

XC2164

Series

ICs for use with Crystal Oscillators



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- ◆CMOS Low Power Consumption
- ◆Oscillation Frequency : 4MHz ~ 125MHz
 - : 4MHz ~ 30MHz (Fundamental Oscillation)
 - : 20MHz ~ 125MHz (3rd Overtone Oscillation)

- ◆3-State Output
- ◆Built-in Capacitors Cg, Cd
- ◆Built-in Feedback Resistor
- ◆Chip form
- ◆Mini Mold SOT-26 Package

General Description

The XC2164 series are high frequency, low current consumption CMOS ICs with built-in crystal oscillator and divider circuits.

For fundamental oscillation, output is selectable from any one of the following values for f₀ : f₀/1, f₀/2, f₀/4, f₀/8.

With oscillation capacitors and a feedback resistor built-in, it is possible to configure a stable fundamental oscillator or 3rd overtone oscillator using only an external crystal. Also available is an external oscillation capacitor / external oscillation feedback resistor type which makes oscillation frequency control possible.

The XC2164 series are integrated into SOT-26 packages. The series is also available in chip form.

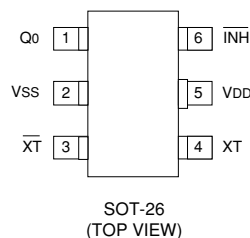
Applications

- Crystal Oscillation Modules
- Micro computer, DSP Clocks
- Communication Equipment
- Various System Clocks

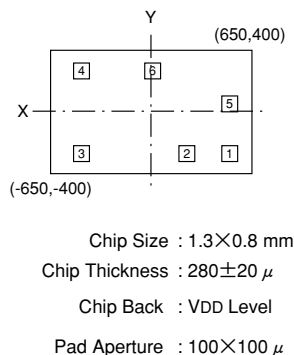
Features

- Oscillation Frequency** : 4MHz ~ 30MHz (Fundamental)
20MHz ~ 125MHz (3rd Overtone)
- Divider Ratio** : Selectable from f₀/1, f₀/2, f₀/4, f₀/8.
(f₀/2, f₀/4, f₀/8 are fundamental only)
- Output** : 3-State
- Operating Voltage Range** : 3.3V±10%, 5.0V±10%
- Low Power Consumption** : Stand -by function included
Selectable from C/E type and O/E type
- Chip Form** : Chip Size 1.3 × 0.8 mm
- Ultra Small Package** : SOT-26 mini mold

Pin Configuration



Pad Layout for Chip form



Pin Assignment & Pad Locations

PIN NUMBER	PIN NAME	FUNCTION	PAD DIMENSIONS	
			X	Y
1	Q0	Clock Output	514	-264
2	VSS	Ground	222	-264
3	/XT	Crystal Oscillator Connection (Output)	-450	-264
4	XT	Crystal Oscillator Connection (Input)	-450	264
5	VDD	Power Supply	514	27
6	/INH	Stand-by Control*	47	264

*Stand-by control pin has a pull-up resistor built-in. unit [μm]

■/INH, Q0 Pin Function

/INH	Q0
"H" or OPEN	Clock Output
"L"	High Impedance

1

■Product Classification

●Ordering Information

XC2164 ①②③④⑤⑥

DESIGNATOR	DESCRIPTION	DESIGNATOR	DESCRIPTION
①	Ratio Divider & Stand-By Mode <ChipEnable> <OutputEnable> A = f0/1 K = f0/1 B = f0/2 L = f0/2 C = f0/4 M = f0/4 D = f0/8 N = f0/8 Note : f0/2, f0/4, f0/8 are fundamental only	④	Recommended Frequency Range & Rf, Cg, Cd values Built-in Type (3rd O/T) = refer to table 1 Built-in Type (Fundamental) = refer to table 2
②	5 : Fixed Number	⑤	Package C : Chip Form M : SOT-26
③	Duty Level 1 : CMOS (VDD/2) Note : TTL : Fundamental 4MHz to 30MHz	⑥	R : Embossed Tape: Standard Feed L : Embossed Tape: Reverse Feed T : Chip Tray W : Wafer

Table 1: Built-in Type (3rd O/T)

SYMBOL	Frequency Range		Rf (kΩ)	Cg (pF)	Cd (pF)
	3.3V±10%	5.0V±10%			
A	—	20MHz to 30MHz	9.0	21.5	21.5
B	20MHz to 30MHz	30MHz to 40MHz	6.5	20.0	20.0
C	30MHz to 40MHz	40MHz to 50MHz	5.0	16.0	16.0
D	40MHz to 50MHz	50MHz to 65MHz	3.5	14.0	14.0
E	50MHz to 65MHz	65MHz to 80MHz	2.8	12.5	12.5
F	65MHz to 80MHz	80MHz to 95MHz	2.5	10.0	10.0
H	80MHz to 95MHz	95MHz to 110MHz	2.2	8.0	8.0
K	95MHz to 110MHz	110MHz to 125MHz	2.0	7.0	7.0
L	110MHz to 125MHz	—	2.3	5.5	5.5

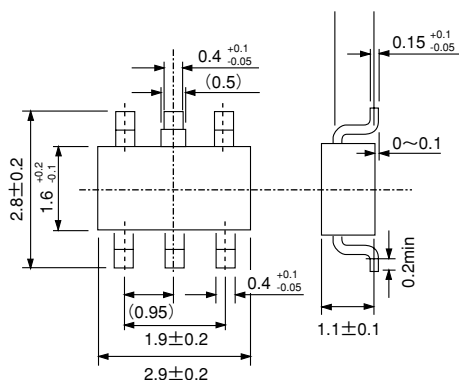
Table 2 : Built-In Type (Fundamental)

SYMBOL	Frequency Range		Rf(*) (MΩ)	Cg (pF)	Cd (pF)
	3.3V±10%	5.0V±10%			
M, V	4MHz to 30MHz	4MHz to 30MHz	3.5/7.0	35.0	35.0
T	4MHz to 30MHz	4MHz to 30MHz	3.5/7.0	20.0	20.0

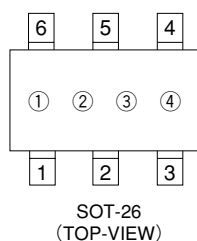
(*) Rf = 3.5MΩ@VDD = 5.0V Operation
Rf = 7.0MΩ@VDD = 3.3V Operation

■ Packaging Information

● SOT-26



■ Marking



① Represents the series name.

MARK
4

② Represents divider ratio

〈Chip Enable〉

MARK	RATIO	MARK	RATIO
A	f ₀ /1	C	f ₀ /4
B	f ₀ /2	D	f ₀ /8

* B,C,D : fundamental only.

〈Output Enable〉

MARK	RATIO	MARK	RATIO
K	f ₀ /1	M	f ₀ /4
L	f ₀ /2	N	f ₀ /8

* L,M,N : fundamental only.

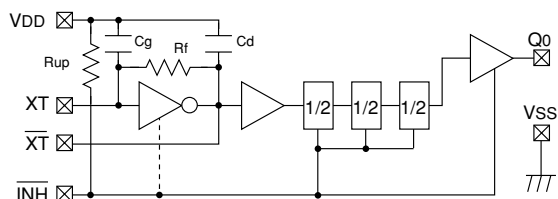
③ Represents recommended frequency & R_f, C_g & C_d values

*) Please refer to the ordering information table above.

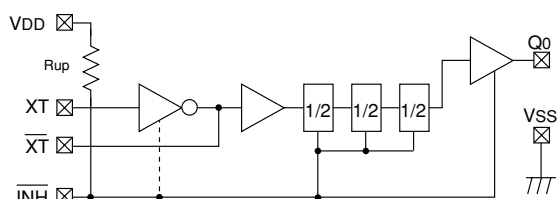
④ Represents the assembly lot no.

(Based on internal standards.)

Block Diagram



Built-in oscillation capacitors, oscillation feedback resistor



External oscillation capacitors, oscillation feedback resistor

Absolute Maximum Ratings

$T_a = 25^\circ\text{C}$

PARAMETER	SYMBOL	CONDITIONS	UNITS
Supply Voltage	VDD	VSS-0.3 ~ VSS+7.0	V
Input Voltage	VIN	VSS-0.3 ~ VDD+0.3	V
Continuous Total Power Dissipation	Pd	250 *	mW
Operating Ambient Temperature	Topr	-40 ~ +85	°C
Storage Temperature	Tstg	-65 ~ +150 (Chip Form)	°C
		-55 ~ +125 (SOT-26)	°C

*When implemented on a glass epoxy PCB (SOT-26 package)

■Electrical Characteristics

●DC Electrical Characteristics

XC2164A51M Fundamental

5.0V Operation (unless otherwise stated, $V_{DD}=5.0V$, No Load, $T_a=30 \sim +80^{\circ}C$)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Operating Supply Voltage	VDD			4.5	5.0	5.5	V
"H" Level Input Voltage	VIH			2.4			V
"L" Level Input Voltage	VIL					0.4	V
"H" Level Output Voltage	VOH	CMOS : VDD=4.5V, IOH=-16mA		3.9	4.2		V
"L" Level Output Voltage	VOL	CMOS : VDD=4.5V, IOH=16mA			0.3	0.4	V
Consumption Current 1	IDD1	/INH=Open, Q =Open, f=30MHz	XC2164A51M, V		11	(15)	mA
			XC2164A51T		11	(15)	
Consumption Current 2	IDD2	/INH=Open, Q =Open, f=30MHz	XC2164A51M, V		5	(8)	μA
			XC2164A51T		5	(8)	
Input pull up resistance 1	Rup1	/INH= 'L'		0.5	1.0	2.0	MΩ
Input pull up resistance 2	Rup2	/INH=0.7VDD		25	50	100	kΩ
Internal Oscillation Capacitance	Cg	note 1	XC2164A51M, V		35		pF
			XC2164A51T		20		
	Cd	note 1	XC2164A51M, V		35		
			XC2164A51T		20		
Internal Oscillation Feedback Resistance	Rf				3.5		MΩ
Output Disable Leakage Current	Ioz	/INH= 'L'				10	μA

note 1 : the values for Cg, Cd are the designed values.

XC2164A51M Fundamental

3.3V Operation (unless otherwise stated, $V_{DD}=3.3V$, No Load, $T_a=30 \sim +80^{\circ}C$)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Operating Supply Voltage	VDD			2.97	3.30	3.63	V
"H" Level Input Voltage	VIH			2.4			V
"L" Level Input Voltage	VIL					0.4	V
"H" Level Output Voltage	VOH	CMOS : 2.97V, IOH=-8mA		2.5			V
"L" Level Output Voltage	VOL	CMOS : 2.97V, IOH=8mA				0.4	V
Consumption Current 1	IDD1	/NH=Open, Q =Open, f=30MHz	XC2164A51M, V		5	(8)	mA
			XC2164A51T		4	(6.5)	
Consumption Current 2	IDD2	/NH=Open, Q =Open, f=30MHz	XC2164A51M, V		2	(4)	μA
			XC2164A51T		2	(4)	
Input pull up resistance 1	Rup1	/INH= 'L'		1.0	2.0	4.0	MΩ
Input pull up resistance 2	Rup2	/INH=0.7VDD		35	70	140	kΩ
Internal Oscillation Capacitance	Cg	note 1	XC2164A51M, V		35		pF
			XC2164A51T		20		
	Cd	note 1	XC2164A51M, V		35		
			XC2164A51T		20		
Internal Oscillation Feedback Resistance	Rf				7.0		MΩ
Output Disable Leakage Current	Ioz	/INH= 'L'				10	μA

note 1 : the values for Cg, Cd are the pre-set values.

Oscillation Frequency vs. Supply Voltage, Negative Resistance Value
(The designed value when 300MHz crystal is used.)

SYMBOL	OSCILLATION FREQUENCY vs. SUPPLY VOLTAGE		NEGATIVE RESISTANCE VALUE	
	$V_{DD}=3.3V \pm 10\%$	$V_{DD}=5.0V \pm 10\%$	$V_{DD}=3.3V$	$V_{DD}=3.3V$
M	$\pm 4.3ppm$	$\pm 4.5ppm$	-130 Ω	-220 Ω
V	$\pm 1.2ppm$	$\pm 2.1ppm$	-150 Ω	-250 Ω
T	$\pm 9.4ppm$	$\pm 7.0ppm$	-660 Ω	-760 Ω

XC2164A51A ~ XC2164A51K 3rd Overtone 5.0 Operation (Unless otherwise stated, VDD=5.0V, No Load, Ta=30 ~ + 80°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Voltage	VDD		4.5	5.0	5.5	V
"H" Level Input Voltage	VIH		2.4			V
"L" Level Input Voltage	VIL				0.4	V
"H" Level Output Voltage	VOH	CMOS : 4.5V, IOH=-16mA	3.9	4.2		V
"L" Level Output Voltage	VOL	CMOS : 4.5V, IOH=16mA		0.3	0.4	V
Consumption Current 1	IDD1	/INH=Open, Q0=Open	XC2164A51A,f0=30MHz	17.0	(23)	mA
			XC2164A51B,f0=40MHz	17.0	(23)	
			XC2164A51C,f0=55MHz	19.0	(26)	
			XC2164A51D,f0=70MHz	23.0	(32)	
			XC2164A51E,f0=85MHz	24.0	(32)	
			XC2164A51F,f0=100MHz	30.0	(40)	
			XC2164A51H,f0=110MHz	30.0	(40)	
			XC2164A51K,f0=125MHz	30.0	(40)	
Consumption Current 2	IDD2	/INH='L', Q0=Open		5.0	(8)	μA
Input Pull Up Resistance 1	Rup1	/INH='L'	0.5	1.0	2.0	MΩ
Input Pull Up Resistance 2	Rup2	/INH=0.7VDD	25	50	100	kΩ
Internal Oscillation Feedback Resistance	Rf	XC2164A51A		9.0		kΩ
		XC2164A51B		6.5		
		XC2164A51C		5.0		
		XC2164A51D		3.5		
		XC2164A51E		2.8		
		XC2164A51F		2.5		
		XC2164A51H		2.2		
		XC2164A51K		2.0		
Output Disable Leakage Current	Ioz	/INH='L'			10	μA

XC2164A51B ~ XC2164A51L 3rd Overtone

3.3V Operation (Unless otherwise stated, V_{DD}=3.3V, No Load, Ta=30 ~ +80°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Voltage	V _{DD}		2.97	3.30	3.63	V
"H" Level Input Voltage	V _{IH}		2.4			V
"L" Level Input Voltage	V _{IL}				0.4	V
"H" Level Output Voltage	V _{OH}	CMOS : V _{DD} =2.97V, I _{OH} =-8mA	2.5			V
"L" Level Output Voltage	V _{OL}	CMOS : V _{DD} =2.97V, I _{OH} =8mA			0.4	V
Consumption Current 1	IDD1	/INH=Open, Q0=Open	XC2164A51B, f ₀ =30MHz	4.5	(7)	mA
			XC2164A51C, f ₀ =40MHz	5.0	(8)	
			XC2164A51D, f ₀ =55MHz	6.5	(10)	
			XC2164A51E, f ₀ =70MHz	8.0	(13)	
			XC2164A51F, f ₀ =85MHz	8.5	(13)	
			XC2164A51H, f ₀ =100MHz	9.5	(15)	
			XC2164A51K, f ₀ =110MHz	10.0	(15)	
			XC2164A51L, f ₀ =125MHz	10.5	(15)	
Consumption Current 2	IDD2	/INH='L', Q0=Open		2.0	(4)	μA
Input Pull Up Resistance 1	R _{up1}	/INH='L'	1.0	2.0	4.0	MΩ
Input Pull Up Resistance 2	R _{up2}	/INH=0.7V _{DD}	35	70	140	kΩ
Internal Oscillation Feedback Resistance	R _f	XC2164A51B		6.5		kΩ
		XC2164A51C		5.0		
		XC2164A51D		3.5		
		XC2164A51E		2.8		
		XC2164A51F		2.5		
		XC2164A51H		2.2		
		XC2164A51K		2.0		
		XC2164A51L		2.3		
Output Disable Leakage Current	I _{oz}	/INH='L'			10	μA

●AC Electrical Characteristics

XC2164A51M, T, V Fundamental

(Unless otherwise stated, V_{DD}=3.3V or 5.0V, No Load, Ta=-30 ~ +80°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Rise Time ^(note 1)	tr	CMOS: CL=15pF, 0.1V _{DD} →0.9V _{DD}		1.5		ns
		TTL: Load=10TTL, 0.4V→2.4V		1.5		ns
Output Fall Time ^(note 1)	tf	CMOS: CL=15pF, 0.9V _{DD} →0.1V _{DD}		1.5		ns
		TTL: Load=10TTL, 2.4V→0.4V		1.5		ns
Output Duty Cycle	DUTY	CMOS: CL=15pF @0.5V _{DD}	45		55	%
		TTL: Load=10TTL @1.4V	45		55	%

note 1 : the values for tr, tf are the pre-set values.

XC2164A51A ~ XC2164A51L 3rd Overtone

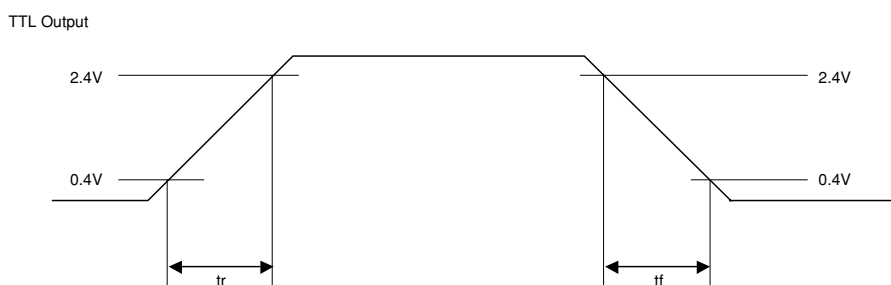
(Unless otherwise stated, V_{DD}=3.3V or 5.0V, No Load, Ta=-30 ~ +80°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Rise Time ^(note 1)	tr	CMOS: CL=15pF, 0.1V _{DD} →0.9V _{DD}		1.5		ns
Output Fall Time ^(note 1)	tf	CMOS: CL=15pF, 0.9V _{DD} →0.1V _{DD}		1.5		ns
Output Duty Cycle	DUTY	CMOS: CL=15pF @0.5V _{DD}	45		55	%

note 1 : the values for tr, tf are the pre-set values.

■ Switching Waveforms

(1) Switching Time



(2) Duty Cycle

