

OVERVIEW

The SM5006 series are crystal oscillator module ICs, that incorporate high-frequency, low current consumption oscillator and output buffer circuits. Highly accurate thin-film feedback resistors and high-frequency capacitors are built-in, eliminating the need for external components to make a stable 3rd-harmonic oscillator.

FEATURES

- Up to 107 MHz operation
- Capacitors C_G , C_D built-in
- Inverter amplifier feedback resistor built-in
- TTL input level
- 16 mA ($V_{DD} = 4.5$ V) drive capability
- 4 mA ($V_{DD} = 4.5$ V) drive capability (5006AH×)
- Output three-state function
- 2.7 to 5.5 V supply voltage
- Oscillator frequency output
- 8-pin SOP (SM5006×××S)
- Chip form (CF5006×××)

SERIES CONFIGURATION

Version ^{*1}	gm ratio	3V operating		5V operating			Built-in capacitance		R_f [k Ω]	Input level	Output duty level
		Output load (max) [pF]	Recommended operating frequency range [MHz]	Output load (max) [pF]	Recommended operating frequency range [MHz]	Output waveform ^{*2} t_r/t_f [ns]	C_G [pF]	C_D [pF]			
SM5006ANAS	0.5	—	—	50	22 to 30	8/8	8	16	8.2	TTL	CMOS
SM5006ANBS	1	—	—	50	30 to 40	8/8	8	16	5.6	TTL	CMOS
SM5006ANCS	2	15	22 to 30	50	40 to 60	7/7	8	16	4.9	TTL	CMOS
SM5006ANDS	2	15	30 to 50	50	50 to 70	7/7	8	16	2.6	TTL	CMOS
SM5006ANES	3	15	50 to 70	30 (15) ^{*3}	70 to 100	6/6	8	16	2.6	TTL	CMOS
SM5006ANFS	4	—	—	30 (15) ^{*3}	80 to 107	6/6	8	16	2.6	TTL	CMOS
SM5006CNCS	2	15	22 to 30	15 50	40 to 60 40 to 50	8/8	8	16	4.9	TTL	CMOS
SM5006CNDS	2	15	30 to 40	15	50 to 70	8/8	8	16	2.6	TTL	CMOS
SM5006CNES	3	15	50 to 70	15	70 to 100	7/7	8	16	2.6	TTL	CMOS
SM5006BNCS	2	15	22 to 70	15 50	22 to 100 22 to 70	7/7	8	16	No	TTL	CMOS
SM5006BNES	3	15	22 to 70	30 (15) ^{*3}	70 to 107	6/6	8	16	No	TTL	CMOS
SM5006DNCS	2	15	22 to 40	15 50	22 to 70 22 to 50	8/8	8	16	No	TTL	CMOS
SM5006DNES	3	15	22 to 70	15 50	22 to 100 22 to 70	7/7	8	16	No	TTL	CMOS
SM5006AKAS	0.5	—	—	15	22 to 30	4/4	8	16	8.2	TTL	TTL
SM5006AKBS	1	—	—	15	30 to 40	4/4	8	16	5.6	TTL	TTL
SM5006AKCS	2	—	—	15	40 to 60	4/4	8	16	4.9	TTL	TTL
SM5006AKDS	2	—	—	15	50 to 70	4/4	8	16	2.6	TTL	TTL
SM5006CKDS	2	—	—	15	50 to 70	4/4	8	16	2.6	TTL	TTL
SM5006BKCS	2	—	—	15	22 to 70	4/4	8	16	No	TTL	TTL
SM5006DKCS	2	—	—	15	22 to 70	4/4	8	16	No	TTL	TTL
SM5006AHAS	0.5	—	—	15	22 to 30	7/7	8	16	8.2	TTL	CMOS
SM5006AHBS	1	—	—	15	30 to 40	7/7	8	16	5.6	TTL	CMOS
SM5006AHCS	2	—	—	15	40 to 60	7/7	8	16	4.9	TTL	CMOS
SM5006AHDS	2	—	—	15	50 to 70	7/7	8	16	2.6	TTL	CMOS

*1. Chip form devices have designation CF5006×××.

*2. 5006×N×: $C_L = 50$ pF, CMOS load
 5006×K×: $C_L = 15$ pF, 10TTL load
 5006AH×: $C_L = 15$ pF, CMOS load

*3. SOP package only

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

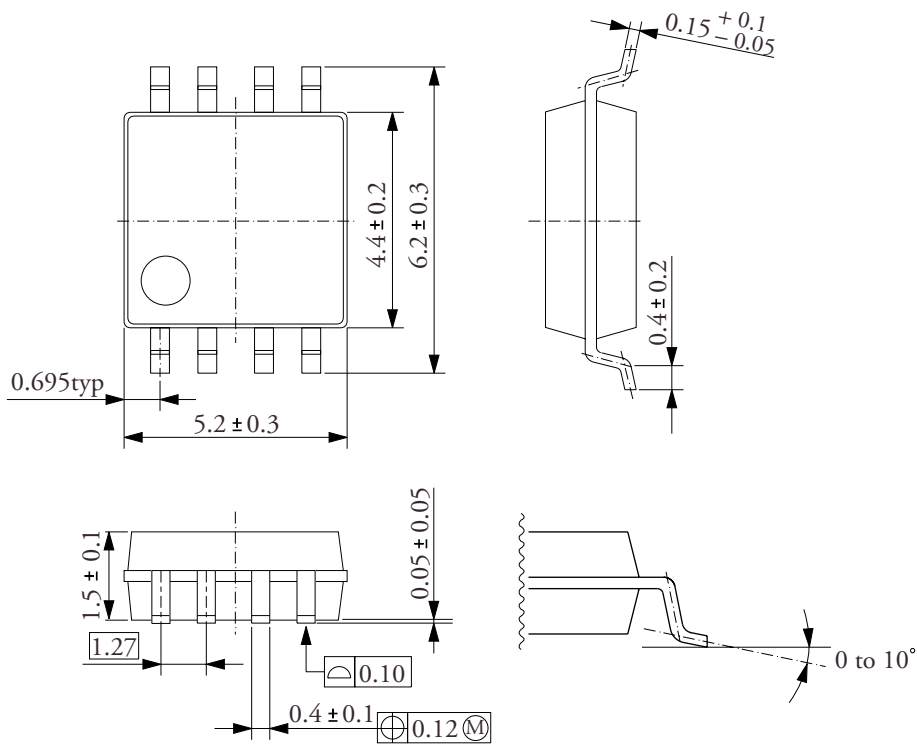
ORDERING INFORMATION

Device	Package
SM5006xxxS	8-pin SOP
CF5006xxx-1	Chip form

PACKAGE DIMENSIONS

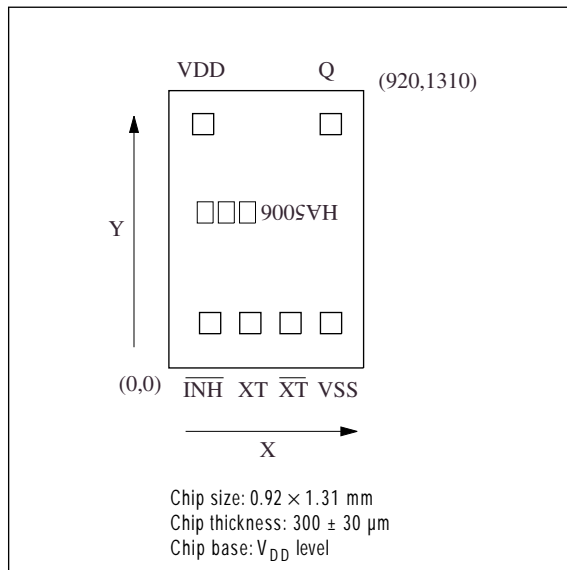
(Unit:mm)

- 8-pin SOP



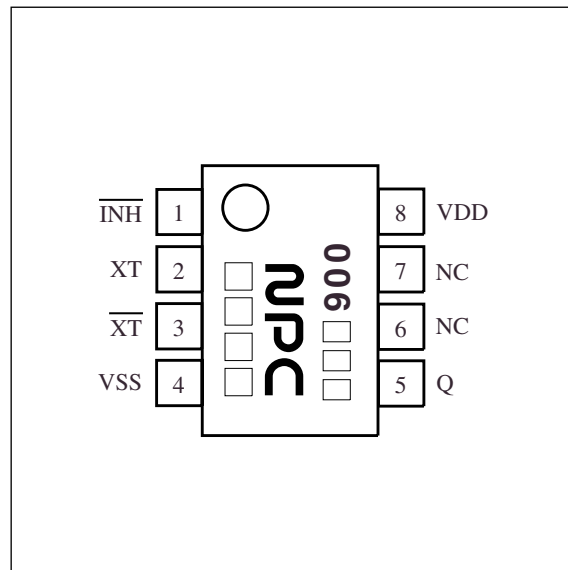
PAD LAYOUT

(Unit: μm)



PINOUT

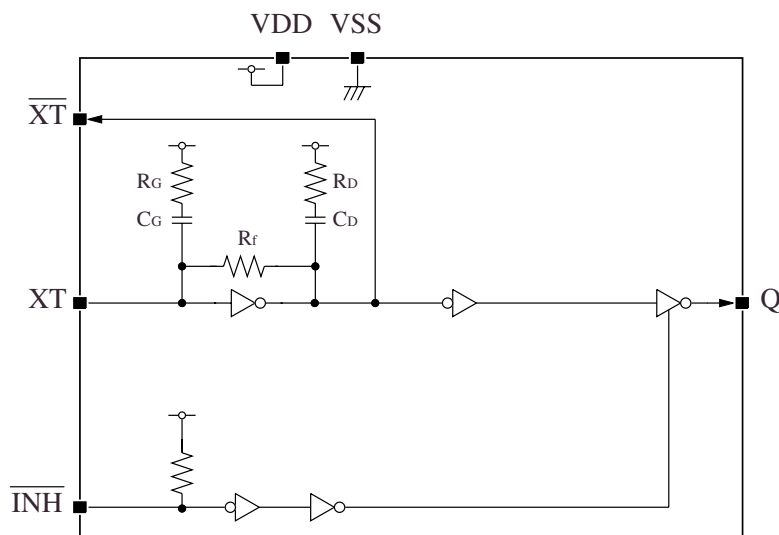
(Top view)



PIN DESCRIPTION and PAD DIMENSIONS

Number	Name	I/O	Description	Pad dimensions [μm]	
				X	Y
1	$\overline{\text{INH}}$	I	Output state control input. High impedance when LOW. Pull-up resistor built in	195	212
2	XT	I	Amplifier input.	385	212
3	$\overline{\text{XT}}$	O	Amplifier output.		
Crystal oscillator connection pins. Crystal oscillator connected between XT and $\overline{\text{XT}}$				575	212
4	VSS	-	Ground	766	212
5	Q	O	Output. Output frequency (f_0)	765	1152
6	NC	-	No connection	-	-
7	NC	-	No connection	-	-
8	VDD	-	Supply voltage	162	1152

BLOCK DIAGRAM



SPECIFICATIONS

Absolute Maximum Ratings

$V_{SS} = 0\text{ V}$

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}	5006×N×, ×K×	25	mA
		5006AH×	10	
Power dissipation	P_D	8-pin SOP	500	mW

Recommended Operating Conditions

SM5006 series (package form)

$V_{SS} = 0\text{ V}$

Parameter	Symbol	Series	Condition	Rating			Unit
				min	typ	max	
Supply voltage	V_{DD}	ANA, ANB, CNC, CND, DNC	$f \leq 50\text{MHz}$, $C_L = 50\text{pF}$	4.5	-	5.5	V
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	
			$f \leq 40\text{MHz}$, $C_L = 15\text{pF}$	2.7	-	3.6	
		ANC, AND, BNC, CNE, DNE	$f \leq 70\text{MHz}$, $C_L = 50\text{pF}$	4.5	-	5.5	V
			$f \leq 100\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	
			$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$	2.7	-	3.6	
		ANE, ANF, BNE	$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	3.0	-	3.6	V
			$f \leq 100\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	
			$f \leq 107\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	
			$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$	2.7	-	3.6	
		AKA, AKB, AKC, CKD, DKC	$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	V
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	
Input voltage	V_{IN}	All series		V_{SS}	-	V_{DD}	V
Operating temperature	T_{OPR}	ANA, ANB, CNC, CND, DNC	$f \leq 50\text{MHz}$, $C_L = 50\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	°C
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	0	-	+70	
			$f \leq 40\text{MHz}$, $C_L = 15\text{pF}$, $2.7 \leq V_{DD} \leq 3.6$	-10	-	+70	
		ANC, AND, BNC, CNE, DNE	$f \leq 50\text{MHz}$, $C_L = 50\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+80	°C
			$f \leq 70\text{MHz}$, $C_L = 50\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-20	-	+80	
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	
			$f \leq 100\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	0	-	+70	
			$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$, $2.7 \leq V_{DD} \leq 3.6$	-20	-	+80	
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $3.0 \leq V_{DD} \leq 3.6$	-20	-	+80	
		ANE, ANF, BNE	$f \leq 70\text{MHz}$, $C_L = 50\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-20	-	+80	°C
			$f \leq 100\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	
			$f \leq 107\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-20	-	+80	
			$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$, $2.7 \leq V_{DD} \leq 3.6$	-20	-	+80	
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $3.0 \leq V_{DD} \leq 3.6$	-20	-	+80	
		AKA, AKB, AKC, CKD, DKC	$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	°C
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	0	-	+70	
		AKD, BKC	$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	°C
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-20	-	+80	
		AHA, AHB, AHC, AHD	$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	°C
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-15	-	+75	

SM5006 series

CF5006 series (chip form)

$V_{SS} = 0\text{ V}$

Parameter	Symbol	Series	Condition	Rating			Unit
				min	typ	max	
Supply voltage	V_{DD}	ANA, ANB, CNC, CND, DNC	$f \leq 50\text{MHz}$, $C_L = 50\text{pF}$	4.5	-	5.5	V
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	
			$f \leq 40\text{MHz}$, $C_L = 15\text{pF}$	2.7	-	3.6	
		ANC, AND, BNC, CNE, DNE	$f \leq 70\text{MHz}$, $C_L = 50\text{pF}$	4.5	-	5.5	V
			$f \leq 100\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	
			$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$	2.7	-	3.6	
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	3.0	-	3.6	
		ANE, ANF, BNE	$f \leq 70\text{MHz}$, $C_L = 50\text{pF}$	4.5	-	5.5	V
			$f \leq 107\text{MHz}$, $C_L = 30\text{pF}$	4.5	-	5.5	
			$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$	2.7	-	3.6	
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	3.0	-	3.6	
		AKA, AKB, AKC, CKD, DKC	$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	V
		AKD, BKC	$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	V
		AHA, AHB, AHC, AHD	$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$	4.5	-	5.5	V
Input voltage	V_{IN}	All series		V_{SS}	-	V_{DD}	V
Operating temperature	T_{OPR}	ANA, ANB, CNC, CND, DNC	$f \leq 50\text{MHz}$, $C_L = 50\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	°C
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-15	-	+75	
			$f \leq 40\text{MHz}$, $C_L = 15\text{pF}$, $2.7 \leq V_{DD} \leq 3.6$	-10	-	+70	
		ANC, AND, BNC, CNE, DNE	$f \leq 70\text{MHz}$, $C_L = 50\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	°C
			$f \leq 100\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-20	-	+80	
			$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$, $2.7 \leq V_{DD} \leq 3.6$	-20	-	+80	
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $3.0 \leq V_{DD} \leq 3.6$	-20	-	+80	
		ANE, ANF, BNE	$f \leq 70\text{MHz}$, $C_L = 50\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	°C
			$f \leq 100\text{MHz}$, $C_L = 30\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	
			$f \leq 107\text{MHz}$, $C_L = 30\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-20	-	+80	
			$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$, $2.7 \leq V_{DD} \leq 3.6$	-20	-	+80	
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $3.0 \leq V_{DD} \leq 3.6$	-20	-	+80	
		AKA, AKB, AKC, CKD, DKC	$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	°C
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-15	-	+75	
		AKD, BKC	$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	°C
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-20	-	+80	
		AHA, AHB, AHC, AHD	$f \leq 50\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-40	-	+85	°C
			$f \leq 70\text{MHz}$, $C_L = 15\text{pF}$, $4.5 \leq V_{DD} \leq 5.5$	-20	-	+80	

Electrical Characteristics

5006×N series

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

Parameter	Symbol	Condition	Rating			Unit	
			min	typ	max		
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, $V_{DD} = 2.7$ 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, $\overline{INH} = \text{LOW}$, $V_{DD} = 5.5$ V	$V_{OH} = V_{DD}$	-	-	10	μA
			$V_{OL} = V_{SS}$	-	-	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}	$\overline{INH} = \text{open}$, Measurement cct 3, load cct 1, $V_{DD} = 3.0$ to 3.6 V, $C_L = 15$ pF	f = 30 MHz SM5006ANCS, CF5006ANC SM5006BNCS, CF5006BNC	-	8	16	mA
			f = 30 MHz, $T_a = -10$ to 70 °C SM5006CNCS, CF5006CNC	-	8	16	
			f = 50 MHz SM5006ANDS, CF5006AND	-	13	26	
			f = 70 MHz SM5006BNES, CF5006BNE SM5006CNES, CF5006CNE SM5006DNES, CF5006DNE	-	15	30	
			f = 40 MHz, $T_a = -10$ to 70 °C SM5006CNDS, CF5006CND SM5006DNCS, CF5006DNC	-	11	22	
			f = 70 MHz SM5006ANES, CF5006ANE SM5006ANFS, CF5006ANF	-	20	40	
\overline{INH} pull-up resistance	R_{UP}	Measurement cct 4	50	-	150	k Ω	
Feedback resistance	R_f	Measurement cct 5	SM5006ANAS, CF5006ANA	6.97	8.2	9.43	k Ω
			SM5006ANBS, CF5006ANB	4.76	5.6	6.44	
			SM5006ANCS, CF5006ANC SM5006CNCS, CF5006CNC	4.16	4.9	5.64	
			SM5006ANDS, CF5006AND SM5006ANES, CF5006ANE SM5006ANFS, CF5006ANF SM5006CNDS, CF5006CND SM5006CNES, CF5006CNE	2.21	2.6	2.99	
Built-in resistance	R_G	Design value, determined by the R_f value	17	20	23	Ω	
	R_D	Design value, determined by the R_f value	17	20	23		
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern	7.44	8	8.56	pF	
	C_D	Design value, determined by the internal wafer pattern	14.88	16	17.12		

SM5006 series

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

Parameter	Symbol	Condition	Rating			Unit	
			min	typ	max		
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, $V_{DD} = 4.5$ 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, $\overline{INH} = \text{LOW}$, $V_{DD} = 5.5$ V	$V_{OH} = V_{DD}$	-	-	10	μA
			$V_{OL} = V_{SS}$	-	-	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}	$\overline{INH} = \text{open}$, Measurement cct 3, load cct 1, $V_{DD} = 4.5$ to 5.5 V, $C_L = 50$ pF	f = 30 MHz SM5006ANAS CF5006ANA	-	18	35	mA
			f = 40 MHz SM5006ANBS CF5006ANB	-	20	40	
			f = 60 MHz CF5006ANC	-	30	60	
			f = 60 MHz, $T_a = -20$ to 80 °C SM5006ANCS	-	30	50	
			f = 70 MHz CF5006AND CF5006BNC	-	40	80	
			f = 70 MHz, $T_a = -20$ to 80 °C SM5006ANDS SM5006BNCS	-	40	70	
		$\overline{INH} = \text{open}$, Measurement cct 3, load cct 1, $V_{DD} = 4.5$ to 5.5 V	f = 60 MHz, $C_L = 15$ pF, $T_a = -15$ to 75 °C CF5006CNC	-	28	50	
			f = 60 MHz, $C_L = 15$ pF, $T_a = 0$ to 70 °C SM5006CNCS	-	28	50	
			f = 70 MHz, $C_L = 15$ pF, $T_a = -15$ to 75 °C CF5006CND CF5006DNC	-	35	65	
			f = 70 MHz, $C_L = 15$ pF, $T_a = 0$ to 70 °C SM5006CNDS SM5006DNCS	-	35	65	
			f = 100 MHz, $C_L = 15$ pF, $T_a = -20$ to 80 °C CF5006CNE CF5006DNE	-	45	80	
			f = 100 MHz, $C_L = 15$ pF, $T_a = 0$ to 70 °C SM5006CNES SM5006DNES	-	45	80	
			f = 100 MHz, $C_L = 30$ pF CF5006ANE	-	50	100	
			f = 100 MHz, $C_L = 15$ pF SM5006ANES	-	45	90	
f = 107 MHz, $C_L = 30$ pF, $T_a = -20$ to 80 °C CF5006ANF CF5006BNE	-	60	100				
f = 107 MHz, $C_L = 15$ pF, $T_a = -20$ to 80 °C SM5006ANFS SM5006BNES	-	50	90				
\overline{INH} pull-up resistance	R_{UP}	Measurement cct 4	50	-	150	k Ω	
Feedback resistance	R_f	Measurement cct 5	SM5006ANAS, CF5006ANA	6.97	8.2	9.43	k Ω
			SM5006ANBS, CF5006ANB	4.76	5.6	6.44	
			SM5006ANCS, CF5006ANC SM5006CNCS, CF5006CNC	4.16	4.9	5.64	
			SM5006ANDS, CF5006AND SM5006ANES, CF5006ANE SM5006ANFS, CF5006ANF SM5006CNDS, CF5006CND SM5006CNES, CF5006CNE	2.21	2.6	2.99	
Built-in resistance	R_G	Design value, determined by the R_f value	17	20	23	Ω	
	R_D	Design value, determined by the R_f value	17	20	23		
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern	7.44	8	8.56	pF	
	C_D	Design value, determined by the internal wafer pattern	14.88	16	17.12		

SM5006 series

5006×K series

$V_{DD} = 4.5$ to 5.5 V, $V_{SS} = 0$ V, $T_a = -40$ to 85 °C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit
				min	typ	max	
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, $V_{DD} = 4.5$ V, $I_{OH} = 16$ mA	SM5006AKAS, CF5006AKA SM5006AKBS, CF5006AKB SM5006AKCS, CF5006AKC SM5006CKDS, CF5006CKD SM5006DKCS, CF5006DKC	3.9	4.2	-	V
			SM5006AKDS, CF5006AKD SM5006BKCS, CF5006BKC	4.0	4.2	-	
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, $\overline{INH} = \text{LOW}$, $V_{DD} = 5.5$ V	$V_{OH} = V_{DD}$	-	-	10	μA
			$V_{OL} = V_{SS}$	-	-	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}	$\overline{INH} = \text{open}$, Measurement cct 3, load cct 1, $V_{DD} = 4.5$ to 5.5 V, $C_L = 15$ pF	f = 30 MHz SM5006AKAS CF5006AKA	-	16	32	mA
			f = 40 MHz SM5006AKBS CF5006AKB	-	18	36	
			f = 60 MHz, $T_a = -15$ to 75 °C CF5006AKC CF5006DKC	-	25	50	
			f = 60 MHz, $T_a = 0$ to 70 °C SM5006AKCS SM5006DKCS	-	25	50	
			f = 70 MHz, $T_a = -20$ to 80 °C CF5006AKD CF5006BKC	-	35	70	
			f = 70 MHz, $T_a = -15$ to 75 °C CF5006CKD	-	35	70	
			f = 70 MHz, $T_a = 0$ to 70 °C SM5006AKDS SM5006BKCS SM5006CKDS	-	35	70	
\overline{INH} pull-up resistance	R_{UP}	Measurement cct 4		50	-	150	k Ω
Feedback resistance	R_f	Measurement cct 5	SM5006AKAS, CF5006AKA	6.97	8.2	9.43	k Ω
			SM5006AKBS, CF5006AKB	4.76	5.6	6.44	
			SM5006AKCS, CF5006AKC	4.16	4.9	5.64	
			SM5006AKDS, CF5006AKD SM5006CKDS, CF5006CKD	2.21	2.6	2.99	
Built-in resistance	R_G	Design value, determined by the R_f value		17	20	23	Ω
	R_D	Design value, determined by the R_f value		17	20	23	
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern		7.44	8	8.56	pF
	C_D	Design value, determined by the internal wafer pattern		14.88	16	17.12	

SM5006 series

5006AH series

$V_{DD} = 4.5$ to 5.5 V, $V_{SS} = 0$ V, $T_a = -40$ to 85 °C unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit	
				min	typ	max		
HIGH-level output voltage	V_{OH}	Q: Measurement cct 1, $V_{DD} = 4.5$ 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, $\overline{INH} = \text{LOW}$, $V_{DD} = 5.5$ V	$V_{OH} = V_{DD}$	-	-	10	μA	
			$V_{OL} = V_{SS}$	-	-	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}	$\overline{INH} = \text{open}$, Measurement cct 3, load cct 1, $V_{DD} = 4.5$ to 5.5 V, $C_L = 15$ pF	$f = 30$ MHz	SM5006AHAS CF5006AHA	-	15	30	mA
			$f = 40$ MHz	SM5006AHBS CF5006AHB	-	18	36	
			$f = 60$ MHz, $T_a = -20$ to 80 °C	CF5006AHC	-	25	50	
			$f = 60$ MHz, $T_a = -15$ to 75 °C	SM5006AHCS	-	25	50	
			$f = 70$ MHz, $T_a = -20$ to 80 °C	CF5006AHD	-	32	65	
			$f = 70$ MHz, $T_a = -15$ to 75 °C	SM5006AHDS	-	32	65	
\overline{INH} pull-up resistance	R_{UP}	Measurement cct 4		50	-	150	k Ω	
Feedback resistance	R_f	Measurement cct 5	SM5006AHAS, CF5006AHA	6.97	8.2	9.43	k Ω	
			SM5006AHBS, CF5006AHB	4.76	5.6	6.44		
			SM5006AHCS, CF5006AHC	4.16	4.9	5.64		
			SM5006AHDS, CF5006AHD	2.21	2.6	2.99		
Built-in resistance	R_G	Design value, determined by the R_f value		17	20	23	Ω	
	R_D	Design value, determined by the R_f value		17	20	23		
Built-in capacitance	C_G	Design value, determined by the internal wafer pattern		7.44	8	8.56	pF	
	C_D	Design value, determined by the internal wafer pattern		14.88	16	17.12		

Switching Characteristics

5006×N series

3V operation: $V_{DD} = 2.7$ to 3.6 V, $V_{SS} = 0$ V, $T_a = -20$ to 80 °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 $0.9V_{DD}$, $C_L = 15$ pF, $T_a = -10$ to 70 °C	SM5006ANAS, CF5006ANA SM5006ANBS, CF5006ANB SM5006CNCS, CF5006CNC SM5006CNDS, CF5006CND SM5006DNCS, CF5006DNC	-	3.5	7.0	ns
	t_{r2}	Measurement cct 3, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$, $C_L = 15$ pF	SM5006ANCS, CF5006ANC SM5006ANDS, CF5006AND SM5006ANES, CF5006ANE SM5006ANFS, CF5006ANF SM5006BNCS, CF5006BNC SM5006BNES, CF5006BNE SM5006CNES, CF5006CNE SM5006DNES, CF5006DNE	-	3.5	7.0	
Output fall time	t_{f1}	Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$, $C_L = 15$ pF, $T_a = -10$ to 70 °C	SM5006ANAS, CF5006ANA SM5006ANBS, CF5006ANB SM5006CNCS, CF5006CNC SM5006CNDS, CF5006CND SM5006DNCS, CF5006DNC	-	3.5	7.0	ns
	t_{f2}	Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$, $C_L = 15$ pF	SM5006ANCS, CF5006ANC SM5006ANDS, CF5006AND SM5006ANES, CF5006ANE SM5006ANFS, CF5006ANF SM5006BNCS, CF5006BNC SM5006BNES, CF5006BNE SM5006CNES, CF5006CNE SM5006DNES, CF5006DNE	-	3.5	7.0	
Output duty cycle ^{*1}	Duty	Measurement cct 3, load cct 1, $T_a = 25$ °C, $V_{DD} = 3.3$ V, $C_L = 15$ pF, $f = 30$ MHz	SM5006ANAS, CF5006ANA SM5006ANBS, CF5006ANB SM5006ANCS, CF5006ANC SM5006CNCS, CF5006CNC	40	-	60	%
		Measurement cct 3, load cct 1, $T_a = 25$ °C, $V_{DD} = 3.3$ V, $C_L = 15$ pF, $f = 40$ MHz	SM5006CNDS, CF5006CND SM5006DNCS, CF5006DNC	40	-	60	
		Measurement cct 3, load cct 1, $T_a = 25$ °C, $V_{DD} = 3.3$ V, $C_L = 15$ pF, $f = 50$ MHz	SM5006ANDS, CF5006AND SM5006BNCS, CF5006BNC	40	-	60	
		Measurement cct 3, load cct 1, $T_a = 25$ °C, $V_{DD} = 3.3$ V, $C_L = 15$ pF, $f = 70$ MHz	SM5006ANES, CF5006ANE SM5006ANFS, CF5006ANF SM5006BNES, CF5006BNE SM5006CNES, CF5006CNE SM5006DNES, CF5006DNE	40	-	60	
Output disable delay time	t_{pLZ}	Measurement cct 3, load cct 1, $T_a = 25$ °C, $V_{DD} = 5$ V, $C_L \leq 15$ pF	-	-	100	ns	
Output enable delay time	t_{pZL}		-	-	100	ns	

*1. Determined by the lot monitor.

SM5006 series

5V operation: $V_{DD} = 4.5$ to 5.5 V, $V_{SS} = 0$ V, $T_a = -40$ 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 $0.9V_{DD}$, $C_L = 15$ pF	SM5006ANAS, CF5006ANA SM5006ANBS, CF5006ANB SM5006CNCS, CF5006CNC SM5006CNDS, CF5006CND SM5006DNCS, CF5006DNC	-	2.0	4.0	ns
			SM5006ANCS, CF5006ANC SM5006ANDS, CF5006AND SM5006BNCS, CF5006BNC SM5006CNES, CF5006CNE SM5006DNES, CF5006DNE	-	1.5	3.0	
	t_{r2}	Measurement cct 3, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$, $C_L = 30$ pF	CF5006ANE CF5006ANF CF5006BNE	-	2.0	4.0	
	t_{r3}	Measurement cct 3, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$, $C_L = 50$ pF	SM5006ANAS, CF5006ANA SM5006ANBS, CF5006ANB SM5006CNCS, CF5006CNC SM5006CNDS, CF5006CND SM5006DNCS, CF5006DNC	-	4.0	8.0	
			SM5006ANCS, CF5006ANC SM5006ANDS, CF5006AND SM5006BNCS, CF5006BNC SM5006CNES, CF5006CNE SM5006DNES, CF5006DNE	-	3.5	7.0	
			SM5006ANES, CF5006ANE SM5006ANFS, CF5006ANF SM5006BNES, CF5006BNE	-	3.0	6.0	
Output fall time	t_{f1}	Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$, $C_L = 15$ pF	SM5006ANAS, CF5006ANA SM5006ANBS, CF5006ANB SM5006CNCS, CF5006CNC SM5006CNDS, CF5006CND SM5006DNCS, CF5006DNC	-	2.0	4.0	ns
			SM5006ANCS, CF5006ANC SM5006ANDS, CF5006AND SM5006BNCS, CF5006BNC SM5006CNES, CF5006CNE SM5006DNES, CF5006DNE	-	1.5	3.0	
	t_{f2}	Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$, $C_L = 30$ pF	CF5006ANE CF5006ANF CF5006BNE	-	2.0	4.0	
	t_{f3}	Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$, $C_L = 50$ pF	SM5006ANAS, CF5006ANA SM5006ANBS, CF5006ANB SM5006CNCS, CF5006CNC SM5006CNDS, CF5006CND SM5006DNCS, CF5006DNC	-	4.0	8.0	
			SM5006ANCS, CF5006ANC SM5006ANDS, CF5006AND SM5006BNCS, CF5006BNC SM5006CNES, CF5006CNE SM5006DNES, CF5006DNE	-	3.5	7.0	
			SM5006ANES, CF5006ANE SM5006ANFS, CF5006ANF SM5006BNES, CF5006BNE	-	3.0	6.0	

SM5006 series

Parameter	Symbol	Condition		Rating			Unit	
				min	typ	max		
Output duty cycle ^{*1}	Duty	Measurement cct 3, load cct 1, Ta = 25 °C, V _{DD} = 5.0 V	f = 30MHz, C _L = 50 pF	SM5006ANAS CF5006ANA	45	-	55	%
			f = 40MHz, C _L = 50 pF	SM5006ANBS CF5006ANB	45	-	55	
			f = 60MHz, C _L = 50 pF	SM5006ANCS CF5006ANC	45	-	55	
			f = 70MHz, C _L = 50 pF	SM5006ANDS CF5006AND SM5006BNCS CF5006BNC	45	-	55	
			f = 100MHz, C _L = 30 pF	CF5006ANE	45	-	55	
			f = 100MHz, C _L = 15 pF	SM5006ANES	45	-	55	
			f = 107MHz, C _L = 30 pF	CF5006ANF CF5006BNE	45	-	55	
			f = 107MHz, C _L = 15 pF	SM5006ANFS SM5006BNES	45	-	55	
			f = 50MHz, C _L = 50 pF	SM5006CNCS CF5006CNC SM5006DNCS CF5006DNC	45	-	55	
			f = 100MHz, C _L = 15 pF	SM5006CNES CF5006CNE SM5006DNES CF5006DNE	45	-	55	
			f = 60MHz, C _L = 15 pF	SM5006CNCS CF5006CNC	40	-	60	
			f = 70MHz, C _L = 15 pF	SM5006CNDS CF5006CND SM5006DNCS CF5006DNC	40	-	60	
Output disable delay time	t _{pLZ}	Measurement cct 3, load cct 1, Ta = 25 °C, V _{DD} = 5 V, C _L ≤ 15 pF			-	-	100	ns
Output enable delay time	t _{pZL}				-	-	100	ns

*1. Determined by the lot monitor.

SM5006 series

5006×K series

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

Parameter	Symbol	Condition		Rating			Unit	
				min	typ	max		
Output rise time	t_r	Measurement cct 3, load cct 1, 0.4V to 2.4V, $V_{DD} = 4.5\text{ to }5.5\text{ V}$	$C_L = 15\text{ pF}$	-	2	4	ns	
			$C_L = 50\text{ pF}$	-	-	7		
Output fall time	t_f	Measurement cct 3, load cct 1, 2.4V to 0.4V, $V_{DD} = 4.5\text{ to }5.5\text{ V}$	$C_L = 15\text{ pF}$	-	2	4	ns	
			$C_L = 50\text{ pF}$	-	-	7		
Output duty cycle ^{*1}	Duty	Measurement cct 3, load cct 1, $T_a = 25\text{ }^\circ\text{C}$, $V_{DD} = 5.0\text{ V}$, $C_L = 15\text{ pF}$	f = 30MHz	SM5006AKAS CF5006AKA	45	-	55	%
			f = 40MHz	SM5006AKBS CF5006AKB	45	-	55	
			f = 60MHz	SM5006AKCS CF5006AKC	40	-	60	
			f = 70MHz	SM5006AKDS CF5006AKD SM5006BKCS CF5006BKC	45	-	55	
			f = 50MHz	SM5006DKCS CF5006DKC	45	-	55	
			f = 70MHz	SM5006CKDS CF5006CKD SM5006DKCS CF5006DKC	40	-	60	
Output disable delay time	t_{PLZ}	Measurement cct 3, load cct 1, $T_a = 25\text{ }^\circ\text{C}$, $V_{DD} = 5\text{ V}$, $C_L \leq 15\text{ pF}$		-	-	100	ns	
Output enable delay time	t_{PZL}			-	-	100	ns	

*1. Determined by the lot monitor.

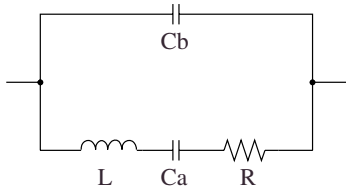
5006AH series

$V_{DD} = 4.5\text{ to }5.5\text{ V}$, $V_{SS} = 0\text{ V}$, $T_a = -40\text{ to }85\text{ }^\circ\text{C}$ unless otherwise noted.

Parameter	Symbol	Condition		Rating			Unit	
				min	typ	max		
Output rise time	t_{r1}	Measurement cct 3, load cct 1, 0.1 V_{DD} to 0.9 V_{DD}	$C_L = 15\text{ pF}$	-	5.0	7.0	ns	
	t_{r2}		$C_L = 50\text{ pF}$	-	13	21		
Output fall time	t_{f1}	Measurement cct 3, load cct 1, 0.9 V_{DD} to 0.1 V_{DD}	$C_L = 15\text{ pF}$	-	5.0	7.0	ns	
	t_{f2}		$C_L = 50\text{ pF}$	-	13	21		
Output duty cycle ^{*1}	Duty	Measurement cct 3, load cct 1, $T_a = 25\text{ }^\circ\text{C}$, $V_{DD} = 5.0\text{ V}$, $C_L = 15\text{ pF}$	f = 30MHz	SM5006AHAS CF5006AHA	45	-	55	%
			f = 40MHz	SM5006AHBS CF5006AHB	45	-	55	
			f = 50MHz	SM5006AHCS CF5006AHC	45	-	55	
			f = 60MHz, $T_a = -20\text{ to }80\text{ }^\circ\text{C}$	CF5006AHC	40	-	60	
			f = 60MHz, $T_a = -15\text{ to }75\text{ }^\circ\text{C}$	SM5006AHCS	40	-	60	
			f = 70MHz, $T_a = -20\text{ to }80\text{ }^\circ\text{C}$	CF5006AHD	40	-	60	
			f = 70MHz, $T_a = -15\text{ to }75\text{ }^\circ\text{C}$	SM5006AHDS	40	-	60	
Output disable delay time	t_{PLZ}	Measurement cct 3, load cct 1, $T_a = 25\text{ }^\circ\text{C}$, $V_{DD} = 5\text{ V}$, $C_L \leq 15\text{ pF}$		-	-	100	ns	
Output enable delay time	t_{PZL}			-	-	100	ns	

*1. Determined by the lot monitor.

Current consumption and Output waveform with NPC's standard crystal



f (MHz)	R (Ω)	L (mH)	Ca (fF)	Cb (pF)
30	18.62	16.24	1.733	5.337
40	20.53	11.34	1.396	3.989
50	22.17	7.40	1.370	4.105
70	25.42	4.18	1.254	5.170
100	16.60	3.56	0.726	5.394
107	35.83	2.98	0.732	2.265

FUNCTIONAL DESCRIPTION

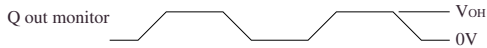
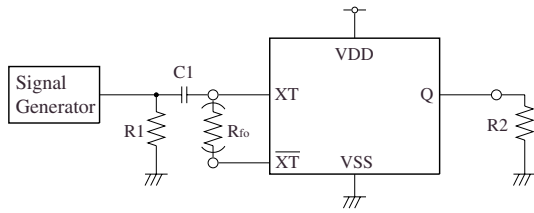
Standby Function

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

\overline{INH}	Q	Oscillator
HIGH (or open)	f_0 output frequency	Normal operation
LOW	High impedance	Normal operation

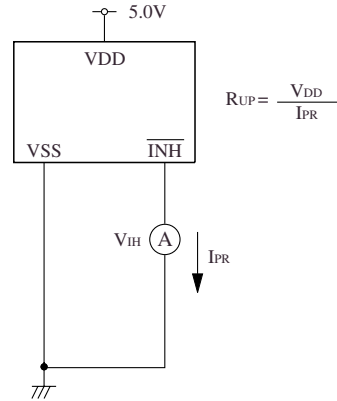
MEASUREMENT CIRCUITS

Measurement cct 1

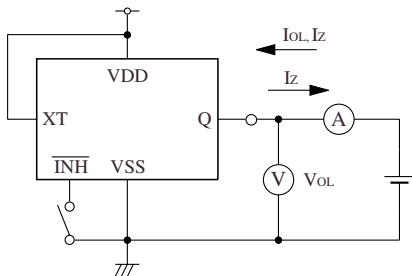


- 3.5V_{p-p}, 10MHz sine wave input signal (5V operation)
- 2.0V_{p-p}, 10MHz sine wave input signal (3V operation)
- C1 : 0.001μF
- R1 : 50Ω
- R2 : 250Ω (5006×N×5V operation)
- 275Ω (5006×N×3V operation)
- 245Ω (5006AKA, AKB, AKC, CKD, DKC)
- 250Ω (5006AKD, BKC)
- 975Ω (5006AH×)
- R_{fo} : 2.7kΩ (5006B××, D××)

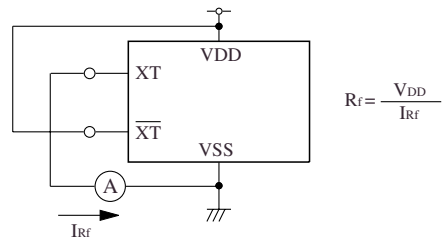
Measurement cct 4



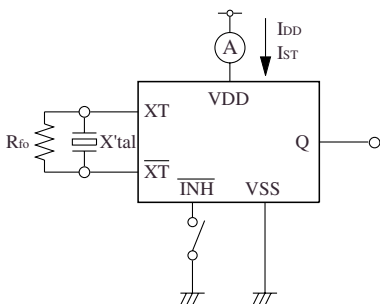
Measurement cct 2



Measurement cct 5

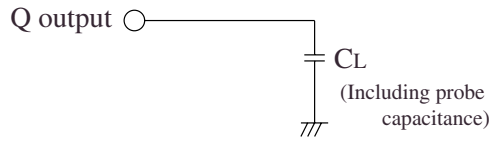


Measurement cct 3

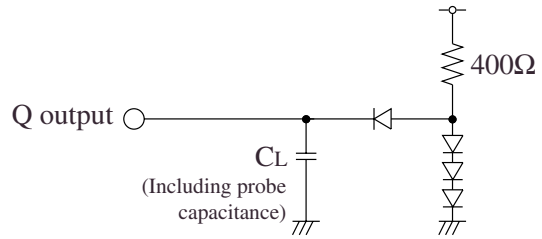


- R_{fo} : 2.7kΩ (5006B××, D××)

Load cct 1

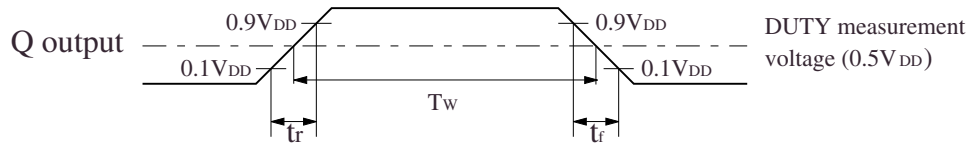


Load cct 2

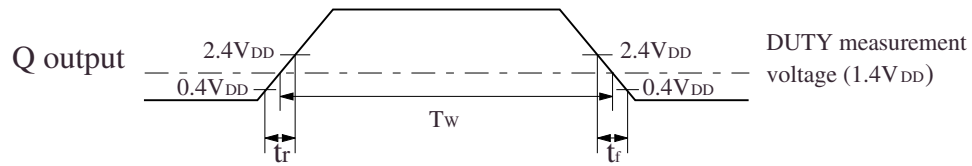


Switching Time Measurement Waveform

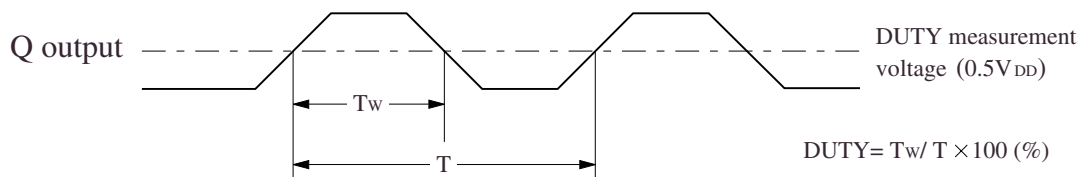
Output duty level (CMOS)



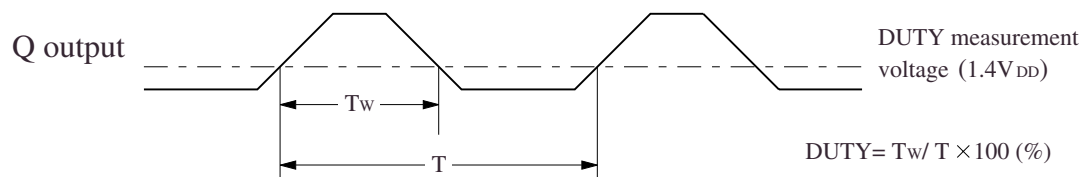
Output duty level (TTL)



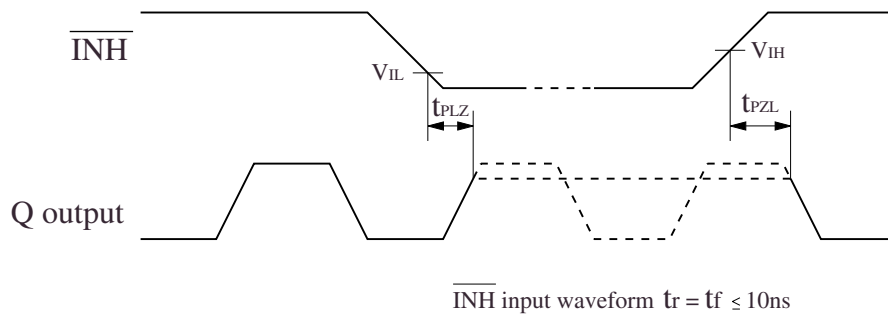
Output duty cycle (CMOS)



Output duty cycle (TTL)



Output Enable/Disable Delay



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