

- ◆ CMOS Low Supply Current
- ◆ Oscillator Frequency : 4MHz to 70MHz
- ◆ Built-In Oscillator Capacitors
- ◆ 3 State Output : fo/1, fo/2, fo/4, fo/8
- ◆ Supply Voltage : 5.0V
- ◆ Mini Mold SOT-26 Package

### ■ General Description

The XC2151 series are a group of high frequency, CMOS low power crystal oscillators with oscillator & divider circuitry, oscillator capacitors and amplifier feedback resistors built-in.

An oscillator circuit can be created from just an external crystal.

Output frequency can be selected from four frequencies :

Fundamental f0/1, Divided f0/2, f0/4, f0/8.

The output buffer is 3-state and has a fanout of 10 - TTL.

### ■ Applications

- Crystal Oscillator Modules
- Communication Equipment
- Microcomputers
- Clock Units in Motor Control
- System Clocks on Boards
- Timers
- Palmtops

### ■ Features

**High Precision** : Built-in oscillator capacitors  
16pF TYP (or selectable from 10 to 20pF)  
On-chip amplifier feedback resistor  
5MΩ TYP (or selectable from 1.6kΩ to 8.4kΩ)

**Oscillator Frequency** : 4MHz to 70MHz

**Divider Ratio** : Selectable from f0/1, f0/2, f0/4, f0/8

**Output** : 3 state, 10 - TTL fanout

**Operating Voltage Range** : 4.0V to 6.0V

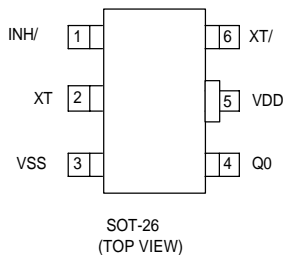
**Small Quiescent Current**

**Stand-By Function**

**Low Cost** : Oscillator circuit can be created from just an external crystal

**Ultra Small Package** : SOT - 26 (150mW) mini mold

### ■ Pin Configuration



### ■ Pin Assignment

PIN NUMBER	PIN NAME	FUNCTION
1	INH/	Control *
2	XT	Oscillator Connection (Input)
3	VSS	GND
4	Q0	Output
5	VDD	Power Supply
6	XT/	Oscillator Connection (Output)

\* Control pin has pull-up resistor built-in.

### ■ INH, Q0 Pin Function

XC2151x51

INH/	Q0
H	Output
open	Output
L	High Impedance (oscillator stopped)

XC2151x55

INH/	Q0
H	Output
open	Output
L	High Impedance (oscillator operating)

H = High Level

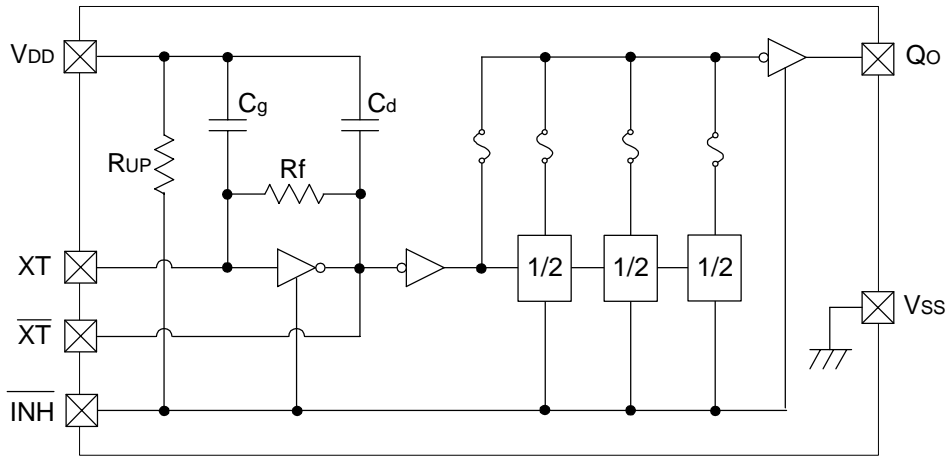
L = Low Level

### ■ Absolute Maximum Ratings

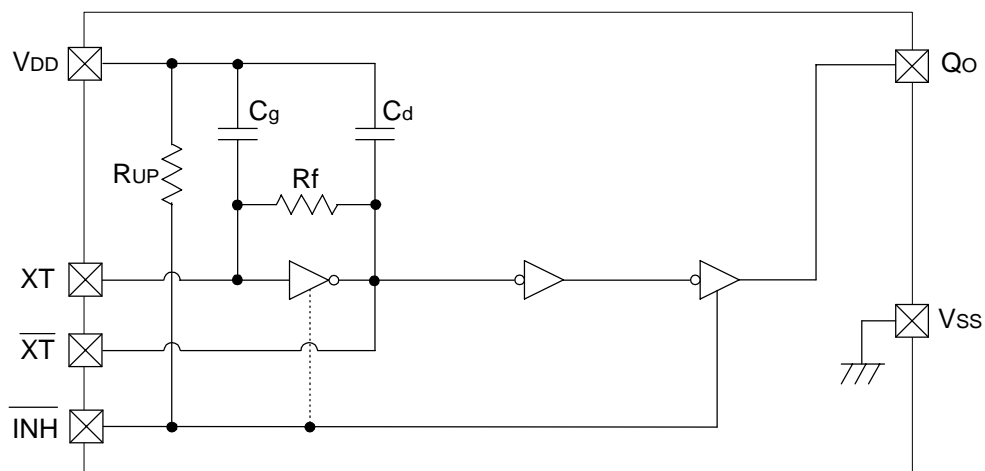
PARAMETER	SYMBOL	CONDITIONS	UNITS
Supply Voltage	VDD	VSS - 0.3 to VSS + 7.0	V
Input Voltage	VIN	VSS - 0.3 to VDD + 0.3	V
Power Dissipation	Pd	150	mW
Operating Ambient Temp.	Topr	-30 to +75	°C
Storage Temp.	Tstg	-55 to +125	°C

### ■ Block Diagram

XC2151A Series



XC2151T / C Series



## ■ Electrical Characteristics

XC2151T51A / 55A (overtone)

V<sub>DD</sub>=5.0V, Fosc=20MHz, No Load, Ta = 25 °C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Voltage	V <sub>DD</sub>		4.0		6.0	V
Input Voltage 'High'	V <sub>IH</sub>		2.4			V
Input Voltage 'Low'	V <sub>IL</sub>				0.4	V
Output Current 'High'	I <sub>OH</sub>	V <sub>OH</sub> = 4.6V		- 10		mA
Output Current 'Low'	I <sub>OL</sub>	V <sub>OL</sub> = 0.4V	16			mA
Supply Current 1	I <sub>DD1</sub>	/ INH = OPEN, Q <sub>0</sub> = OPEN		18	25	mA
Supply Current 2 (51A)	I <sub>DD2</sub>	/ INH = "L"		2	5	μA
Supply Current 2 (55A)	I <sub>DD2</sub>	/ INH = "L"		16	23	mA
Input Pull-Up Resistance	R <sub>UP</sub>	/ INH = 4.5V	50		200	kΩ
Internal Oscillator Capacitance	C <sub>g,Cd</sub>	see note below	18	20	22	pF
Internal Oscillator Feedback Resistance	R <sub>f</sub>		5.0	5.5	6.1	kΩ
Output Disable Leakage Current	I <sub>OZ</sub>	/ INH = "L"			10	μA

note : the values for C<sub>g,Cd</sub> are the designed values.

XC2151T51D / 55D (overtone)

V<sub>DD</sub>=5.0V, Fosc=70MHz, No Load, Ta = 25 °C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Voltage	V <sub>DD</sub>		4.0		6.0	V
Input Voltage 'High'	V <sub>IH</sub>		2.4			V
Input Voltage 'Low'	V <sub>IL</sub>				0.4	V
Output Current 'High'	I <sub>OH</sub>	V <sub>OH</sub> = 4.6V		- 10		mA
Output Current 'Low'	I <sub>OL</sub>	V <sub>OL</sub> = 0.4V	16			mA
Supply Current 1	I <sub>DD1</sub>	/ INH = OPEN, Q <sub>0</sub> = OPEN		25	35	mA
Supply Current 2 (51D)	I <sub>DD2</sub>	/ INH = "L"		2	5	μA
Supply Current 2 (55D)	I <sub>DD2</sub>	/ INH = "L"		23	32	mA
Input Pull-Up Resistance	R <sub>UP</sub>	/ INH = 4.5V	50		200	kΩ
Internal Oscillator Capacitance	C <sub>g,Cd</sub>	see note below	9	10	11	pF
Internal Oscillator Feedback Resistance	R <sub>f</sub>		2.7	3.0	3.3	kΩ
Output Disable Leakage Current	I <sub>OZ</sub>	/ INH = "L"			10	μA

note : the values for C<sub>g,Cd</sub> are the designed values.

XC2151T (overtone)

PART No.	DUTY LEVEL	OUTPUT	DIVIDER RATIO	R <sub>f</sub> (kΩ)	C <sub>g/Cd</sub> (pF)	RECOMMENDED FREQUENCY RANGE
XC2151T51A	TTL	10TTL	f <sub>0</sub> / 1	5.5	20	20MHz to 33MHz
XC2151T51B	TTL	10TTL	f <sub>0</sub> / 1	4.0	20	30MHz to 45MHz
XC2151T51C	TTL	10TTL	f <sub>0</sub> / 1	3.0	13	43MHz to 57MHz
XC2151T51D	TTL	10TTL	f <sub>0</sub> / 1	3.0	10	55MHz to 70MHz

### ■ Electrical Characteristics

XC2151C51F / 55F (overtone)

V<sub>DD</sub>=5.0V, F<sub>osc</sub>=20MHz, No Load, T<sub>a</sub> = 25 °C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Voltage	V <sub>DD</sub>		4.0		6.0	V
Input Voltage 'High'	V <sub>IH</sub>		2.4			V
Input Voltage 'Low'	V <sub>IL</sub>				0.4	V
Output Current 'High'	I <sub>OH</sub>	V <sub>OH</sub> = 4.6V		- 10		mA
Output Current 'Low'	I <sub>OL</sub>	V <sub>OL</sub> = 0.4V	16			mA
Supply Current 1	I <sub>DD1</sub>	/ INH = OPEN, Q <sub>0</sub> = OPEN		18	25	mA
Supply Current 2 (51F)	I <sub>DD2</sub>	/ INH = "L"		2	5	μA
Supply Current 2 (55F)	I <sub>DD2</sub>	/ INH = "L"		16	23	mA
Input Pull-Up Resistance	R <sub>UP</sub>	/ INH = 4.5V	50		200	kΩ
Internal Oscillator Capacitance	C <sub>g</sub> ,C <sub>d</sub>	see note below	18	20	22	pF
Internal Oscillator Feedback Resistance	R <sub>f</sub>		5.0	5.5	6.1	kΩ
Output Disable Leakage Current	I <sub>OZ</sub>	/ INH = "L"			10	μA

note : the values for C<sub>g</sub>,C<sub>d</sub> are the designed values.

XC2151C51L / 55L (overtone)

V<sub>DD</sub>=5.0V, F<sub>osc</sub>=70MHz, No Load, T<sub>a</sub> = 25 °C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Voltage	V <sub>DD</sub>		4.0		6.0	V
Input Voltage 'High'	V <sub>IH</sub>		2.4			V
Input Voltage 'Low'	V <sub>IL</sub>				0.4	V
Output Current 'High'	I <sub>OH</sub>	V <sub>OH</sub> = 4.6V		- 10		mA
Output Current 'Low'	I <sub>OL</sub>	V <sub>OL</sub> = 0.4V	16			mA
Supply Current 1	I <sub>DD1</sub>	/ INH = OPEN, Q <sub>0</sub> = OPEN		25	35	mA
Supply Current 2 (51L)	I <sub>DD2</sub>	/ INH = "L"		2	5	μA
Supply Current 2 (55L)	I <sub>DD2</sub>	/ INH = "L"		23	32	mA
Input Pull-Up Resistance	R <sub>UP</sub>	/ INH = 4.5V	50		200	kΩ
Internal Oscillator Capacitance	C <sub>g</sub> ,C <sub>d</sub>	see note below	9	10	11	pF
Internal Oscillator Feedback Resistance	R <sub>f</sub>		2.7	3.0	3.3	kΩ
Output Disable Leakage Current	I <sub>OZ</sub>	/ INH = "L"			10	μA

note : the values for C<sub>g</sub>,C<sub>d</sub> are the designed values.

XC2151C (overtone)

PART No.	DUTY LEVEL	OUTPUT	DIVIDER RATIO	R <sub>f</sub> (kΩ)	C <sub>g</sub> /C <sub>d</sub> (pF)	RECOMMENDED
XC2151C51F	CMOS (V <sub>DD</sub> /2)	10TTL	f <sub>0</sub> / 1	5.5	20	20MHz to 33MHz
XC2151C51H	CMOS (V <sub>DD</sub> /2)	10TTL	f <sub>0</sub> / 1	4.0	20	30MHz to 45MHz
XC2151C51K	CMOS (V <sub>DD</sub> /2)	10TTL	f <sub>0</sub> / 1	3.0	13	43MHz to 57MHz
XC2151C51L	CMOS (V <sub>DD</sub> /2)	10TTL	f <sub>0</sub> / 1	3.0	10	55MHz to 70MHz

## ■ Electrical Characteristics

XC2151A510 / 519 ( fundamental )  
 $V_{DD}=5.0V$ ,  $F_{osc}=20MHz$ , No Load,  $T_a = 25^{\circ}C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Voltage	$V_{DD}$		4.0		6.0	V
Input Voltage 'High'	$V_{IH}$		2.4			V
Input Voltage 'Low'	$V_{IL}$				0.4	V
Output Current 'High'	$I_{OH}$	$V_{OH} = 4.6V$		- 10		mA
Output Current 'Low'	$I_{OL}$	$V_{OL} = 0.4V$	16			mA
Supply Current 1	$I_{DD1}$	/ INH = OPEN, Q0 = OPEN			12	mA
Supply Current 2	$I_{DD2}$	/ INH = "L"		2	5	$\mu A$
Input Pull-Up Resistance	RUP	/ INH = 4.5V	50		200	$k\Omega$
Internal Oscillator Capacitance	Cg,Cd	see note below		16		pF
Internal Oscillator Feedback Resistance	Rf			5		$M\Omega$
Output Disable Leakage Current	IOZ				10	$\mu A$

note : the values for Cg,Cd are the designed values with XC2151A510. The XC2151A519 is an external type.

XC2151A580 / 589 ( fundamental,  $f_0 / 8$  )  
 $V_{DD}=5.0V$ ,  $F_{osc}=20MHz$ , No Load,  $T_a = 25^{\circ}C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Voltage	$V_{DD}$		4.0		6.0	V
Input Voltage 'High'	$V_{IH}$		2.4			V
Input Voltage 'Low'	$V_{IL}$				0.4	V
Output Current 'High'	$I_{OH}$	$V_{OH} = 4.6V$		- 10		mA
Output Current 'Low'	$I_{OL}$	$V_{OL} = 0.4V$	16			mA
Supply Current 1	$I_{DD1}$	/ INH = OPEN, Q0 = OPEN			12	mA
Supply Current 2	$I_{DD2}$	/ INH = "L"		2	5	$\mu A$
Input Pull-Up Resistance	RUP	/ INH = 4.5V	50		200	$k\Omega$
Internal Oscillator Capacitance	Cg,Cd	see note below		16		pF
Internal Oscillator Feedback Resistance	Rf			5		$M\Omega$
Output Disable Leakage Current	IOZ				10	$\mu A$

note : the values for Cg,Cd are the designed values with XC2151A580. The XC2151A589 is an external type.

XC2151A ( fundamental )

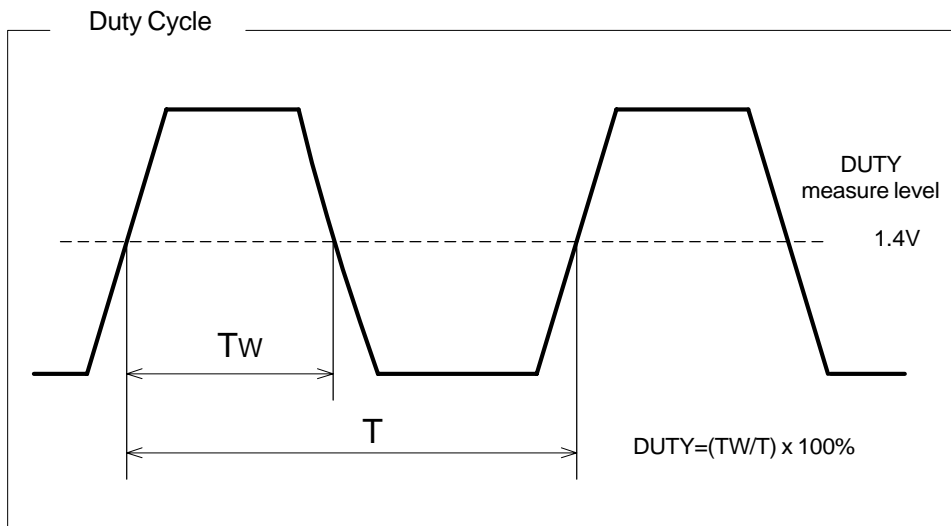
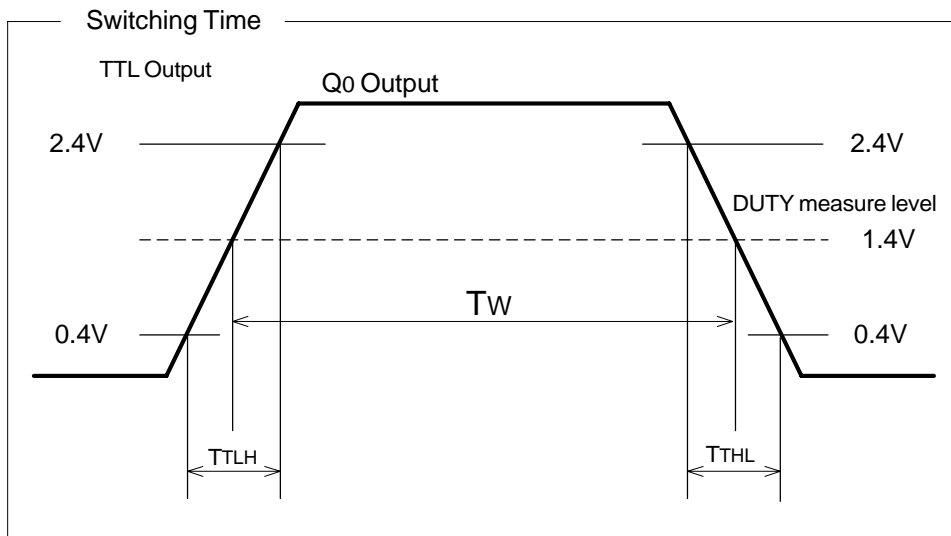
PART No.	DUTY LEVEL	OUTPUT	DIVIDER RATIO	Rf (M $\Omega$ )	Cg/Cd (pF)	RECOMMENDED FREQUENCY RANGE
XC2151A510	CMOS ( $V_{DD}/2$ ), TTL	10TTL	$f_0 / 1$	5.0	16	4MHz to 30MHz
XC2151A520	CMOS ( $V_{DD}/2$ ), TTL	10TTL	$f_0 / 2$	5.0	16	4MHz to 30MHz
XC2151A540	CMOS ( $V_{DD}/2$ ), TTL	10TTL	$f_0 / 4$	5.0	16	4MHz to 30MHz
XC2151A580	CMOS ( $V_{DD}/2$ ), TTL	10TTL	$f_0 / 8$	5.0	16	4MHz to 30MHz
XC2151A519	CMOS ( $V_{DD}/2$ ), TTL	10TTL	$f_0 / 1$	5.0	16 (ext.)	4MHz to 30MHz
XC2151A529	CMOS ( $V_{DD}/2$ ), TTL	10TTL	$f_0 / 2$	5.0	16 (ext.)	4MHz to 30MHz
XC2151A549	CMOS ( $V_{DD}/2$ ), TTL	10TTL	$f_0 / 4$	5.0	16 (ext.)	4MHz to 30MHz
XC2151A589	CMOS ( $V_{DD}/2$ ), TTL	10TTL	$f_0 / 8$	5.0	16 (ext.)	4MHz to 30MHz

### Switching Characteristics

XC2151T (overtone, fundamental)  
TTL Duty, VDD=5.0V, Ta = 25°C

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Rise Time	TTLH	Load=10TTL, 0.4V→2.4V			5	nsec
Output Fall Time	TTHL	Load=10TTL, 2.4V→0.4V			5	nsec
Duty Cycle	DUTY	Load=10TTL @ 1.4V	45		55	%

### Switching Waveforms

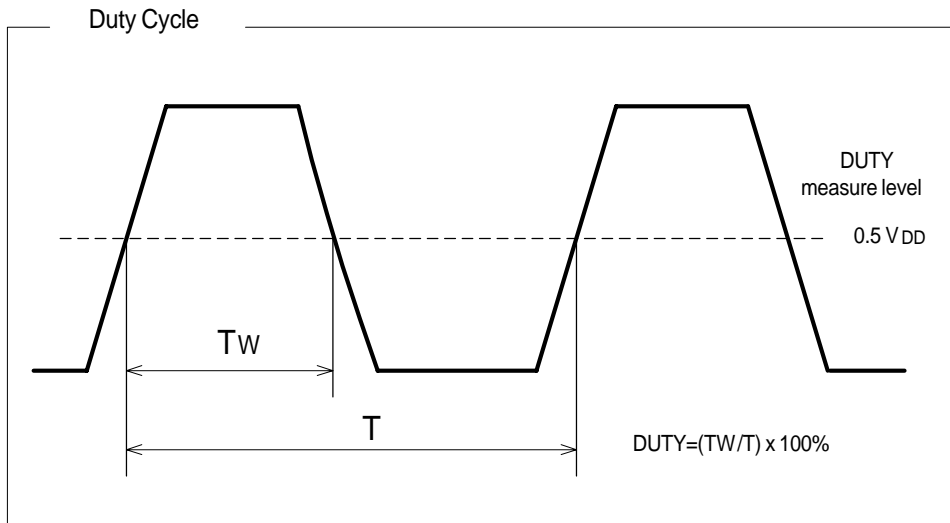
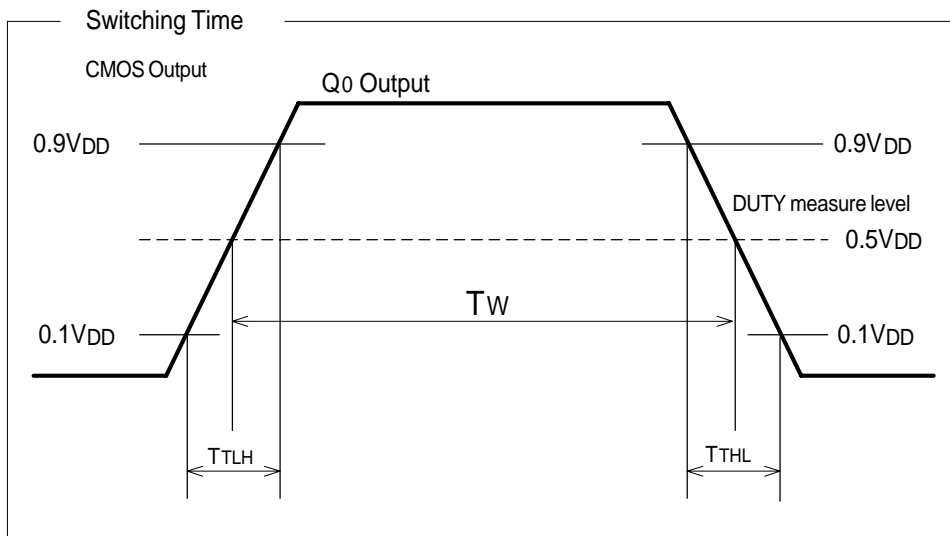


## ■ Switching Characteristics

XC2151C (overtone, fundamental)  
TTL Duty,  $V_{DD}=5.0V$ ,  $T_a = 25^\circ C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Rise Time	T <sub>TLH</sub>	CL=15pF, 0.1V <sub>DD</sub> → 0.9V <sub>DD</sub>			5	nsec
Output Fall Time	T <sub>THL</sub>	CL=15pF, 0.9V <sub>DD</sub> → 0.1V <sub>DD</sub>			5	nsec
Duty Cycle	DUTY	CL=15pF @ V <sub>DD</sub> / 2	45		55	%

## ■ Switching Waveforms

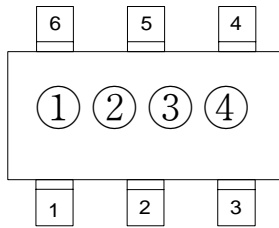


### Ordering Information

XC 2 1 5 1 x x x x x x  
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 a b c d e f g h

DESIGNATOR	DESCRIPTION	DESIGNATOR	DESCRIPTION
a	Supply Voltage : 5 = 5.0V	e	Stand-by Mode and Divider Ratio : 1=f0/1 (CE), 2=f0/2 (CE), 4=f0/4 (CE), 8=f0/8 (CE), 5=f0/1 (OE)
b	Product Series : 1 = Large output capability, fundamental & overtone	f	Fundamental / Overtone Rf, Cg, Cd : (please refer to electrical characteristics tables)
c	Duty Level : A = CMOS (V <sub>DD</sub> /2) & TTL C = CMOS (V <sub>DD</sub> /2) T = TTL	g	Package : M = SOT-26
d	Output Capability : 5 = 10TTL	h	Device Orientation : R = Embossed Tape (orientation of device : right) L = Embossed Tape (orientation of device : left)

### Marking



SOT-26  
(TOP VIEW)

① Represents the Divider Ratio

MARK	RATIO	MARK	RATIO
A	f0/1	C	f0/4
B	f0/2	D	f0/8

② Represents Stand-by Mode, Duty Level & Output Capability

MARK	STAND-BY MODE	DUTY LEVEL	OUTPUT CAPABILITY
5	CE	CMOS (V <sub>DD</sub> /2), TTL	10TTL
6	CE	CMOS (V <sub>DD</sub> /2)	10TTL
7	CE	TTL	10TTL
8	OE	XC2151T=TTL , XC2151C=CMOS	10TTL

③ Represents Fundamental / Overtone and Rf, Cg, Cd

④ Represents the Assembly Lot No.  
(based on internal standards)