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## ICs for use with 3rd Overtone Crystal Oscillators

### GENERAL DESCRIPTION

The XC2163 series are high frequency, low current consumption CMOS ICs with built-in crystal oscillator and divider circuits. Output is selectable from any one of the following values for  $f_0$ :  $f_0/1$ ,  $f_0/2$ ,  $f_0/4$ ,  $f_0/8$ .

With oscillation capacitors and a feedback resistors built-in, it is possible to configure a stable 3rd overtone oscillator using only an external crystal oscillator.

Also available is an external oscillation capacitor/external oscillation feedback resistor type, which makes oscillation frequency control possible.

### APPLICATIONS

- Crystal Oscillation Modules
- Computer, DSP Clocks
- Communication Equipment
- Various System Clocks

### FEATURES

- Oscillation Frequency** : 40MHz ~ 125MHz  
(Rf, Cg, Cd internal; 5.0V)
- (3rd Overtone)** : 57MHz ~ 125MHz  
(Rf, Cg, Cd internal; 3.3V)
- : 20MHz ~ 125MHz  
(Rf, Cg, Cd external)
- Divider Ratio** : Selectable from  $f_0/1$ ,  $f_0/2$ ,  $f_0/4$ ,  $f_0/8$ .
- Output** : 3-State
- Operating Voltage Range** : 3.3V  $\pm$  10%, 5.0V  $\pm$  10%
- Low Current Consumption** : Stand-by function included \*

#### CMOS

**Built-in Oscillation Capacitor**

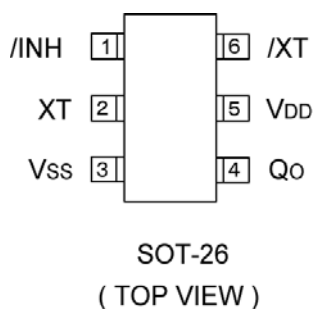
**Built-in Oscillation Feedback Resistor**

**Package** : SOT-26

**Environmentally Friendly** : EU RoHS Compliant, Pb Free

\* Oscillation continues in stand-by mode

### PIN CONFIGURATION



### PIN ASSIGNMENT

PIN NUMBER	PIN NAME	FUNCTION
1	/INH	Stand-by Control*
2	XT	Crystal Oscillator Connection (Input)
3	Vss	GND
4	Q0	Clock Output
5	VDD	Power Supply
6	/XT	Crystal Oscillator Connection (Output)

\* Stand-by control pin has a pull-up resistor built-in.

### /INH, Q0 PIN FUNCTION

/INH	"H" or OPEN	"L"(Stand-by)
Q0	Divider Output	High Impedance

"H" = High Level

"L" = Low Level

## PRODUCT CLASSIFICATION

### Ordering Information

XC2163 \_\_\_\_\_ - (\*1)

DESIGNATOR	DESCRIPTION	SYMBOL	DESCRIPTION
	Divider Ratio	C	: f0/1
		D	: f0/2
		E	: f0/4
		F	: f0/8
	Output Capacity	5	: 10TTL
	Duty Level	1	: CMOS (V <sub>DD</sub> /2) *TTL : 20MHz to 37MHz
	Frequency Range & R <sub>f</sub> , C <sub>g</sub> , C <sub>d</sub> Values	Z	: External type (refer to table 1)
		A ~ L	: Built-in type (refer to table 2)
-	Packages Taping Type (*2)	MR-G	: SOT-26

(\*1) The "-G" suffix indicates that the products are Halogen and Antimony free as well as being fully RoHS compliant.

(\*2) The device orientation is fixed in its embossed tape pocket. For reverse orientation, please contact your local Torex sales office or representative. (Standard orientation: R- , Reverse orientation: L- )

Table 1: Frequency for External Type

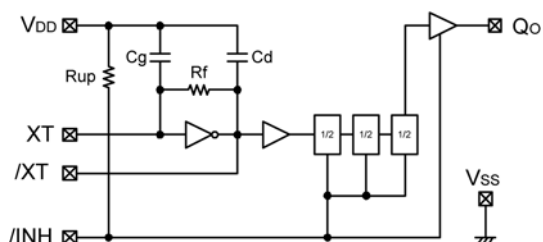
SYMBOL	5.0V TYPE			3.3V TYPE		
	FREQUENCY RANGE	R <sub>f</sub>	C <sub>g</sub> /C <sub>d</sub>	FREQUENCY RANGE	R <sub>f</sub>	C <sub>g</sub> /C <sub>d</sub>
Z	108MHz ~ 125MHz	1.6k	10pF	108MHz ~ 125MHz	3.9k	4pF
	93MHz ~ 110MHz	2.4k	10pF	95MHz ~ 110MHz	2.4k	7pF
	80MHz ~ 95MHz	2.4k	12pF	80MHz ~ 97MHz	2.7k	8pF
	68MHz ~ 83MHz	2.4k	15pF	68MHz ~ 83MHz	2.7k	10pF
	55MHz ~ 70MHz	3.3k	15pF	58MHz ~ 70MHz	3.9k	10pF
	45MHz ~ 57MHz	3.3k	20pF	50MHz ~ 60MHz	3.9k	12pF
	35MHz ~ 47MHz	3.6k	24pF	40MHz ~ 52MHz	2.4k	20pF
	28MHz ~ 37MHz	4.7k	27pF	33MHz ~ 42MHz	3.6k	20pF
	24MHz ~ 30MHz	5.6k	30pF	28MHz ~ 35MHz	3.6k	24pF
	20MHz ~ 26MHz	6.8k	33pF	24MHz ~ 30MHz	3.9k	27pF
-	-	-	20MHz ~ 26MHz	3.9k	33pF	

Note: We recommend that a damping resistor R<sub>d</sub> be added between the /XT pin & the crystal oscillator pin in order to safeguard the crystal oscillator and improve oscillation stability.

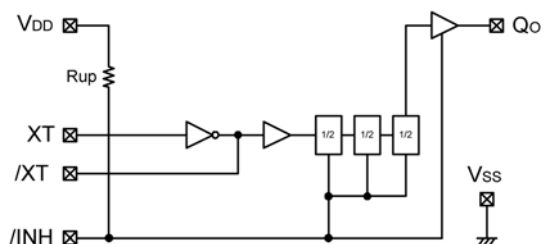
Table 2: Frequency for Built-In Type

SYMBOL	5.0V TYPE			3.3V TYPE		
	FREQUENCY RANGE	R <sub>f</sub>	C <sub>g</sub> /C <sub>d</sub>	FREQUENCY RANGE	R <sub>f</sub>	C <sub>g</sub> /C <sub>d</sub>
A	-	-	-	108MHz ~ 125MHz	1.5k	5.5pF
B	-	-	-	93MHz ~ 110MHz	1.7k	6.5pF
C	108MHz ~ 125MHz	2.2k	5.5pF	80MHz ~ 95MHz	2.2k	5.5pF
D	95MHz ~ 110MHz	2.4k	6.5pF	72MHz ~ 83MHz	2.4k	6.5pF
E	80MHz ~ 97MHz	3.2k	6.5pF	65MHz ~ 75MHz	3.2k	6.5pF
F	68MHz ~ 83MHz	3.7k	6.5pF	57MHz ~ 67MHz	3.7k	6.5pF
H	55MHz ~ 70MHz	4.9k	7.6pF	-	-	-
K	45MHz ~ 57MHz	5.5k	11.0pF	-	-	-
L	40MHz ~ 48MHz	6.5k	11.0pF	-	-	-

## BLOCK DIAGRAMS



① Built-in oscillation capacitors, oscillation feedback resistor



② External oscillation capacitors, oscillation feedback resistor

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	CONDITIONS	UNITS
Supply Voltage	VDD	VSS-0.3 ~ VSS+7.0	V
Input Voltage	VIN	VSS-0.3 ~ VDD+0.3	V
Power Dissipation	Pd	250 *	mW
Operating Temperature Range	Topr	-30 ~ +80	
Storage Temperature Range	Tstg	-55 ~ +125	

\* When implemented on a glass epoxy PCB.

## ELECTRICAL CHARACTERISTICS

XC2163C51AMR

Fosc=108MHz~125MHz

(Unless otherwise stated, VDD=3.3V, Ta=25 )

PARAMETER	SYMBOL	CONDITIONS	STANDARD VALUE			UNITS
			MIN.	TYP.	MAX.	
Operating Voltage	VDD		2.97	-	3.63	V
'H' Level Input Voltage	VIH	/INH pin	2.4	-	-	V
'L' Level Input Voltage	VIL	/INH pin		-	0.4	V
'H' Level Output Voltage	VOH	Qo pin, VDD = 2.97V, IOH = 8mA	2.2	2.4	-	V
'L' Level Output Voltage	VOL	Qo pin, VDD = 2.97V, IOL = 8mA	-	0.3	0.4	V
Supply Current 1	Idd1	/INH = OPEN, CL = 15pF, f = 125MHz	-	18	-	mA
Supply Current 2	Idd2	/INH = 'L', f = 125MHz	-	5	-	mA
Input Pull-Up Resistance 1	Rup1	/INH = 'L'	1.0	2.0	4.0	M
Input Pull-Up Resistance 2	Rup2	/INH = 0.7VDD	35	70	140	k
Internal Oscillation Capacity	Cg	R&D Value	-	5.5	-	pF
	Cd	R&D Value	-	5.5	-	pF
Internal Oscillation Feedback Resistance	Rf		-	1.5	-	k
Output Off Leak Current	Ioz	Qo pin, /INH = 'L'	-	-	10	μA

Note) R&G value

XC2163C51BMR

Fosc=93MHz~110MHz

(Unless otherwise stated, VDD=3.3V, No load, Ta=25 )

PARAMETER	SYMBOL	CONDITIONS	STANDARD VALUE			UNITS
			MIN.	TYP.	MAX.	
Operating Voltage	VDD		2.97	-	3.63	V
'H' Level Input Voltage	VIH	/INH pin	2.4	-	-	V
'L' Level Input Voltage	VIL	/INH pin	-	-	0.4	V
'H' Level Output Voltage	VOH	Qo pin, VDD = 2.97V, IOH = 8mA	2.2	2.4	-	V
'L' Level Output Voltage	VOL	Qo pin, VDD = 2.97V, IOL = 8mA	-	0.3	0.4	V
Supply Current 1	Idd1	/INH = OPEN, CL = 15pF, f = 110MHz	-	15	-	mA
Supply Current 2	Idd2	/INH = 'L', f = 110MHz	-	5	-	mA
Input Pull-Up Resistance 1	Rup1	/INH = 'L'	1.0	2.0	4.0	M
Input Pull-Up Resistance 2	Rup2	/INH = 0.7VDD	35	70	140	k
Internal Oscillation Capacity	Cg	R&D Value	-	6.5	-	pF
	Cd	R&D Value	-	6.5	-	pF
Internal Oscillation Feedback Resistance	Rf		-	1.7	-	k
Output Off Leak Current	Ioz	Qo pin, /INH = 'L'	-	-	10	μA

## SWITCHING CHARACTERISTICS

XC2163C51AMR/XC2163C51BMR

CMOS DUTY:VDD=3.3V, Ta=25

PARAMETER	SYMBOL	CONDITIONS	STANDARD VALUE			UNITS	
			MIN.	TYP.	MAX.		
Output Rise Time	tr	CL=15pF, 0.1VDD 0.9VDD	-	1.5	-	ns	
Output Fall Time	tf	CL=15pF, 0.9VDD 0.1VDD	-	1.5	-	ns	
Output Duty Cycle	DUTY	C51A	0.5VDD, CL=15pF, f=125MHz	45	-	55	%
		C51B	0.5VDD, CL=15pF, f=110MHz				
Output Disable Delay Time	tplz	CL=15pF	-	-	100	ns	

## ELECTRICAL CHARACTERISTICS (Continued)

XC2163C51ZMR

Fosc = 108MHz to 125MHz; Rf = 1.6k , Cg = Cd = 10pF external

(Unless otherwise stated, VDD=5.0V, Ta=25 )

PARAMETER	SYMBOL	CONDITIONS	STANDARD VALUE			UNITS
			MIN.	TYP.	MAX.	
Operating Voltage	VDD		4.5	-	5.5	V
'H' Level Input Voltage	VIH	/INH pin	2.4	-	-	V
'L' Level Input Voltage	VIL	/INH pin	-	-	0.4	V
'H' Level Output Voltage	VOH	Qo pin, VDD = 4.5V, IOH = -16mA	3.9	4.2	-	V
'L' Level Output Voltage	VOL	Qo pin, VDD = 4.5V, IOL = 16mA	-	0.3	0.4	V
Supply Current 1	IDD1	/INH = OPEN, CL = 15pF, f = 120MHz	-	31	-	mA
Supply Current 2	IDD2	/INH = 'L', f = 120MHz	-	14	-	mA
Input Pull-Up Resistance 1	Rup1	/INH = 'L'	0.5	1.0	2.0	M
Input Pull-Up Resistance 2	Rup2	/INH = 0.7VDD	25	50	100	k
Output Off Leak Current	Ioz	Qo pin, /INH = 'L'	-	-	10	μA

## SWITCHING CHARACTERISTICS

XC2163C51ZMR

CMOS DUTY : VDD=5.0V, Ta=25

PARAMETER	SYMBOL	CONDITIONS	STANDARD VALUE			UNITS
			MIN.	TYP.	MAX.	
Output Rise Time	tr	CL=15pF, 0.1VDD 0.9VDD	-	1.5	-	ns
Output Fall Time	tf	CL=15pF, 0.9VDD 0.1VDD	-	1.5	-	ns
Output Duty Cycle	DUTY	0.5VDD, CL=15pF, f=120MHz	45	-	55	%
Output Disable Delay Time	tpLz	CL=15pF	-	-	100	ns
Output Enable Delay Time	tpzL	CL=15pF	-	-	100	ns

The contents can be changed without advance notice.

## ELECTRICAL CHARACTERISTICS (Continued)

XC2163C51ZMR

Fosc= 108MHz to 125MHz : Rf = 3.9k , Cg = Cd = 4pF external

(Unless otherwise stated, VDD=3.3V, Ta=25 )

PARAMETER	SYMBOL	CONDITIONS	STANDARD VALUE			UNITS
			MIN.	TYP.	MAX.	
Operating Voltage	VDD		2.97	-	3.63	V
'H' Level Input Voltage	VIH	/INH pin	2.4	-	-	V
'L' Level Input Voltage	VIL	/INH pin	-	-	0.4	V
'H' Level Output Voltage	VOH	Qo pin, VDD = 2.97V, IOH = -8mA	2.2	2.4	-	V
'L' Level Output Voltage	VOL	Qo pin, VDD = 2.97V, IOL = 8mA	-	0.3	0.4	V
Supply Current 1	IDD1	/INH = OPEN, CL = 15pF, f = 120MHz	-	15	-	mA
Supply Current 2	IDD2	/INH = 'L', f = 100MHz	-	4	-	mA
Input Pull-Up Resistance 1	Rup1	/INH = 'L'	2.0	4.0	6.0	M
Input Pull-Up Resistance 2	Rup2	/INH = 0.7VDD	70	140	250	k
Output Off Leak Current	Ioz	Qo pin, /INH = 'L'	-	-	10	μA

## SWITCHING CHARACTERISTICS

XC2163C51ZMR

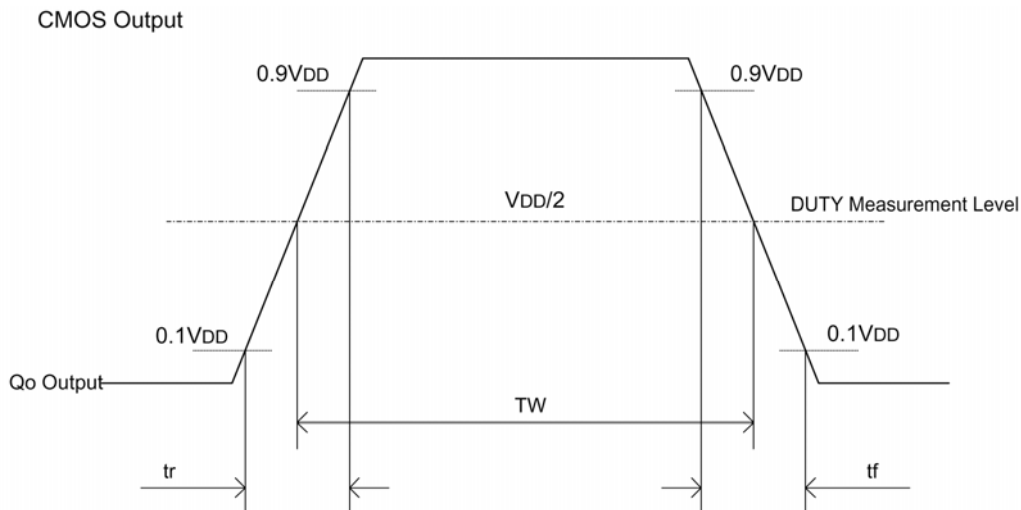
CMOS DUTY : VDD=3.3V, Ta=25

PARAMETER	SYMBOL	CONDITIONS	STANDARD VALUE			UNITS
			MIN.	TYP.	MAX.	
Output Rise Time	tr	CL=15pF, 0.1VDD ~ 0.9VDD	-	1.5	-	ns
Output Fall Time	tf	CL=15pF, 0.9VDD ~ 0.1VDD	-	1.5	-	ns
Output Duty Cycle	DUTY	0.5VDD, CL=15pF, f=120MHz	45	-	55	%
Output Disable Delay Time	tpLz	CL=15pF	-	-	100	ns
Output Enable Delay Time	tpzL	CL=15pF	-	-	100	ns

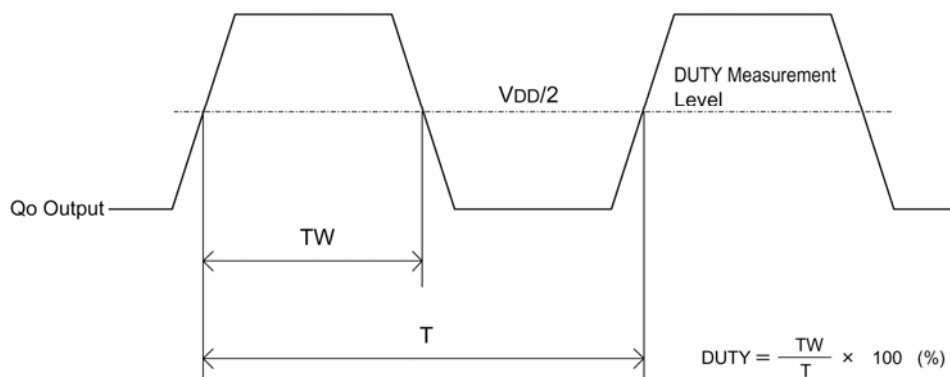
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## SWITCHING CHARACTERISTICS MEASUREMENT WAVEFORMS

### (1) Switching Time

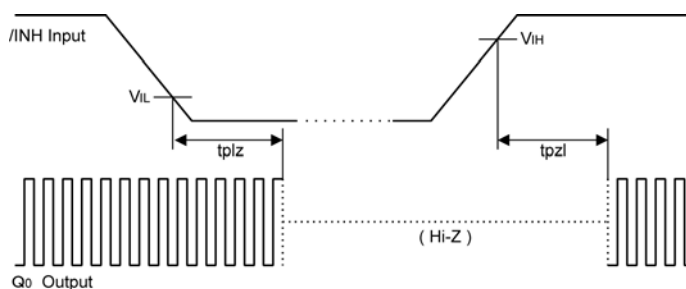


### (2) Output Waveform Symmetry



### (3) Output Disable Delay Time, Output Enable Delay Time

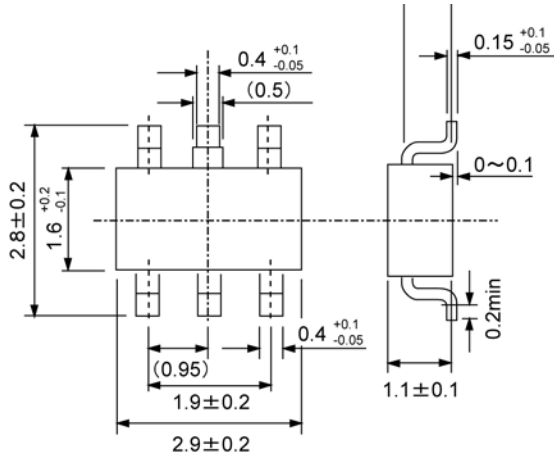
\*) /INH Pin Input Waveform  $t_r = t_f = \text{less than } 10\text{ns}$



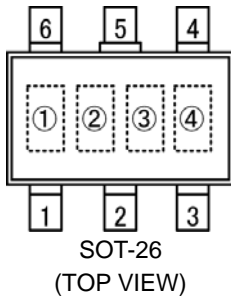


## PACKAGING INFORMATION

SOT-26



## MARKING RULE



Represents product series

MARK
6

Represents divider ratio

MARK	RATIO	MARK	RATIO
C	$f_0/1$	E	$f_0/4$
D	$f_0/2$	F	$f_0/8$

Represents frequency & Rf, Cg & Cd values

MARK	Frequency (MHz)	
	5.0V	3.3V
A	-	108~125
B	-	93~110
C	108~125	80~95
D	95~110	72~83
E	80~97	65~75
F	68~83	57~67
H	55~70	-
K	45~57	-
L	40~48	-
Z	External	

Represents assembly lot number  
(Based on internal standards)

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