

## 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.

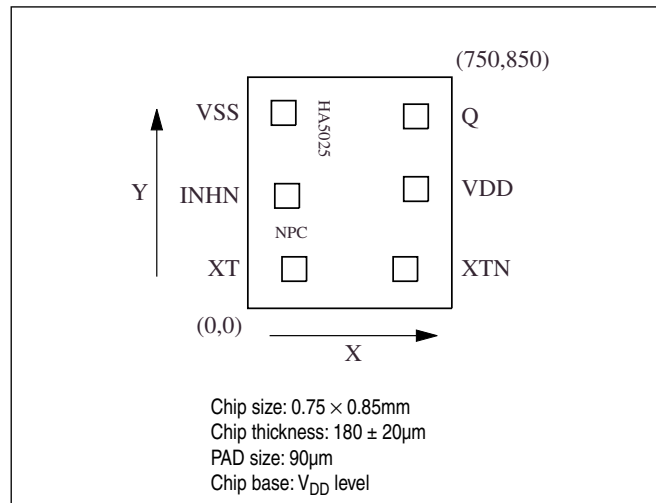
Note. These versions in parentheses ( ) are under development. Please ask our Sales & Marketing section for further detail.

## ORDERING INFORMATION

Device	Package
WF5025×××-3	Wafer form

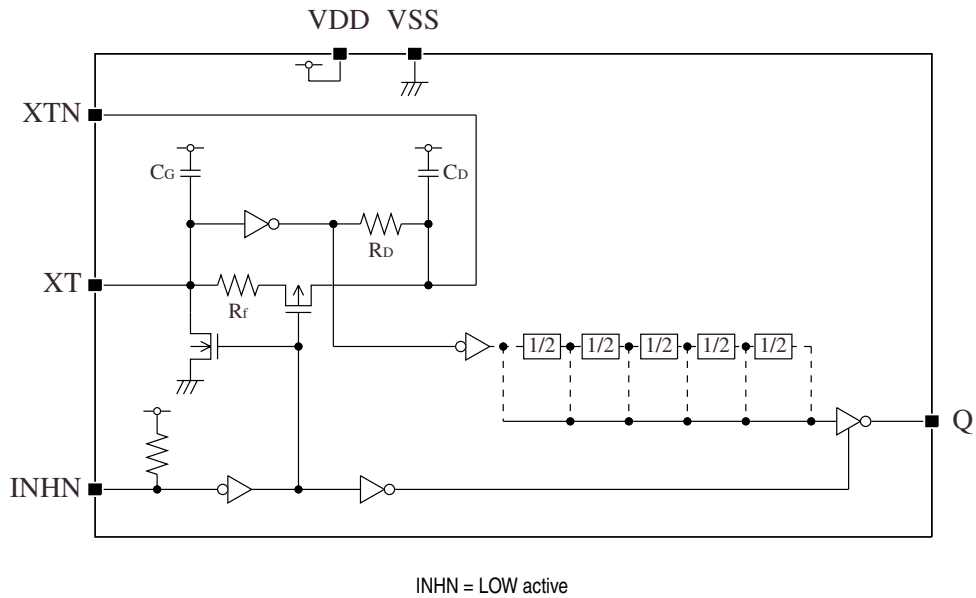
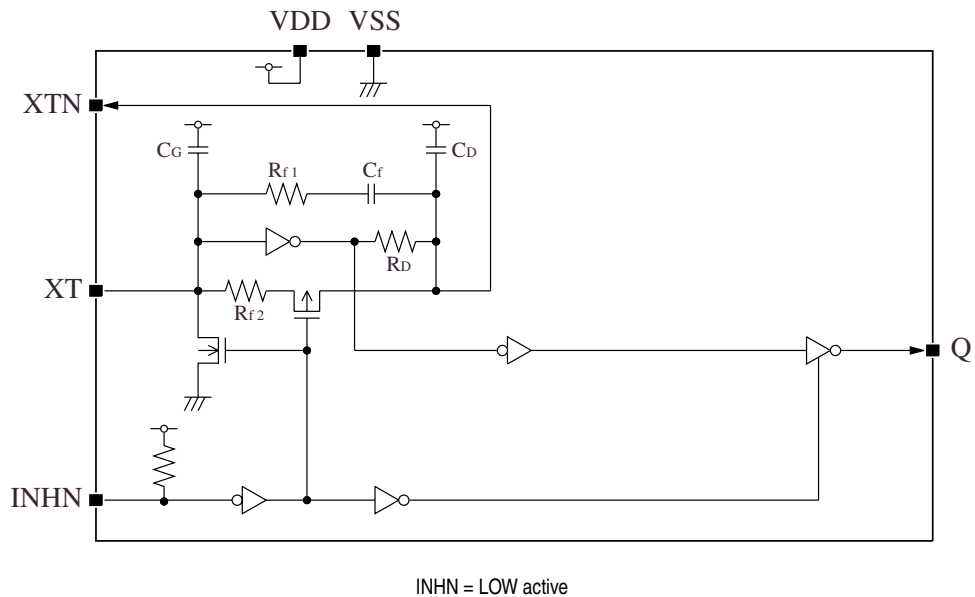
## PAD LAYOUT

(Unit:  $\mu\text{m}$ )



## 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 $\times$ , WF5025BL1)****For 3rd Overtone Oscillator (WF5025ML $\times$ )**

## 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 <sup>*1</sup>			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
			2.25	—	3.6	V
Input voltage	$V_{IN}$		$V_{SS}$	—	$V_{DD}$	V
Operating temperature	$T_{OPR}$		-40	—	+85	°C
Operating frequency <sup>*2</sup>	$f_O$	WF5025AL×	20	—	50	MHz
		WF5025BL1 <sup>*3</sup>	20	—	100	MHz
		WF5025MLA	70	—	80	MHz
		WF5025MLB <sup>*3</sup>	(80)	—	(100)	MHz
		WF5025MLC <sup>*3</sup>	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  $2.75V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
HIGH-level output voltage	V <sub>OH</sub>	Q: Measurement cct 1, V <sub>DD</sub> = 2.25V, I <sub>OH</sub> = 4mA		1.65	1.95	–	V
LOW-level output voltage	V <sub>OL</sub>	Q: Measurement cct 2, V <sub>DD</sub> = 2.25V, I <sub>OL</sub> = 4mA		–	0.3	0.4	V
HIGH-level input voltage	V <sub>IH</sub>	INH N		0.7V <sub>DD</sub>	–	–	V
LOW-level input voltage	V <sub>IL</sub>	INH N		–	–	0.3V <sub>DD</sub>	V
Output leakage current	I <sub>Z</sub>	Q: Measurement cct 2, INHN = LOW	V <sub>OH</sub> = V <sub>DD</sub>	–	–	10	μA
			V <sub>OL</sub> = V <sub>SS</sub>	–	–	10	μA
Current consumption	I <sub>DD2</sub>	Measurement cct 3, load cct 1, INHN = open, C <sub>L</sub> = 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 <sub>ST</sub>	Measurement cct 3, INHN = LOW		–	–	3	μA
INH N pull-up resistance	R <sub>UP1</sub>	Measurement cct 4		2	6	12	MΩ
	R <sub>UP2</sub>			20	100	200	kΩ
Feedback resistance	R <sub>f</sub>	Measurement cct 5		50	–	150	kΩ
Oscillator amplifier output resistance	R <sub>D</sub>	Design value. A monitor pattern on a wafer is tested.		340	400	460	Ω
Built-in capacitance	C <sub>G</sub>	Design value. A monitor pattern on a wafer is tested.		6.8	8	9.2	pF
	C <sub>D</sub>			8.5	10	11.5	pF

**WF5025 series**

**WF5025AL× (3.0V operation)**

$V_{DD} = 2.7$  to  $3.6V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
HIGH-level output voltage	V <sub>OH</sub>	Q: Measurement cct 1, V <sub>DD</sub> = 2.7V, I <sub>OH</sub> = 4mA		2.3	2.4	–	V
LOW-level output voltage	V <sub>OL</sub>	Q: Measurement cct 2, V <sub>DD</sub> = 2.7V, I <sub>OL</sub> = 4mA		–	0.3	0.4	V
HIGH-level input voltage	V <sub>IH</sub>	INHN		0.7V <sub>DD</sub>	–	–	V
LOW-level input voltage	V <sub>IL</sub>	INHN		–	–	0.3V <sub>DD</sub>	V
Output leakage current	I <sub>Z</sub>	Q: Measurement cct 2, INHN = LOW	V <sub>OH</sub> = V <sub>DD</sub>	–	–	10	μA
			V <sub>OL</sub> = V <sub>SS</sub>	–	–	10	μA
Current consumption	I <sub>DD2</sub>	Measurement cct 3, load cct 1, INHN = open, C <sub>L</sub> = 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 <sub>ST</sub>	Measurement cct 3, INHN = LOW		–	–	5	μA
INHN pull-up resistance	R <sub>UP1</sub>	Measurement cct 4		2	4	8	MΩ
	R <sub>UP2</sub>			15	75	150	kΩ
Feedback resistance	R <sub>f</sub>	Measurement cct 5		50	–	150	kΩ
Oscillator amplifier output resistance	R <sub>D</sub>	Design value. A monitor pattern on a wafer is tested.		340	400	460	Ω
Built-in capacitance	C <sub>G</sub>	Design value. A monitor pattern on a wafer is tested.		6.8	8	9.2	pF
	C <sub>D</sub>			8.5	10	11.5	pF

**WF5025 series**

**WF5025BL1 (2.5V operation)**

$V_{DD} = 2.25$  to  $2.75V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
HIGH-level output voltage	$V_{OH}$	Q: Measurement cct 1, $V_{DD} = 2.25V$ , $I_{OH} = 8mA$	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	$V_{IH}$	INH N	$0.7V_{DD}$	—	—	V
LOW-level input voltage	$V_{IL}$	INH N	—	—	$0.3V_{DD}$	V
Output leakage current	$I_Z$	Q: Measurement cct 2, INHN = LOW				
		$V_{OH} = V_{DD}$	—	—	10	$\mu A$
		$V_{OL} = V_{SS}$	—	—	10	$\mu A$
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	$\mu A$
INH N pull-up resistance	$R_{UP1}$	Measurement cct 4	2	6	12	$M\Omega$
	$R_{UP2}$		20	100	200	$k\Omega$
Feedback resistance	$R_f$	Measurement cct 5	50	—	150	$k\Omega$
Oscillator amplifier output resistance	$R_D$	Design value. A monitor pattern on a wafer is tested.	170	200	230	$\Omega$
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  $3.6V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
HIGH-level output voltage	$V_{OH}$	Q: Measurement cct 1, $V_{DD} = 2.7V$ , $I_{OH} = 8mA$	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	$V_{IH}$	INH N	$0.7V_{DD}$	—	—	V
LOW-level input voltage	$V_{IL}$	INH N	—	—	$0.3V_{DD}$	V
Output leakage current	$I_Z$	Q: Measurement cct 2, INHN = LOW				
		$V_{OH} = V_{DD}$	—	—	10	$\mu A$
		$V_{OL} = V_{SS}$	—	—	10	$\mu A$
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	$\mu A$
INH N pull-up resistance	$R_{UP1}$	Measurement cct 4	2	4	8	$M\Omega$
	$R_{UP2}$		15	75	150	$k\Omega$
Feedback resistance	$R_f$	Measurement cct 5	50	—	150	$k\Omega$
Oscillator amplifier output resistance	$R_D$	Design value. A monitor pattern on a wafer is tested.	170	200	230	$\Omega$
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

## WF5025 series

### WF5025ML× (2.5V operation)

$V_{DD} = 2.25$  to  $2.75$ V,  $V_{SS} = 0$ V,  $T_a = -40$  to  $+85^{\circ}\text{C}$  unless otherwise noted.

Parameter	Symbol	Condition			Rating <sup>*1</sup>			Unit	
					min	typ	max		
HIGH-level output voltage	V <sub>OH</sub>	Q: Measurement cct 1, V <sub>DD</sub> = 2.25V, I <sub>OH</sub> = 8mA			1.65	1.95	–	V	
LOW-level output voltage	V <sub>OL</sub>	Q: Measurement cct 2, V <sub>DD</sub> = 2.25V, I <sub>OL</sub> = 8mA			–	0.3	0.4	V	
HIGH-level input voltage	V <sub>IH</sub>	INH N			0.7V <sub>DD</sub>	–	–	V	
LOW-level input voltage	V <sub>IL</sub>	INH N			–	–	0.3V <sub>DD</sub>	V	
Output leakage current	I <sub>Z</sub>	Q: Measurement cct 2, INHN = LOW			V <sub>OH</sub> = V <sub>DD</sub>	–	–	10	μA
					V <sub>OL</sub> = V <sub>SS</sub>	–	–	10	μA
Current consumption	I <sub>DD1</sub>	Measurement cct 3, load cct 1, INHN = open, C <sub>L</sub> = 15pF	f = 100MHz	WF5025MLB	–	TBD	TBD	mA	
			f = 133MHz	WF5025MLC	–	15	30	mA	
	I <sub>DD2</sub>	Measurement cct 3, load cct 1, INHN = open, C <sub>L</sub> = 30pF	f = 72MHz	WF5025MLA	–	11	22	mA	
			f = 100MHz	WF5025MLB	–	TBD	TBD	mA	
			f = 100MHz	WF5025MLC	–	15	30	mA	
Standby current	I <sub>ST</sub>	Measurement cct 3, INHN = LOW			–	–	3	μA	
INH N pull-up resistance	R <sub>UP1</sub>	Measurement cct 4			2	6	12	MΩ	
	R <sub>UP2</sub>				20	100	200	kΩ	
AC feedback resistance	R <sub>f1</sub>	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 <sub>f2</sub>	Measurement cct 5			50	–	150	kΩ	
Oscillator amplifier output resistance	R <sub>D</sub>	Design value. A monitor pattern on a wafer is tested.			85	100	115	Ω	
AC feedback capacitance	C <sub>f</sub>	Design value. A monitor pattern on a wafer is tested.			8.5	10	11.5	pF	
Built-in capacitance	C <sub>G</sub>	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 <sub>D</sub>	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.



## WF5025 series

### WF5025ML× (3.0V operation)

$V_{DD} = 2.7$  to  $3.6V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  unless otherwise noted.

Parameter	Symbol	Condition		Rating <sup>*1</sup>			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	$V_{IH}$	INH N		$0.7V_{DD}$	–	–	V
LOW-level input voltage	$V_{IL}$	INH N		–	–	$0.3V_{DD}$	V
Output leakage current	$I_Z$	Q: Measurement cct 2, INH N = LOW	$V_{OH} = V_{DD}$	–	–	10	$\mu A$
			$V_{OL} = V_{SS}$	–	–	10	$\mu A$
Current consumption	$I_{DD1}$	Measurement cct 3, load cct 1, INH N = open, $C_L = 15pF$	$f = 100MHz$ WF5025MLB	–	TBD	TBD	mA
			$f = 133MHz$ WF5025MLC	–	20	40	mA
	$I_{DD2}$	Measurement cct 3, load cct 1, INH N = open, $C_L = 30pF$	$f = 72MHz$ WF5025MLA	–	15	30	mA
			$f = 100MHz$ WF5025MLB	–	TBD	TBD	mA
			$f = 100MHz$ WF5025MLC	–	20	40	mA
	$I_{ST}$	Measurement cct 3, INH N = LOW		–	–	5	$\mu A$
INH N pull-up resistance	$R_{UP1}$	Measurement cct 4		2	4	8	$M\Omega$
	$R_{UP2}$			15	75	150	$k\Omega$
AC feedback resistance	$R_{f1}$	Design value. A monitor pattern on a wafer is tested.	WF5025MLA	3.99	4.7	5.41	$k\Omega$
			WF5025MLB	TBD	TBD	TBD	$k\Omega$
			WF5025MLC	2.97	3.5	4.03	$k\Omega$
DC feedback resistance	$R_{f2}$	Measurement cct 5		50	–	150	$k\Omega$
Oscillator amplifier output resistance	$R_D$	Design value. A monitor pattern on a wafer is tested.		85	100	115	$\Omega$
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  $2.75V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
Output rise time	t <sub>r1</sub>	Measurement cct 3, load cct 1, 0.1V <sub>DD</sub> to 0.9V <sub>DD</sub>	C <sub>L</sub> = 15pF	–	3	6	ns
	t <sub>r2</sub>		C <sub>L</sub> = 30pF	–	5	10	ns
Output fall time	t <sub>f1</sub>	Measurement cct 3, load cct 1, 0.9V <sub>DD</sub> to 0.1V <sub>DD</sub>	C <sub>L</sub> = 15pF	–	3	6	ns
	t <sub>f2</sub>		C <sub>L</sub> = 30pF	–	5	10	ns
Output duty cycle <sup>*1</sup>	Duty1	Measurement cct 3, load cct 1, V <sub>DD</sub> = 2.5V, Ta = 25°C, f = 50MHz	C <sub>L</sub> = 15pF	45	–	55	%
	Duty2		C <sub>L</sub> = 30pF	45	–	55	%
Output disable delay time <sup>*2</sup>	t <sub>PLZ</sub>	Measurement cct 6, load cct 1, V <sub>DD</sub> = 2.5V, Ta = 25°C, C <sub>L</sub> = 15pF	–	–	100	ns	
Output enable delay time <sup>*2</sup>	t <sub>PZL</sub>		–	–	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  $3.6V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  unless otherwise noted.

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

WF5025 series

**WF5025BL1 (2.5V operation)**

$V_{DD} = 2.25$  to  $2.75V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  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 <sup>*1</sup>	Duty1	Measurement cct 3, load cct 1, $V_{DD} = 2.5V$ , $T_a = 25^{\circ}C$	$C_L = 15pF$ $f = 100MHz$	45	–	55	%
	Duty2		$C_L = 30pF$ $f = 80MHz$	45	–	55	%
	Duty3		$C_L = 30pF$ $f = 100MHz$	40	–	60	%
Output disable delay time <sup>*2</sup>	$t_{PLZ}$	Measurement cct 6, load cct 1, $V_{DD} = 2.5V$ , $T_a = 25^{\circ}C$ , $C_L = 15pF$		–	–	100	ns
Output enable delay time <sup>*2</sup>	$t_{PZL}$			–	–	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  $3.6V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  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 <sup>*1</sup>	Duty1	Measurement cct 3, load cct 1, $V_{DD} = 3.0V$ , $T_a = 25^{\circ}C$ , $f = 100MHz$	$C_L = 15pF$	45	–	55	%
	Duty2		$C_L = 30pF$	45	–	55	%
Output disable delay time <sup>*2</sup>	$t_{PLZ}$	Measurement cct 6, load cct 1, $V_{DD} = 3.0V$ , $T_a = 25^{\circ}C$ , $C_L = 15pF$		–	–	100	ns
Output enable delay time <sup>*2</sup>	$t_{PZL}$			–	–	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.

## WF5025 series

### WF5025ML× (2.5V operation)

$V_{DD} = 2.25$  to  $2.75V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  unless otherwise noted.

Parameter	Symbol	Condition			Rating <sup>*1</sup>			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
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 <sup>*2</sup>	Duty1	Measurement cct 3, load cct 1, $V_{DD} = 2.5V$ , $T_a = 25^{\circ}C$ , $C_L = 15pF$	$f = 72MHz$	WF5025MLA	45	–	55	%
			$f = 100MHz$	WF5025MLB	(45)	–	(55)	%
			$f = 133MHz$	WF5025MLC	45	–	55	%
	Duty2	Measurement cct 3, load cct 1, $V_{DD} = 2.5V$ , $T_a = 25^{\circ}C$ , $C_L = 30pF$	$f = 72MHz$	WF5025MLA	45	–	55	%
			$f = 100MHz$	WF5025MLB	(40)	–	(60)	%
			$f = 100MHz$	WF5025MLC	40	–	60	%
Output disable delay time <sup>*3</sup>	$t_{PLZ}$	Measurement cct 6, load cct 1, $V_{DD} = 2.5V$ , $T_a = 25^{\circ}C$ , $C_L = 15pF$			–	–	100	ns
Output enable delay time <sup>*3</sup>	$t_{PZL}$				–	–	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  $3.6V$ ,  $V_{SS} = 0V$ ,  $T_a = -40$  to  $+85^{\circ}C$  unless otherwise noted.

Parameter	Symbol	Condition			Rating <sup>*1</sup>			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 <sup>*2</sup>	Duty1	Measurement cct 3, load cct 1, $V_{DD} = 3.0V$ , $T_a = 25^{\circ}C$ , $C_L = 15pF$	$f = 72MHz$	WF5025MLA	45	–	55	%
			$f = 100MHz$	WF5025MLB	(45)	–	(55)	%
			$f = 133MHz$	WF5025MLC	45	–	55	%
	Duty2	Measurement cct 3, load cct 1, $V_{DD} = 3.0V$ , $T_a = 25^{\circ}C$ , $C_L = 30pF$	$f = 72MHz$	WF5025MLA	45	–	55	%
			$f = 100MHz$	WF5025MLB	(45)	–	(55)	%
		Measurement cct 3, load cct 1, $V_{DD} = 3.3V$ , $T_a = 25^{\circ}C$ , $C_L = 30pF$ , $f = 100MHz$		WF5025MLC	45	–	55	%
Output disable delay time <sup>*3</sup>	$t_{PLZ}$	Measurement cct 6, load cct 1, $V_{DD} = 3.0V$ , $T_a = 25^{\circ}C$ , $C_L = 15pF$			–	–	100	ns
Output enable delay time <sup>*3</sup>	$t_{PZL}$				–	–	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.

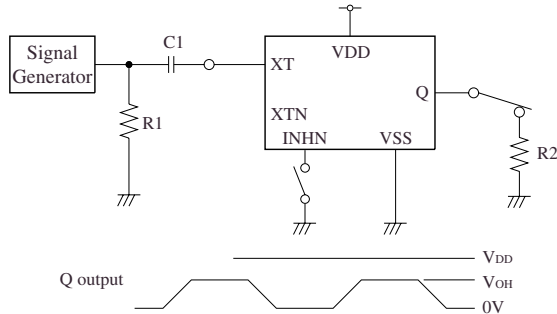
Version	INHN	Q	Oscillator
WF5025AL×	HIGH (or open)	Any $f_O$ , $f_O/2$ , $f_O/4$ , $f_O/8$ , $f_O/16$ or $f_O/32$ output frequency	Normal operation
WF5025BL1, ML×		$f_O$	
WF5025AL×, BL1, ML×	LOW	High impedance	Stopped

### 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

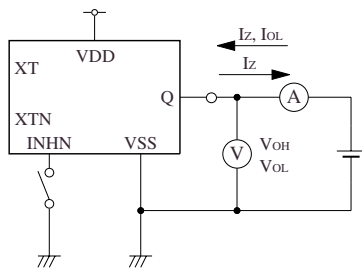
C1: 0.001μF

R1: 50Ω

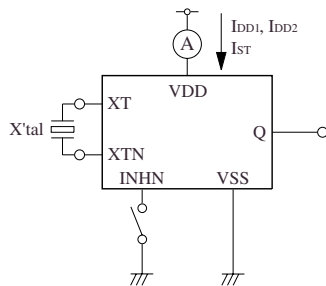
R2: 5025AL× : 412Ω (2.5V operation)  
575Ω (3.0V operation)

5025BL1, ML× : 206Ω (2.5V operation)  
287Ω (3.0V operation)

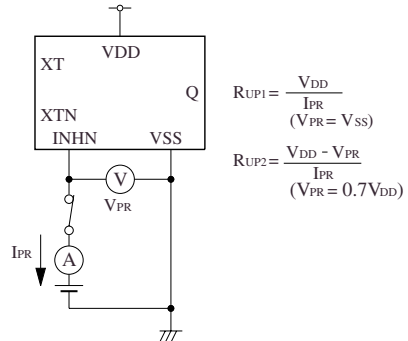
### Measurement cct 2



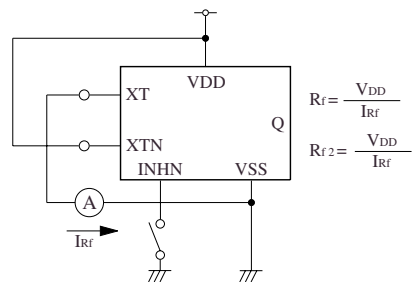
### Measurement cct 3



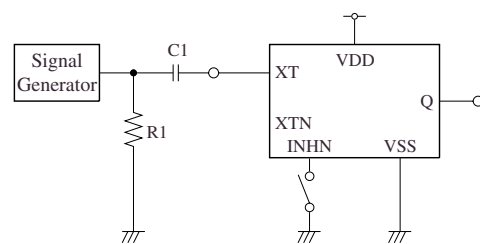
### Measurement cct 4



### Measurement cct 5



### Measurement cct 6

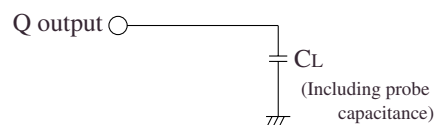


2Vp-p, 10MHz sine wave input signal

C1: 0.001μF

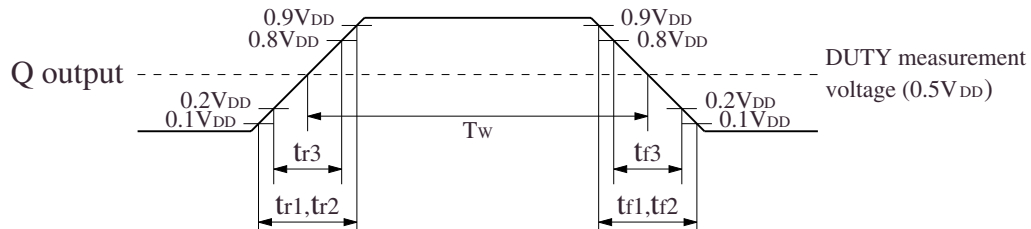
R1: 50Ω

### Load cct 1

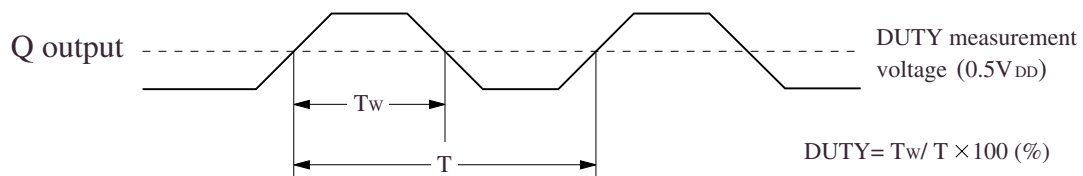


## Switching Time Measurement Waveform

### Output duty level, $t_r$ , $t_f$

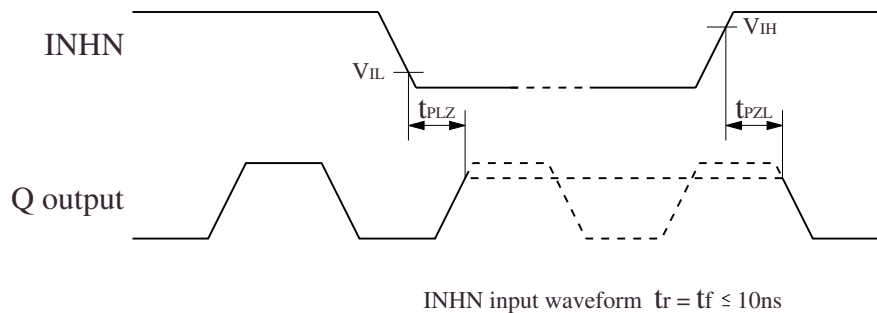


### Output duty cycle



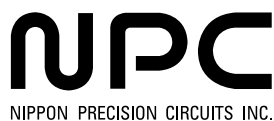
### Output Enable/Disable Delay

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.



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