct 3, load cct 1, 0.9V_{DD} to 0.1V_{DD}		C_L = 15pF	–	2	4	ns
	t_{f2}			C_L = 30pF	–	3	6	ns
Output duty cycle*2	Duty1	Measurement cct 3, load cct 1, V_{DD} = 2.5V, Ta = 25°C, C_L = 15pF	f = 72MHz	WF5025MLA	45	–	55	%
			f = 100MHz	WF5025MLB	(45)	–	(55)	%
			f = 133MHz	WF5025MLC	45	–	55	%
	Duty2	Measurement cct 3, load cct 1, V_{DD} = 2.5V, Ta = 25°C, C_L = 30pF	f = 72MHz	WF5025MLA	45	–	55	%
			f = 100MHz	WF5025MLB	(40)	–	(60)	%
			f = 100MHz	WF5025MLC	40	–	60	%
Output disable delay time*3	t_{PLZ}	Measurement cct 6, load cct 1, V_{DD} = 2.5V, Ta = 25°C, C_L = 15pF			–	–	100	ns
Output enable delay time*3	t_{PZL}				–	–	100	ns

*1. Values in parentheses ( ) are provisional only.
*2. The duty cycle characteristic is checked the sample chips of each production lot.
*3. 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.

WF5025ML× (3.0V operation)

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = –40 to +85°C unless otherwise noted.

Parameter	Symbol	Condition			Rating*1 min	Rating*1 typ	Rating*1 max	Unit
Output rise time	t_{r1}	Measurement cct 3, load cct 1, 0.1V_{DD} to 0.9V_{DD}		C_L = 15pF	–	1.5	3	ns
	t_{r2}			C_L = 30pF	–	2.5	5	ns
Output fall time	t_{f1}	Measurement cct 3, load cct 1, 0.9V_{DD} to 0.1V_{DD}		C_L = 15pF	–	1.5	3	ns
	t_{f2}			C_L = 30pF	–	2.5	5	ns
Output duty cycle*2	Duty1	Measurement cct 3, load cct 1, V_{DD} = 3.0V, Ta = 25°C, C_L = 15pF	f = 72MHz	WF5025MLA	45	–	55	%
			f = 100MHz	WF5025MLB	(45)	–	(55)	%
			f = 133MHz	WF5025MLC	45	–	55	%
	Duty2	Measurement cct 3, load cct 1, V_{DD} = 3.0V, Ta = 25°C, C_L = 30pF	f = 72MHz	WF5025MLA	45	–	55	%
			f = 100MHz	WF5025MLB	(45)	–	(55)	%
		Measurement cct 3, load cct 1, V_{DD} = 3.3V, Ta = 25°C, C_L = 30pF, f = 100MHz		WF5025MLC	45	–	55	%
Output disable delay time*3	t_{PLZ}	Measurement cct 6, load cct 1, V_{DD} = 3.0V, Ta = 25°C, C_L = 15pF			–	–	100	ns
Output enable delay time*3	t_{PZL}				–	–	100	ns

*1. Values in parentheses ( ) are provisional only.
*2. The duty cycle characteristic is checked the sample chips of each production lot.
*3. 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

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

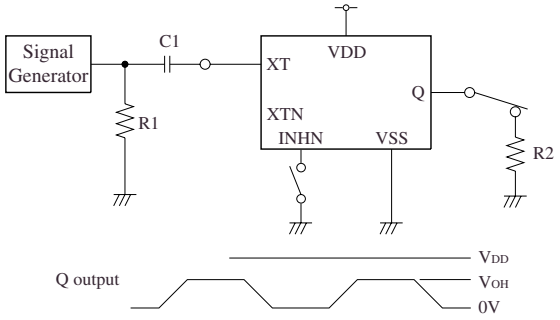
Version	INHN	Q	Oscillator
WF5025AL×	HIGH (or open)	Any f_O, $f_O/2$, $f_O/4$, $f_O/8$, $f_O/16$ or $f_O/32$ output frequency	Normal operation
WF5025BL1, ML×		f_O	
WF5025AL×, BL1, ML×	LOW	High impedance	Stopped

Power-save Pull-up Resistor

The INHN pull-up resistance changes in response to the input level (HIGH or LOW). When INHN goes LOW (standby state), the pull-up resistance becomes large to reduce the current consumption during standby.

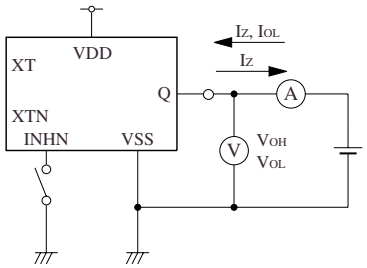
MEASUREMENT CIRCUITS

Measurement cct 1

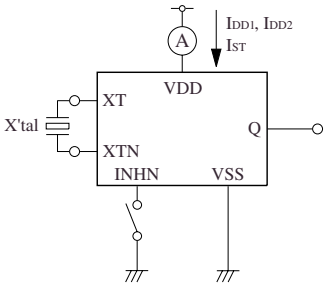


2Vp-p, 10MHz sine wave input signal
C1: 0.001µF
R1: 50Ω
R2: 5025AL× : 412Ω (2.5V operation)
575Ω (3.0V operation)
5025BL1, ML× : 206Ω (2.5V operation)
287Ω (3.0V operation)

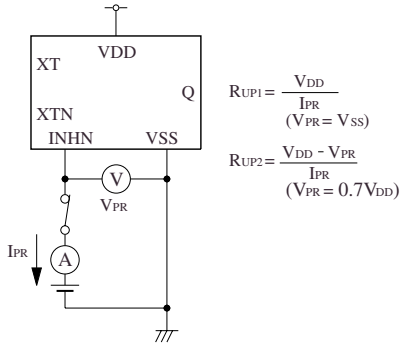
Measurement cct 2



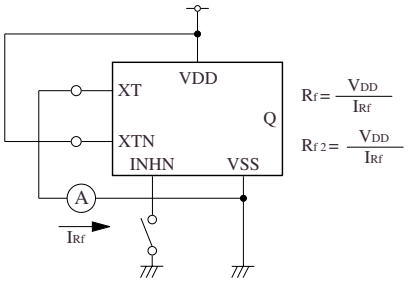
Measurement cct 3



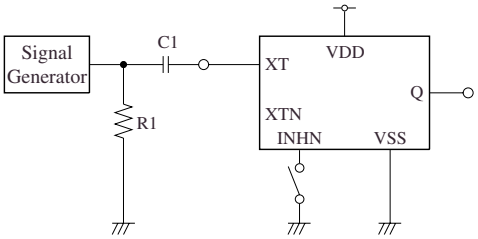
Measurement cct 4



Measurement cct 5

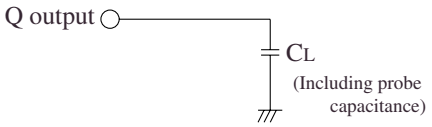


Measurement cct 6



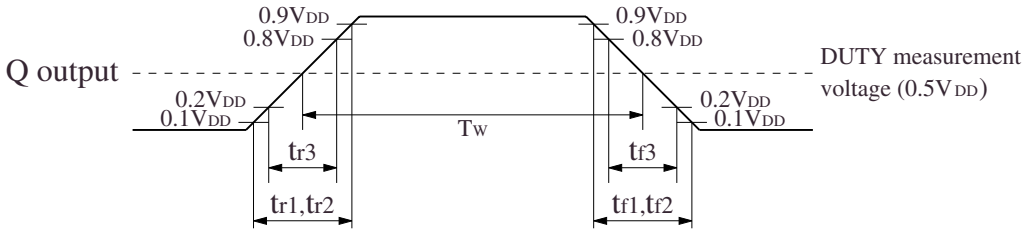
2Vp-p, 10MHz sine wave input signal
C1: 0.001µF
R1: 50Ω

Load cct 1

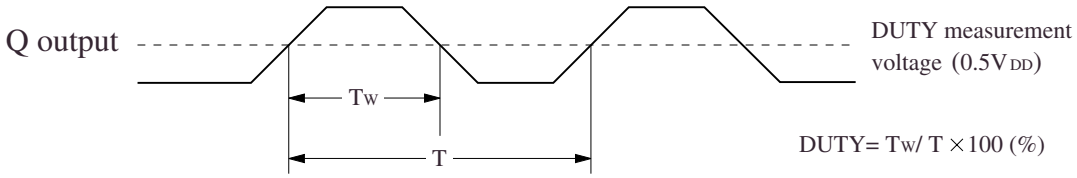


Switching Time Measurement Waveform

Output duty level, t_r, t_f

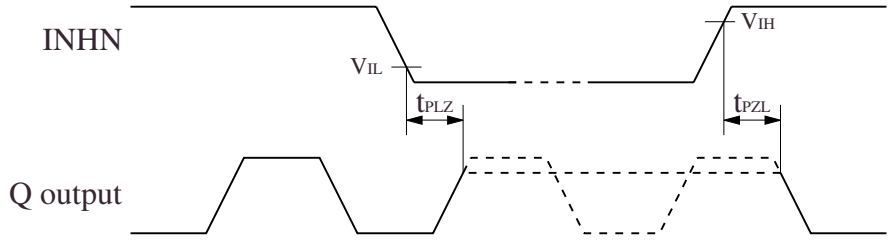


Output duty cycle



Output Enable/Disable Delay

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.



INHN input waveform tr = tf ≤ 10ns

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