NIPPON PRECISION CIRCUITS INC.

SM5010 series

Crystal Oscillator Module ICs

OVERVIEW

The SM5010 series are crystal oscillator module ICs, that incorporate oscillator and output buffer circuits. High-frequency capacitors and feedback resistors are built-in, eliminating the need for external components to make a stable fundamental-harmonic oscillator.

FEATURES

- Inverter amplifier feedback resistor built-in
- Capacitors C_G, C_D built-in
- Standby function
- Power-save pull-up resistor built-in (5010CL×)
- 16 mA (V_{DD} = 4.5 V) drive capability (5010AN×, AK×, BN×, BK×, CL×, DN×)
- 4 mA (V_{DD} = 4.5 V) drive capability (5010AH×, BH×)
- Output three-state function
- 2.7 to 5.5 V supply voltage
- Oscillator frequency output (f_O, $f_O/2$, $f_O/4$, $f_O/8$ determined by internal connection)
- 8-pin SOP (SM5010×××S)
- Chip form (CF5010×××)

SERIES CONFIGURATION

Version[1]	Output frequency	3V operating		5V operating			R_D [Ω]	Built-in capacitance		Input level (5V)	Output duty level	Standby function
		Output load (max) [pF]	Recommended operating frequency range [MHz]	Output load (max) [pF]	Recommended operating frequency range [MHz]	Output current [mA]		C_G [pF]	C_D [pF]			
SM5010AN1S	f_0	15	30	50	30	16	–	TBD		TTL	CMOS	No
SM5010AN2S	$f_0/2$	15	30	50	30	16	–			TTL	CMOS/TTL	No
SM5010AN3S	$f_0/4$	15	30	50	30	16	–			TTL	CMOS/TTL	No
SM5010AN4S	$f_0/8$	15	30	50	30	16	–			TTL	CMOS/TTL	No
SM5010AK1S	f_0	–	–	15	30	16	–			TTL	TTL	No
SM5010AH1S	f_0	15	16	15	30	4	–			TTL	CMOS	No
SM5010AH2S	$f_0/2$	15	16	15	30	4	–			TTL	CMOS	No
SM5010AH3S	$f_0/4$	15	16	15	30	4	–			TTL	CMOS	No
SM5010AH4S	$f_0/8$	15	16	15	30	4	–			TTL	CMOS	No
SM5010BN1S	f_0	15	30	50	30	16	820			TTL	CMOS	No
SM5010BN2S	$f_0/2$	15	30	50	30	16	820			TTL	CMOS/TTL	No
SM5010BN3S	$f_0/4$	15	30	50	30	16	820			TTL	CMOS/TTL	No
SM5010BN4S	$f_0/8$	15	30	50	30	16	820			TTL	CMOS/TTL	No
SM5010BK1S	f_0	–	–	15	30	16	820			TTL	TTL	No
SM5010BH1S	f_0	15	16	15	30	4	820			TTL	CMOS	No
SM5010BH2S	$f_0/2$	15	16	15	30	4	820			TTL	CMOS	No
SM5010BH3S	$f_0/4$	15	16	15	30	4	820			TTL	CMOS	No
SM5010BH4S	$f_0/8$	15	16	15	30	4	820			TTL	CMOS	No
SM5010CL1S	f_0	15	30	50	30	16	–			CMOS	CMOS	Yes
SM5010CL2S	$f_0/2$	15	30	50	30	16	–			CMOS	CMOS	Yes
SM5010CL3S	$f_0/4$	15	30	50	30	16	–			CMOS	CMOS	Yes
SM5010CL4S	$f_0/8$	15	30	50	30	16	–			CMOS	CMOS	Yes
SM5010DN1S	f_0	15	30	50	30	16	820			TTL	CMOS	No

1. Chip form devices have designation CF5010×××.

Note: Recommended operating frequency is not the guaranteed value but is measured using NPC's standard crystal.

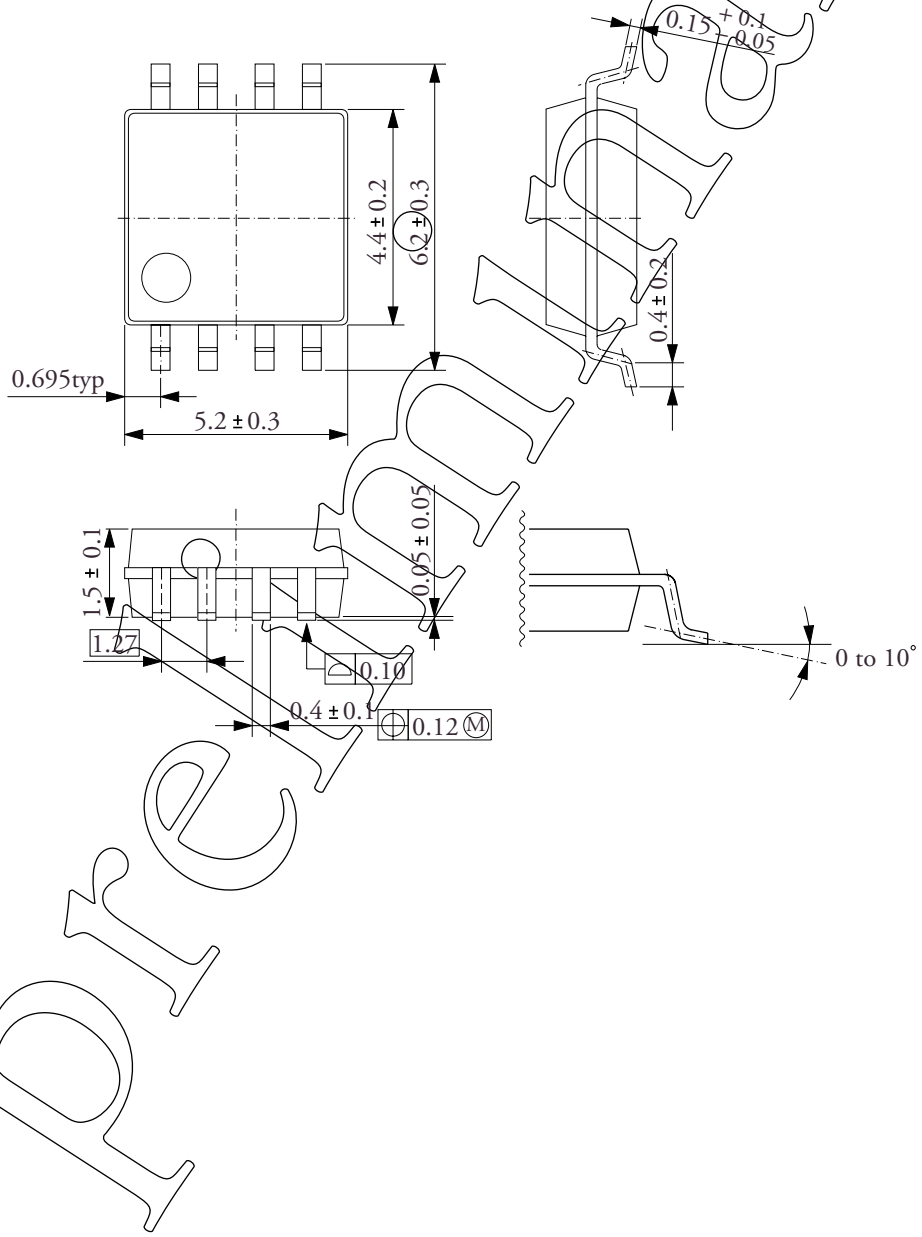
ORDERING INFORMATION

Device	Package
SM5010×××S	8-pin SOP
CF5010×××–1	Chip form

PACKAGE DIMENSIONS

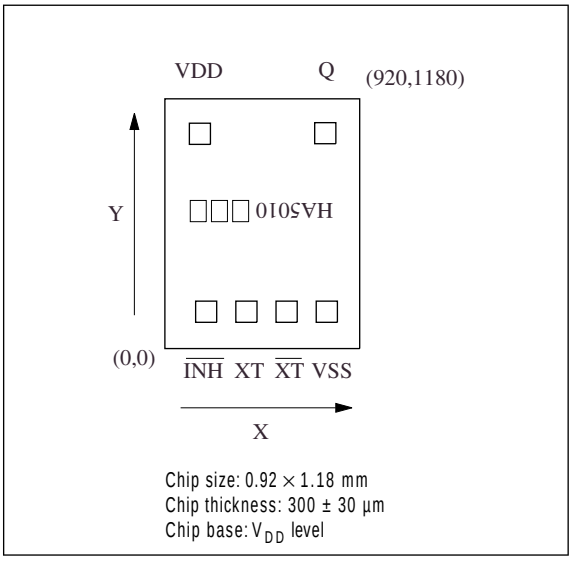
(Unit:mm)

• 8-pin SOP



PAD LAYOUT

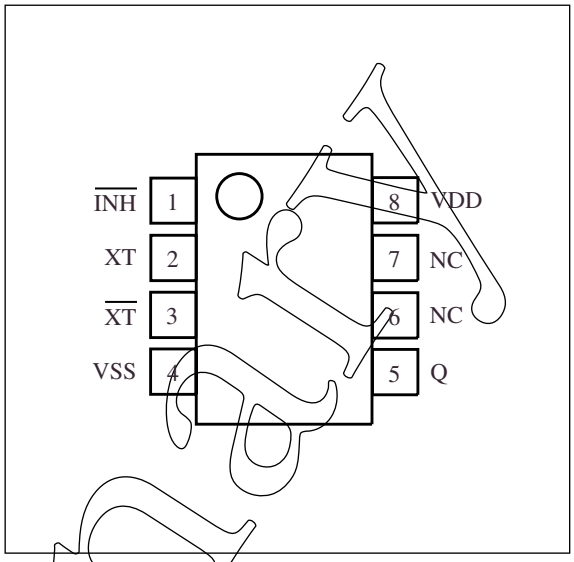
(Unit:µm)



Chip size: 0.92 × 1.18 mm
Chip thickness: 300 ± 30 µm
Chip base: V_{DD} level

PINOUT

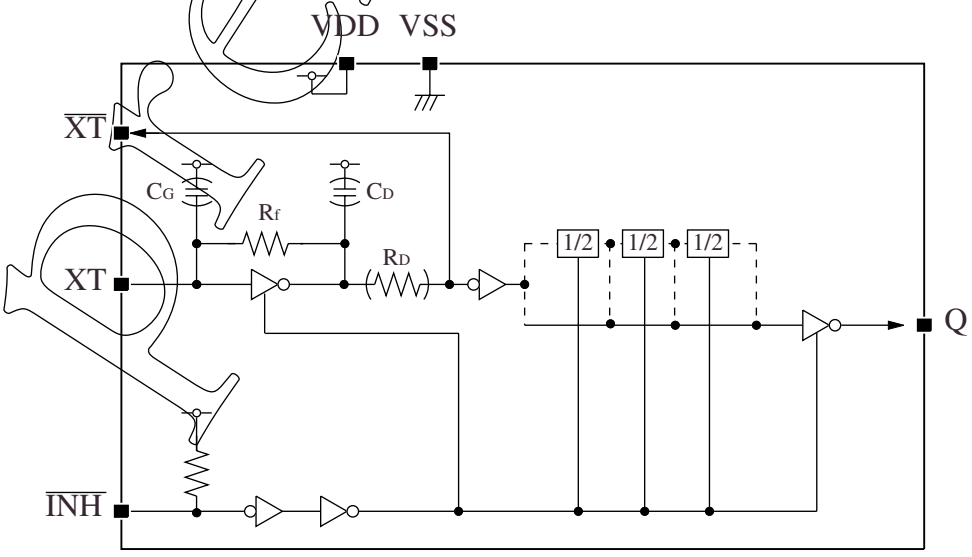
(Top view)



PIN DESCRIPTION and PAD DIMENSIONS

Number	Name	I/O	Description	Pad dimensions [µm]	
				X	Y
1	INH	I	Output state control input. High impedance when LOW. In the case of the 5010CL×, the oscillator stops and Power-saving pull-up resistor built in.	195	174.4
2	XT	I	Amplifier input. Crystal oscillator connection pins.	385	174.4
3	XT	O	Amplifier output. Crystal oscillator connected between XT and XT	575	174.4
4	VSS	–	Ground	765	174.4
5	Q	O	Output. Output frequency (f_O, $f_O/2$, $f_O/4$, $f_O/8$) determined by internal connection	757.6	1017.6
6	NC	–	No connection	–	–
7	NC	–	No connection	–	–
8	VDD	–	Supply voltage	165.4	1014.6

BLOCK DIAGRAM



SPECIFICATIONS

Absolute Maximum Ratings

V_{SS} = 0 V

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}	Chip form	–65 to 150	°C
		8-pin SOP	–55 to 125	
Output current	I_{OUT}	5010×H×	10	mA
		5010×N×, ×K×, CL×	25	
Power dissipation	P_D	8-pin SOP	500	mW
Soldering temperature	T_{sld}	8-pin SOP	255	°C
Soldering time	t_{sld}	8-pin SOP	10	s

Recommended Operating Conditions

3V operation

V_{SS} = 0 V

Parameter	Symbol	Series	Condition	Rating			Unit
				min	typ	max	
Supply voltage	V_{DD}	×N×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	2.7	–	3.6	V
		×H×	2 ≤ f ≤ 16 MHz, C_L ≤ 15 pF	2.7	–	3.6	
		CL×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	2.7	–	3.6	
Input voltage	V_{IN}	×N×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	V_{SS}	–	V_{DD}	V
		×H×	2 ≤ f ≤ 16 MHz, C_L ≤ 15 pF	V_{SS}	–	V_{DD}	
		CL×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	V_{SS}	–	V_{DD}	
Operating temperature	T_{OPR}	×N×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	– 10	–	+ 70	°C
		×H×	2 ≤ f ≤ 16 MHz, C_L ≤ 15 pF	– 10	–	+ 70	
		CL×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	– 20	–	+ 80	

5V operation

V_{SS} = 0 V

Parameter	Symbol	Series	Condition	Rating			Unit
				min	typ	max	
Supply voltage	V_{DD}	×N×	2 ≤ f ≤ 30 MHz, C_L ≤ 50 pF	4.5	–	5.5	V
		×K×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	4.5	–	5.5	
		×H×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	4.5	–	5.5	
		CL×	2 ≤ f ≤ 30 MHz, C_L ≤ 50 pF	4.5	–	5.5	
Input voltage	V_{IN}	×N×	2 ≤ f ≤ 30 MHz, C_L ≤ 50 pF	V_{SS}	–	V_{DD}	V
		×K×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	V_{SS}	–	V_{DD}	
		×H×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	V_{SS}	–	V_{DD}	
		CL×	2 ≤ f ≤ 30 MHz, C_L ≤ 50 pF	V_{SS}	–	V_{DD}	
Operating temperature	T_{OPR}	×N×	2 ≤ f ≤ 30 MHz, C_L ≤ 50 pF	– 40	–	+ 85	°C
		×K×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	– 40	–	+ 85	
		×H×	2 ≤ f ≤ 30 MHz, C_L ≤ 15 pF	– 40	–	+ 85	
		CL×	2 ≤ f ≤ 30 MHz, C_L ≤ 50 pF	– 40	–	+ 85	

Electrical Characteristics

5010×N× series

3 V operation: V_{DD} = 2.7 to 3.6 V, V_{SS} = 0 V, Ta = −10 to 70 °C unless otherwise noted.

Parameter	Symbol	Condition		Rating min	Rating typ	Rating max	Unit
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 2.7 V, I_{OH} = 8 mA		2.1	2.4	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 2.7 V, I_{OL} = 8 mA		–	0.3	0.4	V
Output leakage current	I_Z	Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 3.6 V, V_{OH} = V_{DD}		–	–	10	µA
		Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 3.6 V, V_{OL} = V_{SS}		–	–	10	
HIGH-level input voltage	V_{IH}	$\overline{INH}$		2.0	–	–	V
LOW-level input voltage	V_{IL}	$\overline{INH}$		–	–	0.5	V
Current consumption	I_{DD}	Measurement cct 3, load cct 1, $\overline{INH}$ = open, C_L = 15 pF, f = 30 MHz	5010×N1	TBD			mA
			5010×N2				
			5010×N3				
			5010×N4				
$\overline{INH}$ pull-up resistance	R_{UP1}	Measurement cct 4		–	100	–	kΩ
Feedback resistance	R_f	Measurement cct 5		–	200	–	kΩ
Oscillator amplifier output resistance	R_D	Design value	5010B××	–	820	–	Ω
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern	5010A××, 5010B××	TBD			pF
	C_D						pF

5010×N×, ×K× series

5 V operation: V_{DD} = 4.5 to 5.5 V, V_{SS} = 0 V, Ta = −40 to 85 °C unless otherwise noted.

Parameter	Symbol	Condition		Rating min	Rating typ	Rating max	Unit
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 4.5 V, I_{OH} = 16 mA		3.9	4.2	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 4.5 V, I_{OL} = 16 mA		–	0.3	0.4	V
Output leakage current	I_Z	Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 5.5 V, V_{OH} = V_{DD}		–	–	10	µA
		Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 5.5 V, V_{OL} = V_{SS}		–	–	10	
HIGH-level input voltage	V_{IH}	$\overline{INH}$		2.0	–	–	V
LOW-level input voltage	V_{IL}	$\overline{INH}$		–	–	0.8	V
Current consumption	I_{DD}	Measurement cct 3, load cct 2, $\overline{INH}$ = open, C_L = 50 pF, f = 30 MHz	5010×N1	TBD			mA
			5010×N2				
			5010×N3				
			5010×N4				
		Measurement cct 3, load cct 1, $\overline{INH}$ = open, C_L = 15 pF, f = 30 MHz	5010×K×				
$\overline{INH}$ pull-up resistance	R_{UP1}	Measurement cct 4		–	100	–	kΩ
Feedback resistance	R_f	Measurement cct 5		–	200	–	kΩ
Oscillator amplifier output resistance	R_D	Design value	5010B××	–	820	–	Ω
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern	5010A××, 5010B××	TBD			pF
	C_D						pF

5010×H× series

3 V operation: V_{DD} = 2.7 to 3.6 V, V_{SS} = 0 V, Ta = −10 to 70 °C unless otherwise noted.

Parameter	Symbol	Condition		Rating min	Rating typ	Rating max	Unit
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 2.7 V, I_{OH} = 2 mA		2.1	2.4	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 2.7 V, I_{OL} = 2 mA		–	0.3	0.5	V
Output leakage current	I_Z	Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 3.6 V, V_{OH} = V_{DD}		–	–	10	µA
		Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 3.6 V, V_{OL} = V_{SS}		–	–	10	
HIGH-level input voltage	V_{IH}	$\overline{INH}$		2.0	–	–	V
LOW-level input voltage	V_{IL}	$\overline{INH}$		–	–	0.5	V
Current consumption	I_{DD}	Measurement cct 3, load cct 2, $\overline{INH}$ = open, C_L = 15 pF, f = 16 MHz	5010×H1	TBD			mA
			5010×H2				
			5010×H3				
			5010×H4				
$\overline{INH}$ pull-up resistance	R_{UP1}	Measurement cct 4		–	100	–	kΩ
Feedback resistance	R_f	Measurement cct 5		–	200	–	kΩ
Oscillator amplifier output resistance	R_D	Design value	5010B××	–	820	–	Ω
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern	5010A××, 5010B××	TBD			pF
	C_D						pF

5 V operation: V_{DD} = 4.5 to 5.5 V, V_{SS} = 0 V, Ta = −40 to 85 °C unless otherwise noted.

Parameter	Symbol	Condition		Rating min	Rating typ	Rating max	Unit
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 4.5 V, I_{OH} = 4 mA		3.9	4.2	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 4.5 V, I_{OL} = 4 mA		–	0.3	0.5	V
Output leakage current	I_Z	Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 5.5 V, V_{OH} = V_{DD}		–	–	10	µA
		Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 5.5 V, V_{OL} = V_{SS}		–	–	10	
HIGH-level input voltage	V_{IH}	$\overline{INH}$		2.0	–	–	V
LOW-level input voltage	V_{IL}	$\overline{INH}$		–	–	0.8	V
Current consumption	I_{DD}	Measurement cct 3, load cct 2, $\overline{INH}$ = open, C_L = 15 pF, f = 30 MHz	5010×H1	TBD			mA
			5010×H2				
			5010×H3				
			5010×H4				
$\overline{INH}$ pull-up resistance	R_{UP1}	Measurement cct 4		–	100	–	kΩ
Feedback resistance	R_f	Measurement cct 5		–	200	–	kΩ
Oscillator amplifier output resistance	R_D	Design value	5010B××	–	820	–	Ω
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern	5010A××, 5010B××	TBD			pF
	C_D						pF

5010CL× series

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

Parameter	Symbol	Condition		Rating min	Rating typ	Rating max	Unit
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 2.7 V, I_{OH} = 8 mA		2.2	2.4	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 2.7 V, I_{OL} = 8 mA		–	0.3	0.4	V
Output leakage current	I_Z	Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 3.6 V, V_{OH} = V_{DD}		–	–	10	µA
		Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 3.6 V, V_{OL} = V_{SS}		–	–	10	
HIGH-level input voltage	V_{IH}	$\overline{INH}$		$0.7V_{DD}$			V
LOW-level input voltage	V_{IL}	$\overline{INH}$				$0.3V_{DD}$	V
Current consumption	I_{DD}	Measurement cct 3, load cct 2, $\overline{INH}$ = open, C_L = 15 pF, f = 30 MHz	5010CL1	TBD			mA
			5010CL2				
			5010CL3				
			5010CL4				
$\overline{INH}$ pull-up resistance	R_{UP1}	Measurement cct 4		–	100	–	kΩ
	R_{UP2}			TBD			MΩ
Feedback resistance	R_f	Measurement cct 5		–	200	–	kΩ
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern		TBD			pF
	C_D						pF

5 V operation: V_{DD} = 4.5 to 5.5 V, V_{SS} = 0 V, Ta = –40 to 85 °C unless otherwise noted.

Parameter	Symbol	Condition		Rating min	Rating typ	Rating max	Unit
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, V_{DD} = 4.5 V, I_{OH} = 16 mA		4.0	4.2	–	V
LOW-level output voltage	V_{OL}	Q: Measurement cct 2, V_{DD} = 4.5 V, I_{OL} = 16 mA		–	0.3	0.4	V
Output leakage current	I_Z	Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 5.5 V, V_{OH} = V_{DD}		–	–	10	µA
		Q: Measurement cct 2, $\overline{INH}$ = LOW, V_{DD} = 5.5 V, V_{OL} = V_{SS}		–	–	10	
HIGH-level input voltage	V_{IH}	$\overline{INH}$		$0.7V_{DD}$			V
LOW-level input voltage	V_{IL}	$\overline{INH}$				$0.3V_{DD}$	V
Current consumption	I_{DD}	Measurement cct 3, load cct 2, $\overline{INH}$ = open, C_L = 50 pF, f = 30 MHz	5010CL1	TBD			mA
			5010CL2				
			5010CL3				
			5010CL4				
$\overline{INH}$ pull-up resistance	R_{UP1}	Measurement cct 4		–	100	–	kΩ
	R_{UP2}			TBD			MΩ
Feedback resistance	R_f	Measurement cct 5		–	200	–	kΩ
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern		TBD			pF
	C_D						pF

Switching Characteristics

5010×N× series

3 V operation: V_{DD} = 2.7 to 3.6 V, V_{SS} = 0 V, Ta = −10 to 70 °C unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Output rise time	t_{r1}	Measurement cct 6, load cct 2, C_L = 15 pF, 0.1V_{DD} to 0.9V_{DD}	–	3.0	6.0	ns
Output fall time	t_{f1}	Measurement cct 6, load cct 2, C_L = 15 pF, 0.9V_{DD} to 0.1V_{DD}	–	3.0	6.0	ns
Output duty cycle[1]	Duty	Measurement cct 6, load cct 2, V_{DD} = 3.0 V, Ta = 25 °C, C_L = 15 pF, f = 30MHz	40	–	60	%
Output disable delay time	t_{PLZ}	Measurement cct 7, load cct 2, V_{DD} = 3.0 V, Ta = 25 °C, C_L = 15 pF	–	–	100	ns
Output enable delay time	t_{PZL}		–	–	100	ns

1. Determined by the lot monitor.

5010×N×, ×K× series

5 V operation (5010×N×): V_{DD} = 4.5 to 5.5 V, V_{SS} = 0 V, Ta = −40 to 85 °C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
Output rise time	t_{r2}	Measurement cct 6, load cct 2, 0.1V_{DD} to 0.9V_{DD}	C_L = 15 pF	–	2.0	4.0	ns
	t_{r3}		C_L = 50 pF	–	4.0	8.0	
Output fall time	t_{f2}	Measurement cct 6, load cct 2, 0.9V_{DD} to 0.1V_{DD}	C_L = 15 pF	–	2.0	4.0	ns
	t_{f3}		C_L = 50 pF	–	4.0	8.0	
Output duty cycle[1]	Duty	Measurement cct 6, load cct 2, V_{DD} = 5.0 V, Ta = 25 °C, C_L = 50 pF, f = 30MHz		45	–	55	%
Output disable delay time	t_{PLZ}	Measurement cct 7, load cct 2, V_{DD} = 5.0 V, Ta = 25 °C, C_L = 15 pF		–	–	100	ns
Output enable delay time	t_{PZL}			–	–	100	ns

1. Determined by the lot monitor.

5 V operation (5010AN2, AN3, AN4, BN2, BN3, BN4, ×K×): V_{DD} = 4.5 to 5.5 V, V_{SS} = 0 V, Ta = −40 to 85 °C unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Output rise time	t_{r4}	Measurement cct 6, load cct 1, C_L = 15 pF, 0.4V to 2.4V	–	1.5	3.0	ns
Output fall time	t_{f4}	Measurement cct 6, load cct 1, C_L = 15 pF, 2.4V to 0.4V	–	1.5	3.0	ns
Output duty cycle[1]	Duty	Measurement cct 6, load cct 1, V_{DD} = 5.0 V, Ta = 25 °C, C_L = 15 pF, f = 30MHz	45	–	55	%
Output disable delay time	t_{PLZ}	Measurement cct 7, load cct 1, V_{DD} = 5.0 V, Ta = 25 °C, C_L = 15 pF	–	–	100	ns
Output enable delay time	t_{PZL}		–	–	100	ns

1. Determined by the lot monitor.

5010×H× series

3 V operation: V_{DD} = 2.7 to 3.6 V, V_{SS} = 0 V, Ta = −10 to 70 °C unless otherwise noted.

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Output rise time	t_{r1}	Measurement cct 6, load cct 2, C_L = 15 pF, 0.1V_{DD} to 0.9V_{DD}	–	15	30	ns
Output fall time	t_{f1}	Measurement cct 6, load cct 2, C_L = 15 pF, 0.9V_{DD} to 0.1V_{DD}	–	15	30	ns
Output duty cycle[1]	Duty	Measurement cct 6, load cct 2, V_{DD} = 3.0 V, Ta = 25 °C, C_L = 15 pF, f = 16MHz	40	–	60	%
Output disable delay time	t_{PLZ}	Measurement cct 7, load cct 2, V_{DD} = 3.0 V, Ta = 25 °C, C_L = 15 pF	–	–	100	ns
Output enable delay time	t_{PZL}		–	–	100	ns

1. Determined by the lot monitor.

5 V operation: V_{DD} = 4.5 to 5.5 V, V_{SS} = 0 V, Ta = –40 to 85 °C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
Output rise time	t_{r2}	Measurement cct 6, load cct 2, 0.1V_{DD} to 0.9V_{DD}	C_L = 15 pF	–	5	10	ns
	t_{r3}		C_L = 50 pF	–	13	26	
Output fall time	t_{f2}	Measurement cct 6, load cct 2, 0.9V_{DD} to 0.1V_{DD}	C_L = 15 pF	–	5	10	ns
	t_{f3}		C_L = 50 pF	–	13	26	
Output duty cycle[1]	Duty	Measurement cct 6, load cct 2, V_{DD} = 5.0 V, Ta = 25 °C, C_L = 15 pF, f = 30MHz		45	–	55	%
Output disable delay time	t_{PLZ}	Measurement cct 7, load cct 2, V_{DD} = 5.0 V, Ta = 25 °C, C_L = 15 pF		–	–	100	ns
Output enable delay time	t_{PZL}			–	–	100	ns

1. Determined by the lot monitor.

5010CL× series

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

Parameter	Symbol	Condition		Rating min	Rating typ	Rating max	Unit
Output rise time	t_{r2}	Measurement cct 6, load cct 2, 0.1V_{DD} to 0.9V_{DD}	C_L = 15 pF	–	2.0	4.0	ns
	t_{r4}		C_L = 30 pF	–	3.0	6.0	
Output fall time	t_{f2}	Measurement cct 6, load cct 2, 0.9V_{DD} to 0.1V_{DD}	C_L = 15 pF	–	2.0	4.0	ns
	t_{f4}		C_L = 30 pF	–	3.0	6.0	
Output duty cycle[1]	Duty	Measurement cct 6, load cct 2, V_{DD} = 3.0 V, Ta = 25 °C, C_L = 15 pF, f = 30MHz		45	–	55	%
Output disable delay time[2]	t_{PLZ}	Measurement cct 7, load cct 2, V_{DD} = 3.0 V, Ta = 25 °C, C_L = 15 pF		–	–	100	ns
Output enable delay time[2]	t_{PZL}			–	–	100	ns

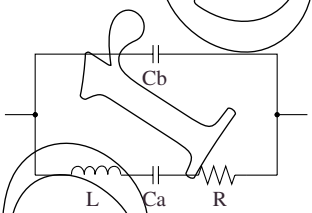
1. Determined by the lot monitor.
2. Oscillator stop function is built-in. When $\overline{INH}$ goes LOW, normal output stops. When $\overline{INH}$ goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.

5 V operation: V_{DD} = 4.5 to 5.5 V, V_{SS} = 0 V, Ta = –40 to 85 °C unless otherwise noted.

Parameter	Symbol	Condition		Rating min	Rating typ	Rating max	Unit
Output rise time	t_{r2}	Measurement cct 6, load cct 2, 0.1V_{DD} to 0.9V_{DD}	C_L = 15 pF	–	1.5	3.0	ns
	t_{r3}		C_L = 50 pF	–	4.0	8.0	
Output fall time	t_{f2}	Measurement cct 6, load cct 2, 0.9V_{DD} to 0.1V_{DD}	C_L = 15 pF	–	1.5	3.0	ns
	t_{f3}		C_L = 50 pF	–	4.0	8.0	
Output duty cycle[1]	Duty	Measurement cct 6, load cct 2, V_{DD} = 5.0 V, Ta = 25 °C, C_L = 50 pF, f = 30MHz		40	–	60	%
Output disable delay time[2]	t_{PLZ}	Measurement cct 7, load cct 2, V_{DD} = 5.0 V, Ta = 25 °C, C_L = 15 pF		–	–	100	ns
Output enable delay time[2]	t_{PZL}			–	–	100	ns

1. Determined by the lot monitor.
2. Oscillator stop function is built-in. When $\overline{INH}$ goes LOW, normal output stops. When $\overline{INH}$ goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.

Current consumption and Output waveform with NPC's standard crystal



f (MHz)	R (Ω)	L (mH)	Ca (fF)	Cb (pF)
30	17.2	4.36	6.46	2.26

FUNCTIONAL DESCRIPTION

Standby Function

AH, AK, AN, BH, BK, BN, DN series

When $\overline{INH}$ goes LOW, the output on Q becomes high impedance, but internally the oscillator does not stop.

CL series

When $\overline{INH}$ goes LOW, the oscillator stops and the oscillator output on Q becomes high impedance.

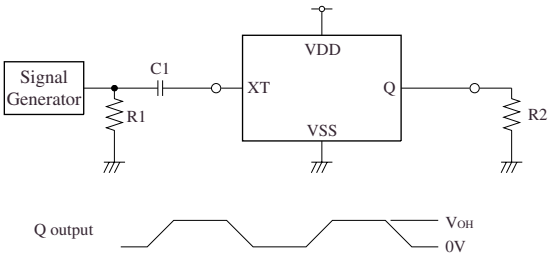
Version	$\overline{INH}$	Q	Oscillator
AH, AK, AN, BH, BK, BN, DN series	HIGH (or open)	Any f_O , $f_O/2$, $f_O/4$ or $f_O/8$ output frequency	Normal operation
	LOW	High impedance	Normal operation
CL series	HIGH (or open)	Any f_O , $f_O/2$, $f_O/4$ or $f_O/8$ output frequency	Normal operation
	LOW	High impedance	Stopped

Power-save Pull-up Resistance (CL series only)

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

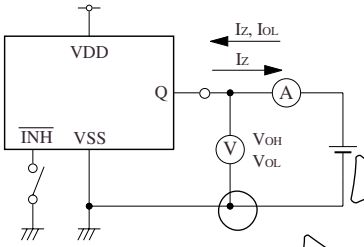
MEASUREMENT CIRCUITS

Measurement cct 1

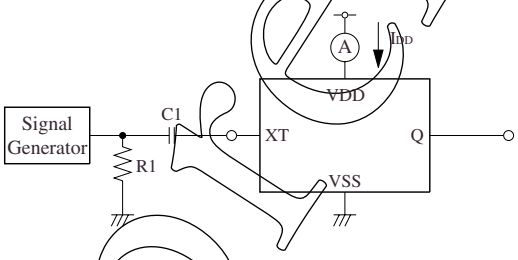


$2.0V_{P-P}$, 10MHz sine wave input signal (3V operation)
$3.5V_{P-P}$, 10MHz sine wave input signal (5V operation)
C1 : 0.001µF
R1 : 50Ω
R2 : 263Ω (5010×N×, ×K×/ 3V operation)
245Ω (5010×N×, ×K×/ 5V operation)
1050Ω (5010×H×/ 3V operation)
975Ω (5010×H×/ 5V operation)
275Ω (5010CL×/ 3V operation)
250Ω (5010CL×/ 5V operation)

Measurement cct 2

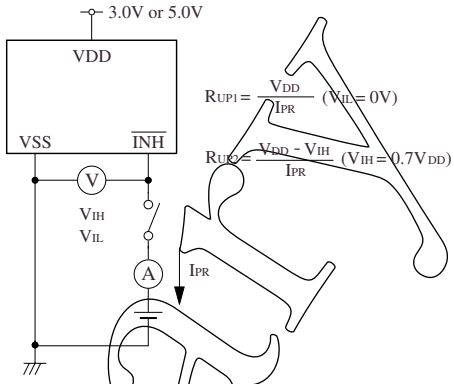


Measurement cct 3

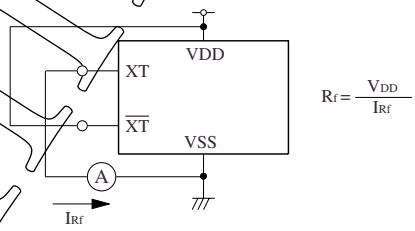


$2.0V_{P-P}$, 30MHz sine wave input signal (3V operation)
$3.5V_{P-P}$, 30MHz sine wave input signal (5V operation)
C1 : 0.001µF
R1 : 50Ω

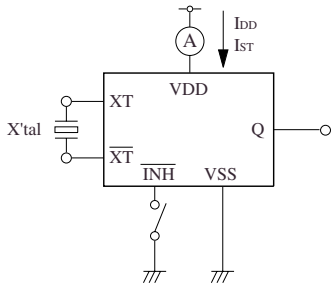
Measurement cct 4



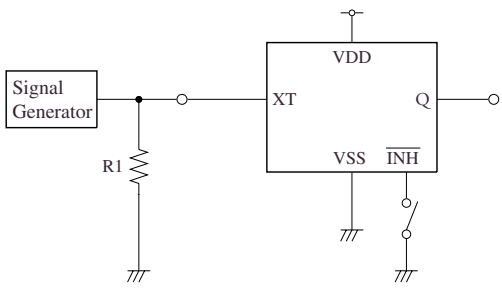
Measurement cct 5



Measurement cct 6

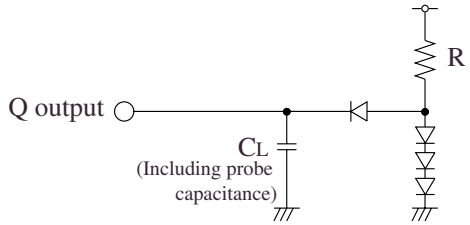


Measurement cct 7



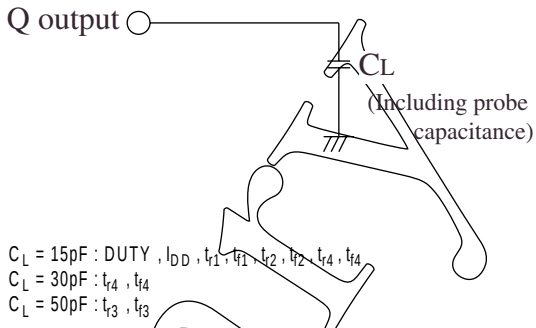
R1 : 50Ω

Load cct 1



C_L = 15pF : DUTY , I_{DD} , t_r , t_f
R = 400Ω

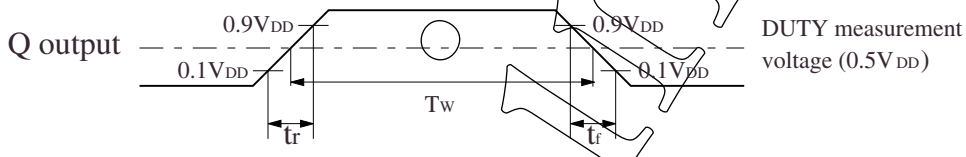
Load cct 2



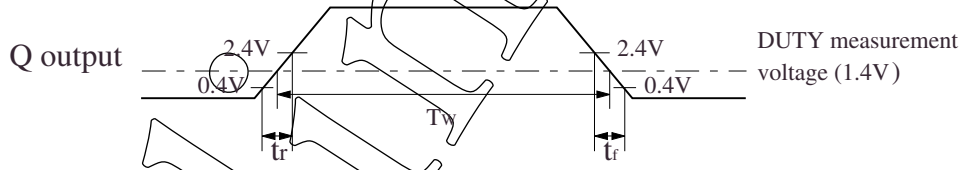
C_L = 15pF : DUTY , I_{DD} , t_{r1} , t_{f1} , t_{r2} , t_{f2} , t_{r4} , t_{f4}
C_L = 30pF : t_{f4} , t_{f4}
C_L = 50pF : t_{r3} , t_{f3}

Switching Time Measurement Waveform

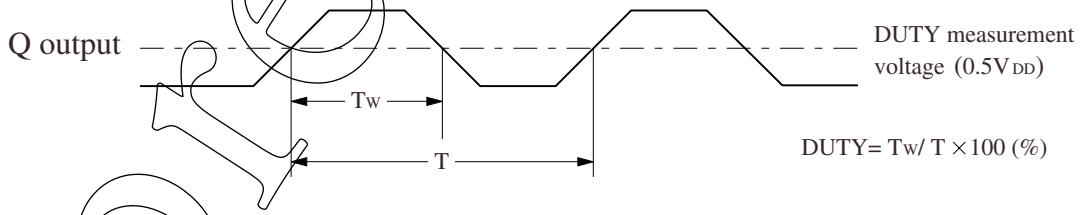
Output duty level (CMOS)



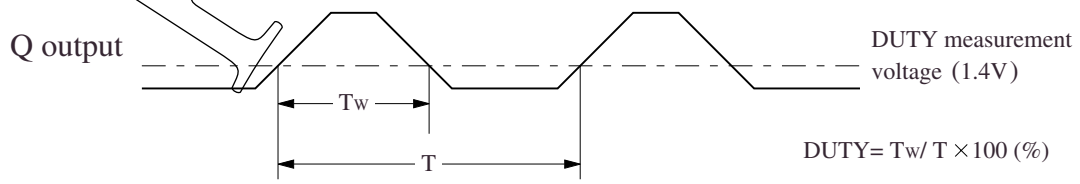
Output duty level (TTL)



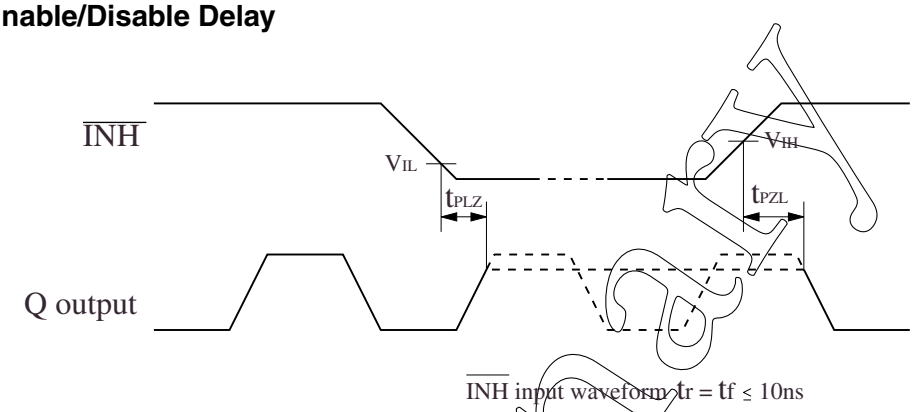
Output duty cycle (CMOS)



Output duty cycle (TTL)



Output Enable/Disable Delay



Note (CL series only) : 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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