

## GENERAL DESCRIPTION

Clock oscillators are devices which generate the pulses to control the timing and operation of logic circuitry. They differ from other components used to control the timing of logic circuits, such as quartz crystals and ceramic resonators, in that clock oscillators need a power supply but no additional external circuitry to operate. Clock oscillators are usually made by combining in a single package a frequency control device such as a quartz crystal, and a hybrid circuit of resistors, capacitors, and either transistors or an integrated circuit. The package is often either a welded steel can or ceramic package hermetically sealed which protects the crystal and electronics from environmental effects and also reduces the unwanted electromagnetic and radio-frequency emissions which oscillators can generate.

## OSCILLATION DEVICES

Various types of circuits can be used to generate timing waveforms for electronic devices. The simplest of these is a simple circuit using capacitors, inductors and an active element such as a transistor or operational amplifier. This is an easy, low cost solution but the frequency is not very stable due to temperature and individual component variations. A more stable circuit would utilize a ceramic resonator, which has the advantage of better frequency tolerance, but resonators are only available in certain frequency ranges and stability of  $\pm 0.5\%$  is the best that can be achieved. If better frequency stability is needed, then the most popular method is to use a circuit which relies on the piezoelectric properties of quartz crystals to stabilize the oscillation.

If an alternating electrical field is applied to a cut and polished quartz crystal, the crystal lattice will deform due

to what is called the piezoelectric effect. At one particular frequency, which is determined by the geometry and size of the crystal, vibration will occur much more easily than at any other frequency. This is called the “resonant” frequency. If an oscillation circuit is built around this crystal, the mechanical vibrations can be used to control the electrical oscillations very precisely.

AVX/Kyocera builds its high quality clock oscillators from the substrate up. The whole module is hermetically sealed into an all-metal welded package to protect it from humidity. The case is directly grounded into a pin to help minimize RF radiation and meet FCC’s EMI specifications.

A full range of clock oscillators are manufactured by AVX/Kyocera. These extend from 1 MHz up to 72 MHz and include TTL and HCMOS compatible drive levels. AVX/Kyocera also offers special low power consumption clocks for long life battery applications. (See chart page 28.) Application specific designs for critical requirements of today’s high-speed, 32-bit microprocessors are available.

## WAVEFORM

The diagram below shows a typical waveform of a clock oscillator with an explanation of the parameters important for correct selection of the appropriate device.

Often called the symmetry of a waveform, duty cycle is a measure of how close to being equal the high and low parts of a waveform are. A perfectly symmetrical waveform will have duty cycle of 50%. We usually specify the minimum and maximum variations of the duty cycle as, for example: 60/40%. This is computed from the times shown on the diagram below as  $A/A+B$ .

Series	Output Frequency (MHz)	Fan Out	Output Level		Features
			V <sub>OH</sub> Min	V <sub>OL</sub> Max	
<b>TTL</b>					
K50 -HC* -C †	8 to 68	50pF	0.9 V <sub>DD</sub>	0.1 V <sub>DD</sub>	CMOS/TTL Drive
KXO -01	8 to 50	10 TTL	2.4	0.4	Cost Performance
KXO -HC* -T (KHO -HC* -T)	1 to 72	10 TTL	2.4	0.4	Versatile Drive Capabilities
<b>HCMOS</b>					
K50 -HC* -C †	8 to 68	50pF	0.9 V <sub>DD</sub>	0.1 V <sub>DD</sub>	CMOS/TTL Drive
K50 -CS* -SE	8 to 50	15pF	V <sub>DD</sub> -0.5	0.5	Low Power Consumption
KXO -HC* -C (KHO -HC* -C)	1 to 72	50 pF	0.9 V <sub>DD</sub>	0.1 V <sub>DD</sub>	Versatile Drive Capabilities
386 -HC	24,32,40,50	7 TTL	0.9V <sub>DD</sub>	0.1 V <sub>DD</sub>	Drives 80386
<b>Low Voltage</b>					
K50 -3C (3.3V)	8 to 68	15pF	0.9 V <sub>DD</sub>	0.1 V <sub>DD</sub>	Low Supply Voltage

†Will also drive TTL. See catalog for details – page 31.

Cordless & Cellular Phones	Frequency (MHz)	Output	Features
Temperature Compensated			
KT11	12.8, 13.0, 14.4, 14.85, 15.36, 16.8, 19.2	1Vp-p/10k /10pF	Surface Mount
KT12	12.8, 13.0, 14.4, 16.8, 19.2, 19.68	1Vp-p/10k /10pF	Miniature Surface Mount
KT14	13.0, 14.4, 14.85, 16.8, 19.2, 19.44, 19.68, 19.8	1Vp-p/10k /10pF	Ultra Low Profile Surface Mount
VCO	200~2000		High Performance Surface Mount

# AVX/Kyocera Clock Oscillators

## GENERAL DESCRIPTION continued

### CLOCK OSCILLATOR APPLICATIONS

In a typical personal computer system 5 or 6 clock oscillators may be used in the main processing unit, for all the add-on boards, video graphics adapters, co-processors, etc., and all the peripheral devices such as printers, modems and networking equipment. Many different companies may be involved in the manufacture of all these individual parts of the system.

The telecommunications industry uses clock oscillators in fax machines, cellular phones, pagers, and radio systems. These oscillators are typically very high precision, temperature compensated and voltage controlled devices.

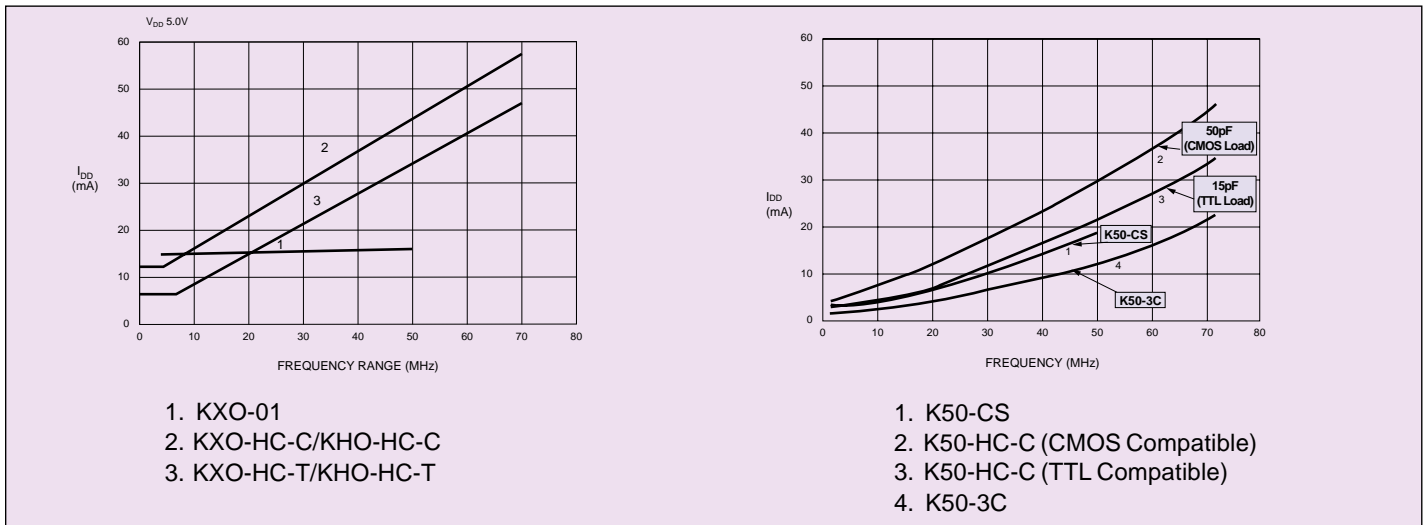
Clock oscillators are manufactured by combining a quartz crystal into a hybrid module containing passive components and active digital devices.

AVX/Kyocera builds its high quality clock oscillators from the substrate up. The whole module is hermetically sealed into an all-metal welded package to protect it from humidity. The case is directly grounded to a pin to help minimize RF radiation and meet FCC's EMI specifications.

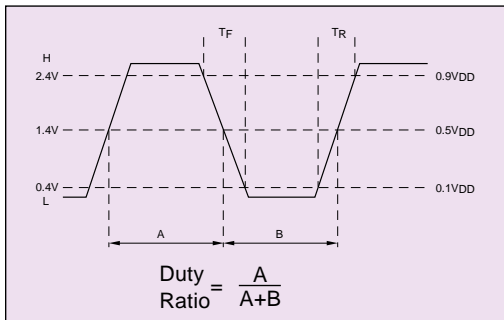
### PACKAGING

The diagrams below show the basic design of the 14 pin and 8 pin DIP (dual inline packages) and ceramic SMT packages in which most of the clock oscillators are available. Leaded oscillators are tube packaged. SMT K50 units are tape and reel packaged 1000 units per reel. Tube packages hold 25 units each for the KXO-01 and KXO-HC series, and 40 units each for the KHO-HC series products.

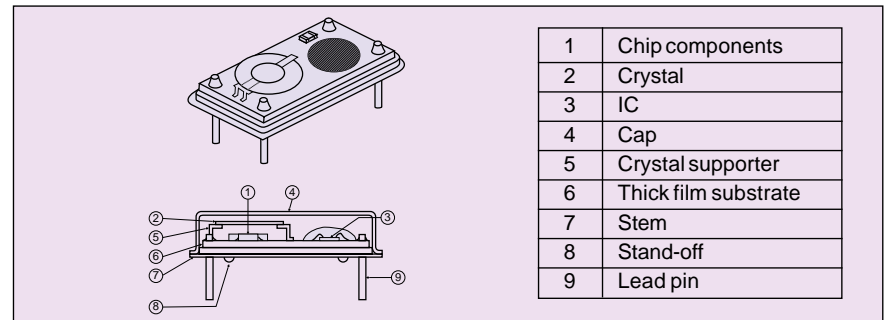
## FREQUENCY vs. POWER SUPPLY CURRENT



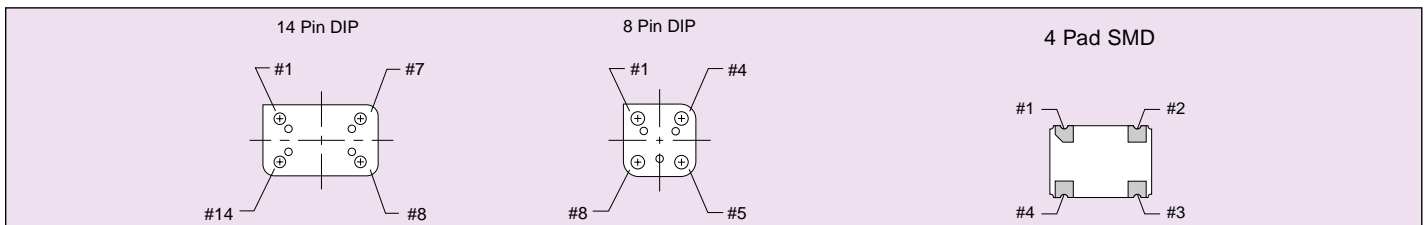
## OUTPUT WAVEFORM



## CLOCK OSCILLATOR GENERAL CONSTRUCTION



## PACKAGES



# AVX/Kyocera Crystal Clock Oscillators

## MECHANICAL

Readings to be made one hour after completion of test.

**Shock Resistance** - Drop module onto a hard wooden surface from a height of 50cm, three times. Unit must meet initial electrical requirements after test.

**Vibration Resistance** - Vibrations with an amplitude of 1.5mm and a sweep between 10 and 55Hz of 1 minute shall be applied for 2 hours in each of the X, Y, and Z axes for a total test time of 6 hours. Unit must meet initial electrical requirements after test.

**Pin Pull and Bend** - A load of 1kg shall be applied for 30 seconds in the direction of each pin. The pin will withstand without damage a bend from its base of 90° in one direction twice. Unit must meet initial electrical requirements after test.

**Solvent Resistance** - After immersion in Freon TF, Freon TE or IPA Liquid, at 25±5°C for a period of 10 minutes, unit shall meet initial electrical requirements.

**Ultrasonic Resistance** - Unit shall withstand ultrasonic washing at 28 to 31kHz and 300 watts per 20 liters of fluid in either Freon TF, Freon TE or IPA for up to 30 seconds without damage.

## ENVIRONMENTAL

Readings to be made two hours after completion of test.

**Soldering Heat** - Immerse pin to within 1mm of the glass stand-off in a solder bath of 280±10°C for 10 seconds. Unit shall meet initial electrical requirements after test.

**Heat Resistance** - After exposure to +85°C for 500 hours, frequency change shall be within ±10ppm of initial value.

**Cold Resistance** - After exposure to -40°C for 500 hours, unit must meet initial electrical requirements.

**Humidity Resistance** - After exposure to +85°C and 85% RH for 500 hours, unit must meet initial electrical requirements and show no significant rusting.

**Thermal Shock** - After 15 cycles of immersions in baths of 100°C and 0°C for 5 minutes with transfer times within 10 seconds, units will meet initial electrical requirements.

**Hermeticity** - Helium leak detector test should be performed under  $5 \times 10^{-7}$  atm, and measured after application of 10kg/sq cm of pressure for three hours and exposure to air for 30 minutes. No air bubbles shall be found when immersed in 75°C water for 5 minutes.

## AVX/Kyocera Crystal Clock Oscillator



# K50-HC-C Series Miniature SMT Crystal Clock Oscillators

**HCMOS Compatible**

**$f_o$ : 8 to 68 MHz**

**Features:**

- 1) Miniature SMT ceramic package
- 2) Frequency: 8~68MHz
- 3) Stability: 100ppm, 50ppm
- 4) Load: 50pF maximum
- 5) Tristate output inhibit
- 6) Hermetically sealed package
- 7) 1000 pieces per reel
- 8) Sold in increments of 1000 pieces

**How to Order**

**K50-HC 1 CS E 40.0000M R**

- ①      ②      ③      ④      ⑤      ⑥

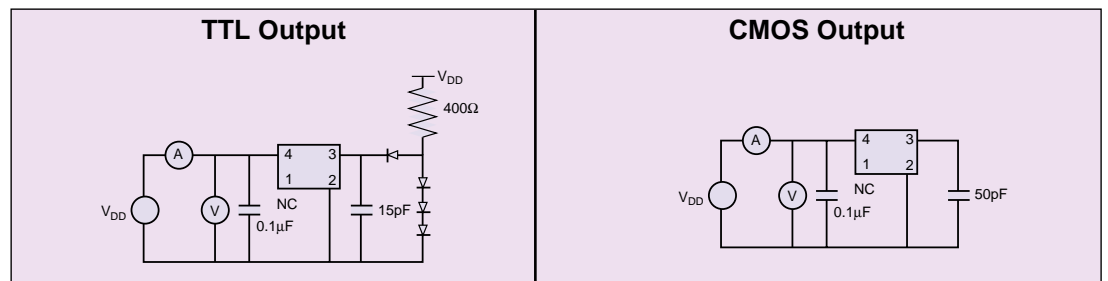
- ① Type: (K50-HC series)
- ② Stability: 1-100ppm, 0-50ppm
- ③ Output compatibility:  
CS = CMOS 45/55 duty cycle @ 50%  $V_{DD}$   
CS = TTL 40/60 duty cycle @ 1.4 volts
- ④ Tristate output: E with function
- ⑤ Frequency (MHz)
- ⑥ Packaging: R=Tape and reel



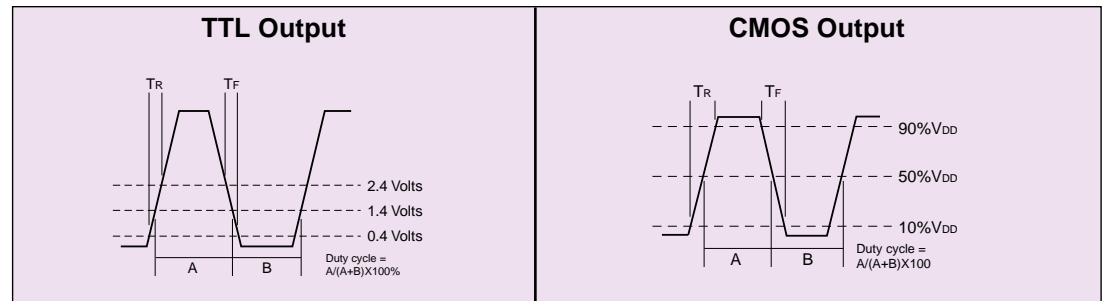
**SPECIFICATIONS (K50-HC)**

Parameters	Code	TTL Output		CMOS Output		Unit
		Rating	Remarks	Rating	Remarks	
Output Frequency	$f_{OUT}$	8~68		8~68		MHz
Frequency precision	$\Delta f/f$	1=100, 0=50	-10 to 70°C, $V_{DD}=5\pm 0.5V$	1=100, 0=50	-10 to 70°C, $V_{DD}=5\pm 0.5V$	ppm
Operating temp.	$t_{OPR}$	-10 to +70		-10 to +70		°C
Storage temp.	$t_{STOR}$	-55 to +125		-55 to +125		°C
Supply voltage	$V_{DD}$	5 ±0.5		5 ±0.5		V
Supply current	$I_{DD}$	40 max @ 10TTL/15pF	25°C, 50MHz	50 max @ 50pF	25°C, 50MHz	mA
Duty cycle	$S_Y$	40/60	at 1.4 volts	45/55	@50% $V_{DD}$	%
Output "0" level	$V_{OL}$	0.4max	@ $I_{OL} = 16mA$	0.5max	@ $I_{OL} = 16mA$	V
Output "1" level	$V_{OH}$	2.4min	@ $I_{OH} = -1mA$	$V_{DD}-0.5min$	@ $I_{OH} = -1mA$	V
Rise / Fall time	$T_R/T_F$	5max	0.4V-2.4V	10max	10-90% $V_{DD}$ , 50pF	nS
Load		$f_o \leq 50MHz = 50pF$ $f_o > 50MHz = 15pF$		$f_o \leq 50MHz = 50pF$ $f_o > 50MHz = 15pF$		
Enable/disable time		100max		100max		nS
Aging rate		±5max		±5max		ppm/y
Input voltage-high	$V_{IH}$	2.2min		2.2min		V
Input voltage-low	$V_{IL}$	0.8max		0.8max		V

**TEST CIRCUIT**



**OUTPUT WAVEFORM**



# K50-3C Series Miniature SMT Crystal Clock Oscillators

3.3 Volt

$f_o$ : 8 to 68 MHz

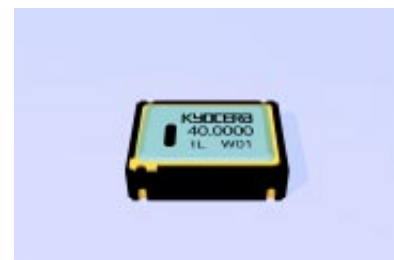
## Features

- 1) 3.3 volt operation
- 2) Tristate output inhibit and oscillation shutdown to reduce power supply current draw
- 3) Miniature SMT ceramic package
- 4) Frequency: 8 to 68MHz
- 5) Stability: 100ppm
- 6) Load: up to 15pF
- 7) Hermetically sealed package
- 8) 1000 pieces per reel
- 9) Sold in increments of 1000 pieces

## How to Order

**K50-3C 1 E 40.0000M R**

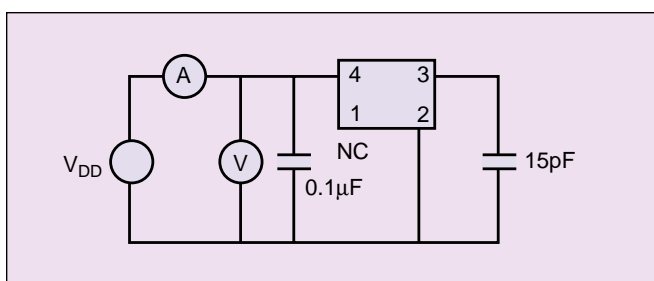
- ① Type: (K50-3C series)  
 ② Stability: 1-100ppm  
 ③ Tristate o/p and shutdown: E with function  
 ④ Frequency (MHz)  
 ⑤ Packaging: R=Tape and reel



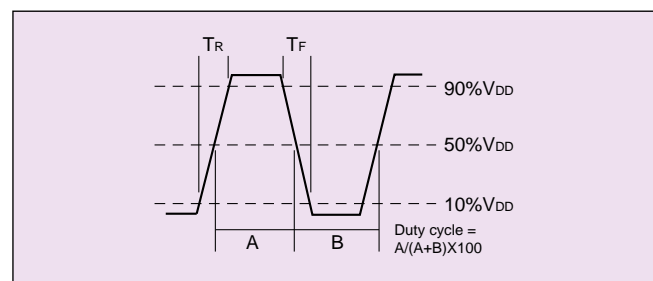
## SPECIFICATIONS (K50-3C)

Parameters	Code	Rating	Unit	Remarks
Output Frequency	$f_{OUT}$	8 to 68	MHz	
Frequency precision	$D_{F/F}$	1=100, 0=50	ppm	-10 to 70°C, $V_{DD}=3.3\pm 10\%$
Operating temp	$t_{OPR}$	-10 to +70	°C	
Storage temp	$t_{STOR}$	-55 to +125	°C	
Supply voltage	$V_{DD}$	3.3 $\pm 10\%$	V	
Supply current <sub>(1)</sub>	$I_{DD(1)}$	25 max @ 15pF	mA	25°C, 68MHz
Supply current <sub>(2)</sub>	$I_{DD(2)}$	100 max	$\mu A$	Oscillation shutdown (pad #1= low, pad #3=high imp.)
Duty cycle	$S_Y$	40/60	%	@50% $V_{DD}$
Output "0" level	$V_{OL}$	10% $V_{DD}$ max	V	@15pF load
Output "1" level	$V_{OH}$	90% $V_{DD}$ min	V	@15pF load
Rise / Fall time	$T_R/T_F$	10max	nS	10%-90% $V_{DD}$ , 15pF
Load		15max	pF	or 5LSTTL
Enable/disable time		5	mS	8.0000 to 32.0000MHz
		150max	nS	32.0001 to 50.0000MHz
		5	mS	50.0001 to 68.0000MHz
Aging rate		$\pm 5$ max	ppm/y	
Input voltage-high	$V_{IH}$	2.0min	V	$V_{DD} = 3.3V$ , $I_{IH} = 10\mu A$
Input voltage-low	$V_{IL}$	0.5max	V	

## TEST CIRCUIT



## OUTPUT WAVEFORM



# K50-CS Series Miniature SMT Crystal Clock Oscillators

Low Power Consumption

$f_o$ : 8 to 50 MHz

## Features

- 1) Miniature SMT ceramic package
- 2) Low power consumption
- 3) Frequency: 8-50MHz
- 4) Stability: 100ppm, 50ppm
- 5) Load: 15pF
- 6) Tristate output inhibit
- 7) Hermetically sealed package
- 8) 1000 pieces per reel
- 9) Sold in increments of 1000 pieces

## How to Order

**K50-CS 1 S E 40.0000M R**

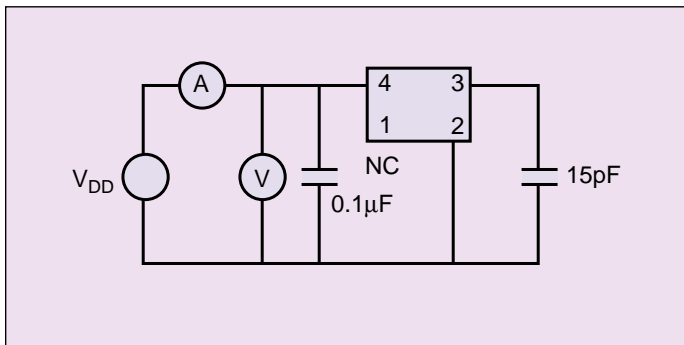
- ① ② ③ ④ ⑤ ⑥
- ① Type: (K50-CS series)
  - ② Stability: 1-100ppm, 0-50ppm
  - ③ Duty cycle: S-45/55
  - ④ Tristate o/p: E with function
  - ⑤ Frequency
  - ⑥ Packaging: R=Tape and reel



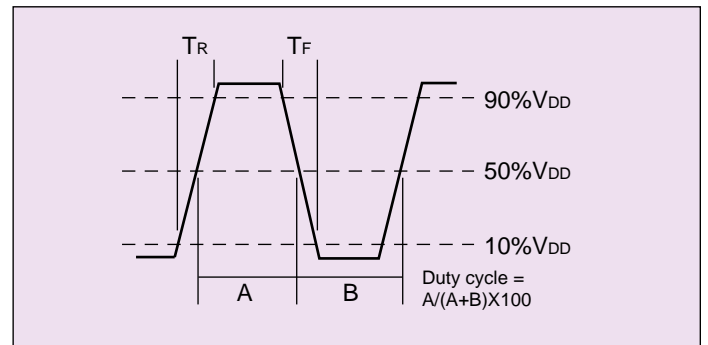
## SPECIFICATIONS (K50-CS)

Parameters	Code	Rating	Unit	Remarks
Output Frequency	$f_{OUT}$	8 to 50	MHz	
Frequency precision	$\Delta f/f$	1=100, 0=50	ppm	-10 to 70°C, $V_{DD}=5\pm 0.5V$
Operating temp	$t_{OPR}$	-10 to +70	°C	
Storage temp	$t_{STOR}$	-55 to +125	°C	
Supply voltage	$V_{DD}$	$5 \pm 0.5$	V	
Supply current	$I_{DD}$	30 max @ 15pF	mA	25°C, 50MHz
Duty cycle	$S_Y$	45/55	%	@50% $V_{DD}$
Output "0" level	$V_{OL}$	$0.1V_{CC}$ max	V	@ $I_{OL} = 4.0mA$
Output "1" level	$V_{OH}$	$0.9V_{CC}$ min	V	@ $I_{OH} = -4.0mA$
Rise / Fall time	$T_R/T_F$	10max	nS	$0.1V_{CC}-0.9V_{CC}$
Load		15max	pF	
Enable/disable time		100max	nS	
Aging rate		$\pm 5$ max	ppm/y	
Input voltage-high	$V_{IH}$	2.2min	V	
Input voltage-low	$V_{IL}$	0.8max	V	

## TEST CIRCUIT



## OUTPUT WAVEFORM



# K50 Series Miniature SMT Clock Oscillators

## Ceramic Package

### DIMENSIONS

Pad #	Function
1	Output Disable*
2	GND/ Case GND
3	Output
4	+VDD

\*Logic "0" disables o/p

\*Marking: \*1) 1 = 100ppm, 0 = 50ppm. \*2) A = CS-E, B = HC-CSE, L = 3C-LE (3.3 volt)

Units: mm (inches)

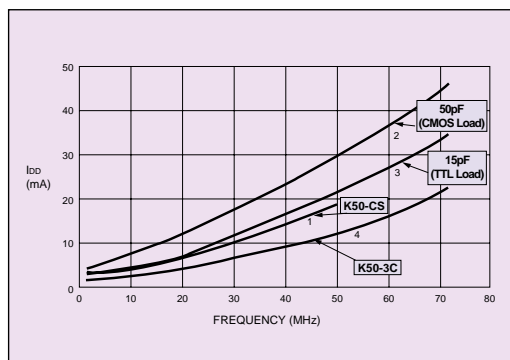
### SOLDERING

#### Suggested IR Reflow Profile

#### Suggested Solder Pad Layout

Units: mm (inches)

### FREQUENCY VS. POWER SUPPLY CURRENT



### ENABLE/DISABLE FUNCTION CHART

K50-HC-C, K50-CS Series		K50-3C-L Series	
#1 Pad	#3 Pad	#1 Pad	#3 Pad
High or Open	Oscillation	High	Oscillation
Low	High Impedance	Low	High Impedance Oscillation Stops

### PACKAGING

#### Reel Dimensions

Detail of Hub

#### Embossed Carrier Tape Dimensions

Units: mm (inches)

# KT11 Series SMT Crystal Clock Oscillators

## Temperature Compensated

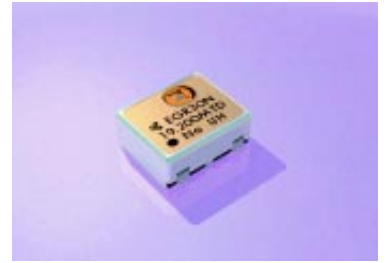
### FEATURES

- 1) Frequency adjustment free after reflow soldering process
- 2) Ultra miniature type (11X9X4mm)
- 3) AFC function available (option)
- 4) 3V/5V drive available
- 5) 1000 pieces per reel
- 6) Sold in increments of 1000 pieces

### HOW TO ORDER

**KT11 - E G R 30 N - 19.200M T**

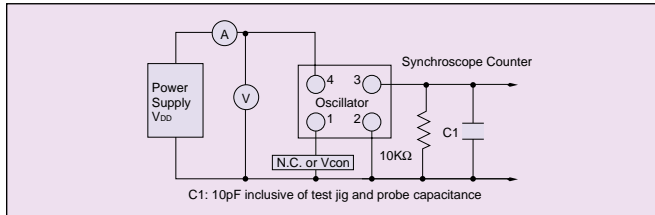
- ① ② ③ ④ ⑤ ⑥ ⑦ ⑧
- ① Type
  - ② Frequency precision: D=±2ppm, E=±2.5ppm, K=±5ppm
  - ③ Lower temperature limit: C=-30°C; E=-20°C, G=-10°C
  - ④ Upper temperature limit: R=60°C; T=70°C; V=80°C
  - ⑤ Supply voltage: 30=3.0V; 50=5.0V
  - ⑥ AFC function; V=with; N=without; L=with (trimmerless)
  - ⑦ Frequency: See table below.
  - ⑧ Packaging: T=Tape and reel



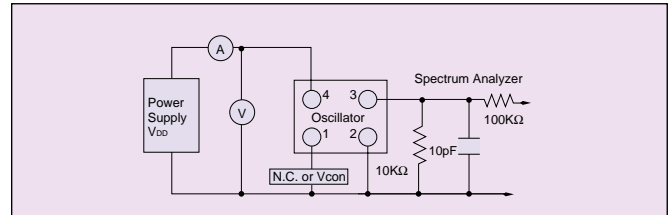
### SPECIFICATIONS

<b>Frequency</b>	19.200MHz/PHS	12.8, 13.0, 14.4, 14.85, 15.36, 15.9, 16.8MHz/Cellular
<b>V<sub>DD</sub></b>	3V±5%	3V or 5V±5%
<b>Output (10k /10pF)</b>	1.0Vp-p min.	1.0Vp-p min.
<b>Current consumption (no load)</b>	2.0mA max.	2.0mA max.
<b>Frequency stability (Δf/fa)</b>	<b>Temperature</b>	±2.5ppm (-10~+60°C)
	<b>Load (10pF/10kΩ ±10%)</b>	±0.2ppm max. (-30~+80°C)
	<b>Voltage (3.0V ±5%)</b>	±0.3ppm max.
<b>Trimmer adjustment (Δf/fa)</b>	±3.0ppm min.	±3.0ppm min.
<b>Voltage control (1.5V±1.0V)Δf/V</b>	±4~±8ppm (±30ppm:Trimmerless type)	±4~±8ppm (±30ppm:Trimmerless type)
<b>Spurious ratio</b>	-3dBc max.	-3dBc max.
<b>Aging</b>	±1.0ppm / y max.	±1.0ppm / y max.

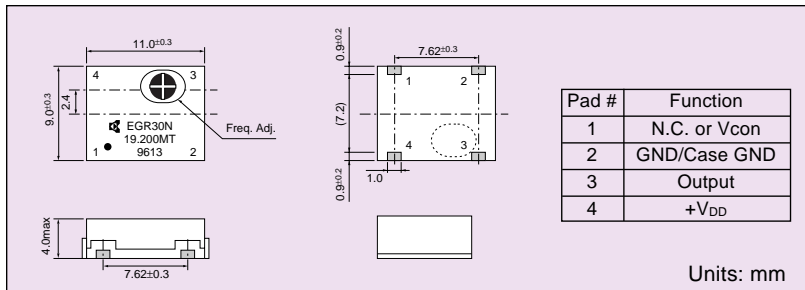
### TEST CIRCUIT (EXCEPT FOR HARMONIC)



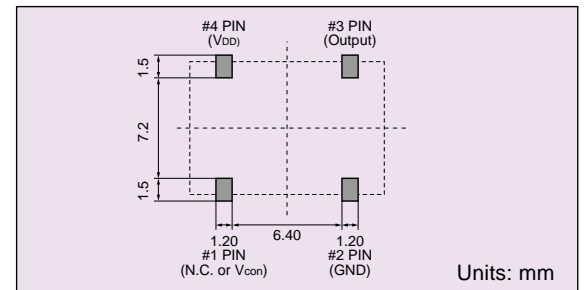
### TEST CIRCUIT (HARMONIC)



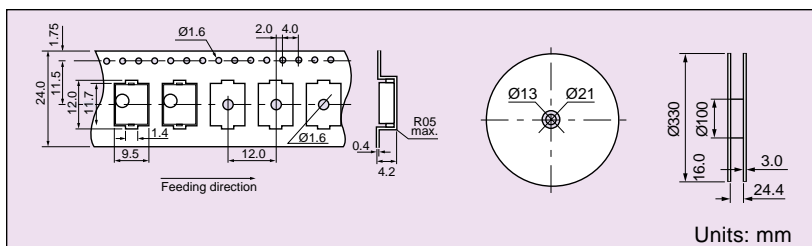
### DIMENSIONS



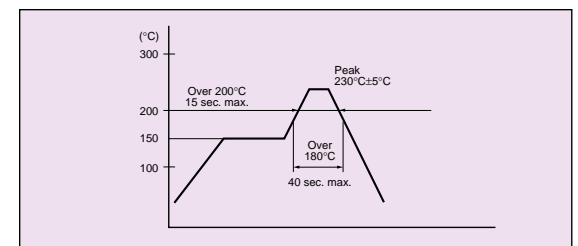
### RECOMMENDED PAD LAYOUT



### TAPING DIMENSIONS



### RECOMMENDED REFLOW PROFILE





# KT12 Series SMD Crystal Clock Oscillators

## Temperature Compensated

### FEATURES

- 1) Miniature SMD type (11.6x9.6x2.3mm)
- 2) Frequency adjustment free after reflow soldering process
- 3) AFC function available (option)
- 4) 3V/5V drive available
- 5) Frequency stability:  $\pm 2$ ppm at  $-30 \sim +80^\circ\text{C}$
- 6) 2000 pieces per reel
- 7) Sold in increments of 2000 pieces

### HOW TO ORDER

**KT12**  - **D C V 33 V** - **19.680M T**

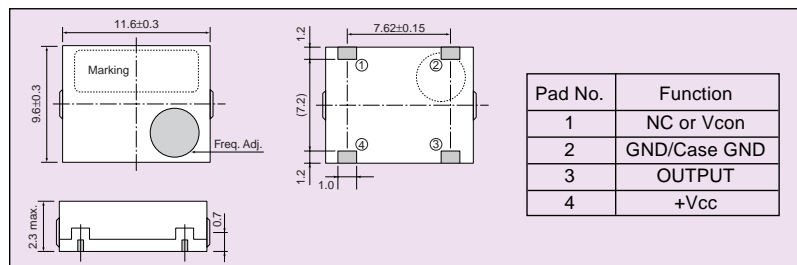
- ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
- ① Type
  - ② Terminals: Blank ()=4 terminals, A=6 terminals, B=8 terminals
  - ③ Frequency stability: D= $\pm 2$ ppm, E= $\pm 2.5$ ppm, K= $\pm 5$ ppm
  - ④ Lower operating temp.: C= $-30^\circ\text{C}$ ; E= $-20^\circ\text{C}$ , G= $-10^\circ\text{C}$
  - ⑤ Upper operating temp.: R= $60^\circ\text{C}$ ; T= $70^\circ\text{C}$ ; V= $80^\circ\text{C}$
  - ⑥ Supply voltage: 30=3.0V; 50=5.0V
  - ⑦ AFC function; V=with; N=without; L=with (trimmerless)
  - ⑧ Frequency: See table below
  - ⑨ Packaging: T= Tape and reel



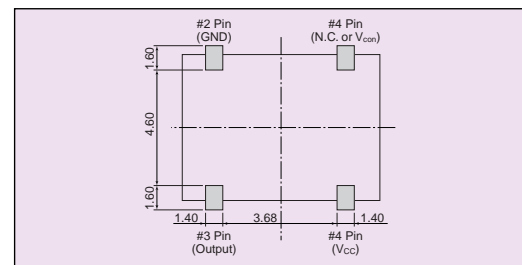
### SPECIFICATIONS

Parameters	Code	Specification		Unit	Remarks
		PHS	Cellular		
Supply Voltage	Vcc	3.0V $\pm 5\%$	3.0V $\pm 5\%$ 5.0V $\pm 5\%$	V	
Output Frequency	Fout	19.200	19.680   19.200 16.800   14.400 13.000   12.800	MHz	—
Operating Temp.	Topr	-10 ~ 60	-30 ~ 80 max.	$^\circ\text{C}$	—
Storage Temp.	Tstr	-20 ~ 70	-40 ~ 85	$^\circ\text{C}$	—
Frequency Stability	f/fo	$\pm 2.5$ max.	$\pm 2.0$ max. $\pm 2.5$ max.	ppm	vs. Temp. (After Reflow) vs. Load vs. Voltage
Aging Rate	Aging		$\pm 1.0$ max.	ppm/year	1 Year
Output Voltage	Vout		1.0 min.	Vp-p	Load 10k /10pF
Supply Current	Icc		2.0 max.	mA	—
Trimmer Control Range	f/C		$\pm 3.0$ min.	ppm	Internal Trimmer
Voltage Control Range	f/V		ex: $\pm 4.0 \sim \pm 8.0$	ppm	1.5V $\pm 1$ V, 2.5 $\pm 1$ V
Harmonics	—		-3.0 max.	dBc	—

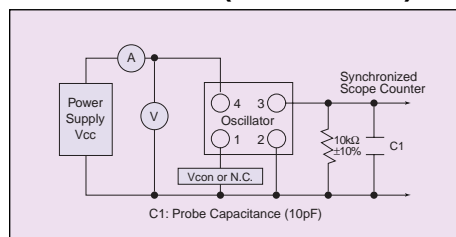
### DIMENSIONS



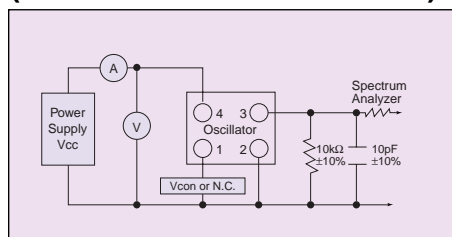
### RECOMMENDED LAND PATTERN



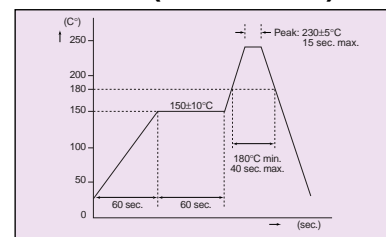
### TEST CIRCUIT (AMPLITUDE)



### TEST CIRCUIT (HARMONICS & FREQUENCY)



### RECOMMENDED REFLOW PROFILE (IR REFLOW)



# KT14 Series SMD Crystal Clock Oscillators

## Temperature Compensated

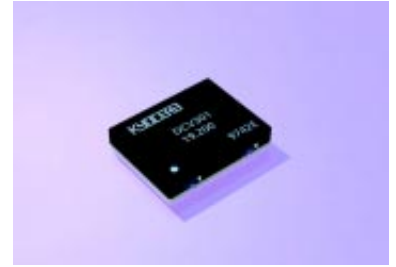
### FEATURES

- 1) Ultra low profile SMD type (9.0x7.0x1.7mm)
- 2) Frequency adjustment free after reflow soldering process
- 3) AFC function available (option)
- 4) 2.8, 3.0, 3.3V drive available
- 5) 2000 pieces per reel
- 6) Sold in increments of 2000 pieces

### HOW TO ORDER

## KT14 - E C T 28 L - 19.440 M T

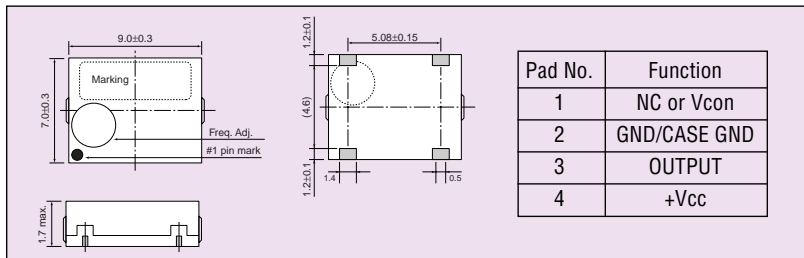
- ① ② ③ ④ ⑤ ⑥ ⑦ ⑧
- ① Type
  - ② Frequency stability: D=±2ppm, E=±2.5ppm, K=±5ppm
  - ③ Lower operating temp.: C=-30°C; E=-20°C, G=-10°C
  - ④ Upper operating temp.: R=60°C; T=70°C; V=80°C
  - ⑤ Supply voltage: 28=2.8V; 50=3.0V
  - ⑥ AFC function; V=with; N=without; L=with (trimmerless)
  - ⑦ Frequency: See table below.
  - ⑧ Packaging: T=Tape and reel



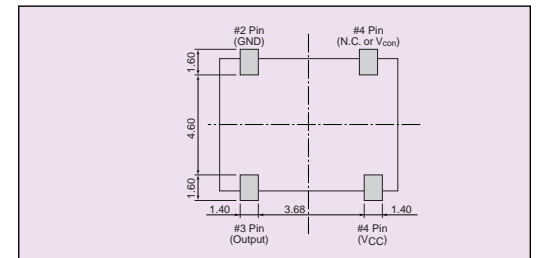
### SPECIFICATIONS

Parameters	Code	Specification		Unit	Remarks	
		PHS	Cellular			
Supply voltage	Vcc	2.8V±5%	2.8V±5%	V	—	
			3.0V±5%			
			3.3V±5%			
Output Frequency	Fout	19.200	13.000	14.400	MHz	—
			14.850	16.800		
			19.200	19.440		
			19.680	19.800		
Operating Temp.	Topr	-10 ~ 60	-30 ~ 80 max.		°C	—
Storage Temp.	Tstr	-20 ~ 70	-40 ~ 85		°C	—
Frequency Stability	f/fo	±2.5 max.	±2.0 max.		ppm	vs. Temp. (After Reflow)
			±2.5 max.			
			vs. Load			
Aging Rate	Aging	±1.0 max.	—		ppm/year	1 Year
Output Voltage	Vout	1.0 min.		Vp-p	Load 10K /10pF	
Supply Current	Icc	2.0 max.		mA	No Load	
Trimmer Control Range	f/C	±3.0 min.	—		ppm	—
Voltage Control Range	f/V	—	ex: ±8.0 ~ ±15.0		ppm	1.5V±1V, 2.5±1V
Harmonics	—	-3.0 max.		dBc	—	

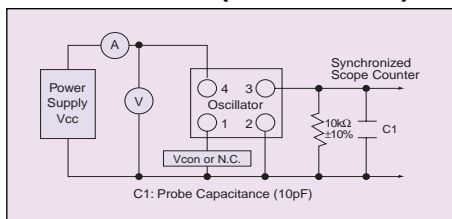
### DIMENSIONS



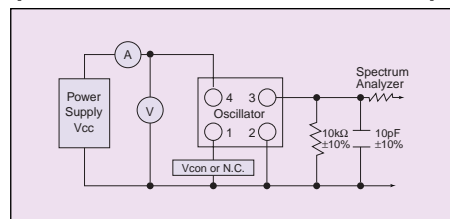
### RECOMMENDED LAND PATTERN



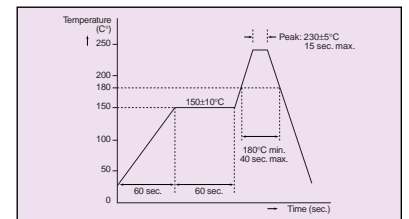
### TEST CIRCUIT (AMPLITUDE)



### TEST CIRCUIT (HARMONICS & FREQUENCY)



### RECOMMENDED REFLOW PROFILE (IR REFLOW)



# Voltage Control Oscillator

## VK Series - Surface Mount

$f_o$ : 100 to 700 MHz

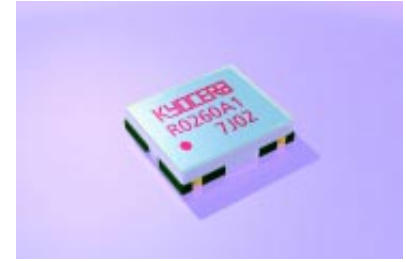
### FEATURES

- 1) Covers UHF band
- 2) For PDC mixing and PHS 2nd local
- 3) Available 2.2V, 3mA typ.
- 4) Small (9x7mm)
- 5) Low profile (2.00mm max.)
- 6) 2000 pieces per reel
- 7) Sold in increments of 2000 pieces

### HOW TO ORDER

## VK - 120 R 0130 A1 W

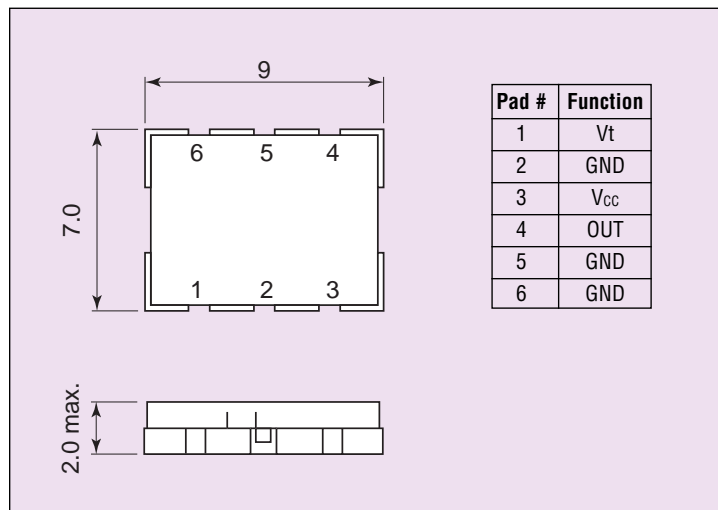
- ① ② ③ ④ ⑤ ⑥
- ① Series: VK=100~700MHz
  - ② Dimensions: 120=9x7mm
  - ③ Applications: R=RX
  - ④ Frequency: 0130=130MHz
  - ⑤ Individual specification
  - ⑥ Packaging: W = Tape and reel



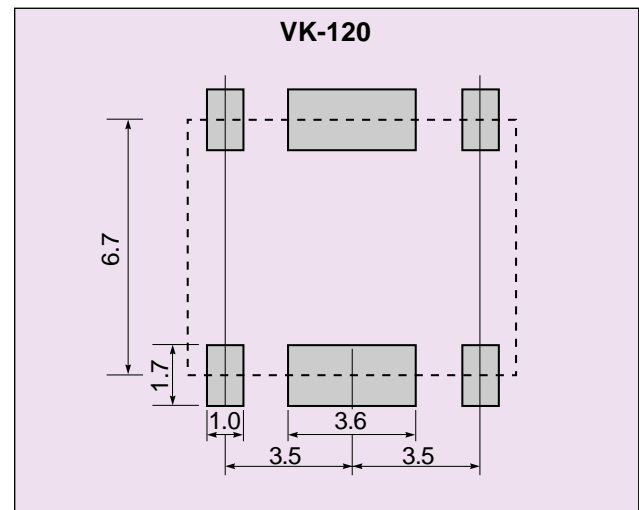
### SPECIFICATIONS

Parameters	Specifications	Unit	Condition
Supply Voltage	2.2±0.2	V	—
Current Consumption	4.0	mA	Ta=25±5°C Vcc=2.2±0.05[V]
Frequency	129.545	MHz	Vt=0.5 ~ 2.5V
Output Level	-3±3	dBm	Ta=25±5°C Vcc=2.2±0.05[V]
Tuning Voltage Sensitivity	2.5±1.0	MHz/V	[f(2.5) - f(0.5)]/2.0
C/N (Phase Noise)	70	dBc	off-set 25kHz 16kHz B.W.
PSU Stability	±200	kHz	Vcc=2.2V ±0.2V
Temperature Stability	±1	MHz	-20 ~ +70°C @25°C
Pulling Stability	±200	kHz	VSWR=2 All phase
Spurious Level	-10	dBc	Reference is fundamental, Harmonics Level
Operating Temp. Range	-20 ~ 70	°C	—

### DIMENSIONS and PAD CONNECTION



### RECOMMENDED LAND PATTERN



# Voltage Control Oscillator

## EK Series - Surface Mount

$f_o$ : 700 to 1300 MHz

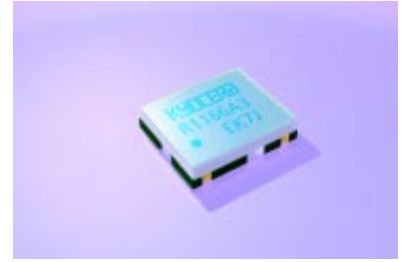
### FEATURES

- 1) High reliability construction
- 2) Reflow soldering available
- 3) High performance for C/N and S/N
- 4) 2000 pieces per reel
- 5) Sold in increments of 2000 pieces

### HOW TO ORDER

## EK - 304 R 0972 AA W

- ① ② ③ ④ ⑤ ⑥
- ① Series: EK=700~1300MHz
  - ② Dimensions
  - ③ Applications: R=RX
  - ④ Frequency: 0927=927MHz
  - ⑤ Individual specification
  - ⑥ Packaging: W = Tape and reel

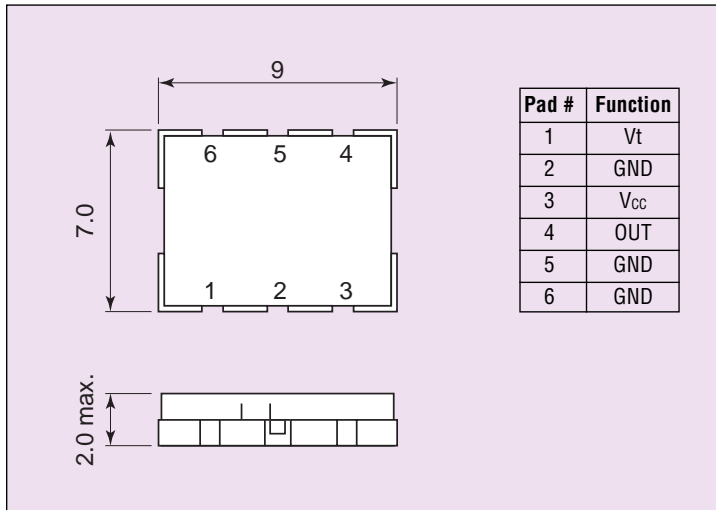


### SPECIFICATIONS

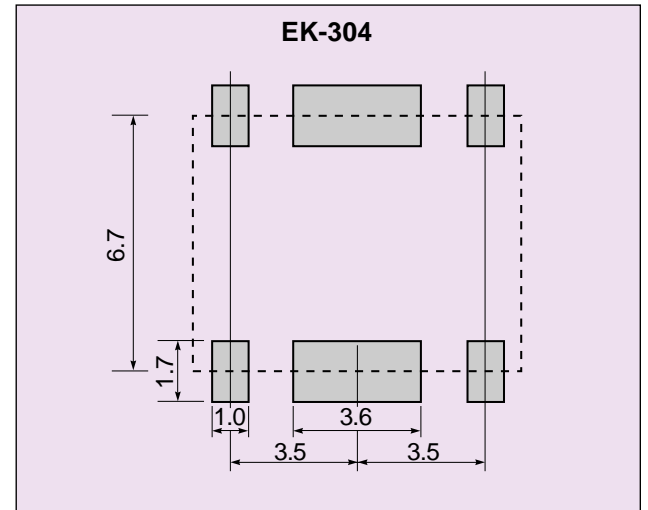
Type		Frequency (MHz)	Part No.	Specifications (Ta=25°C)					
System	Module			V <sub>cc</sub> (V)	I <sub>cc</sub> (mA)	P <sub>o</sub> (DBM)	F <sub>TU</sub> (MHZ/V)	C/N (dBc)	T <sub>OP</sub> (°C)
N-TACS	RX	765 ~ 800	EK-304R0783A1	3 ±0.2	9 max.	-1±3	23±3	65 min. (12.5kHz off BW 8kHz)	-20 ~ 70
PDC		1069~ 1090	EK-304R1080A1	2.2 ±0.2	6 max.	-3±3	25±3	70 min. (50kHz off BW21kHz)	-20~ 80
AMPS		914~939	EK-304R0927A9	2.55 ±0.05	12 max.	+3±2	14±2	108 min. (20kHz off)	-30~ 85
PCS		1310 ~ 1393	EK-304R1352A2	2.8 ±0.1	10 max.	-6 min.	39±4	100 min. (25kHz off)	-10 ~ 75
GSM		1006~ 1031	EK-304R1019A6				15±3		-20~ 75
PDC		780 ~ 841	EK-304R0811A1	2.2 ±0.2	8 max.	-1±3	46±7	67 min. (50kHz off 21kHz BW)	-30 ~ 85

V<sub>cc</sub>: Power supply, I<sub>cc</sub>: Current consumption, P<sub>o</sub>: Output level, F<sub>TU</sub>: Tuning voltage sensitivity, T<sub>OP</sub>: Operating temperature range

### DIMENSIONS and PAD CONNECTION



### RECOMMENDED LAND PATTERN



# Voltage Control Oscillator

## YK Series - Surface Mount

$f_o$ : 700 to 1600 MHz

### FEATURES

- 1) SMD type
- 2) Covers 700~1600Mhz band
- 3) Small (7.8X6.0mm),  
Low Profile (2.00mm max.)
- 4) 2000 pieces per reel
- 5) Sold in increments of 2000 pieces

### HOW TO ORDER

**YK - 501 R 1171 A1 W**

- ① ② ③ ④ ⑤ ⑥
- ① Series: YK=700~1600MHz
  - ② Dimensions
  - ③ Applications: R=RX
  - ④ Frequency: 1171=1171MHz
  - ⑤ Individual specification
  - ⑥ Packaging: W=Tape and reel

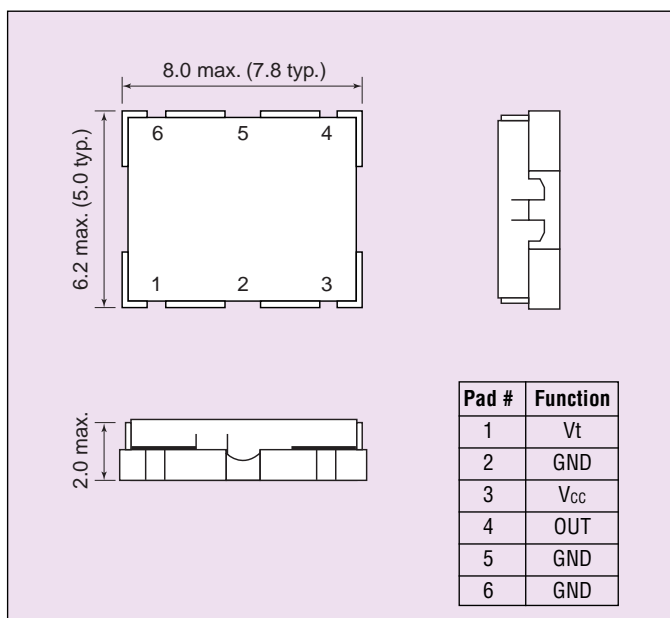


### ELECTRICAL CHARACTERISTICS

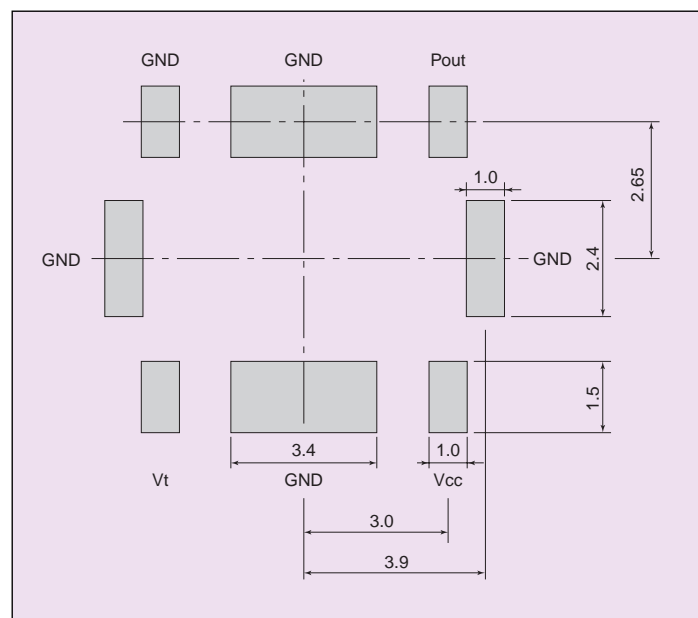
Parameters	Specifications	Unit	Condition
Supply Voltage	2.6±0.1	V	—
Current Consumption	8.0	mA	Ta=25±5°C Vcc=2.5±0.05[V]
Frequency	1136 ~ 1206	MHz	Vt=0.3 ~ 2.4[V]
Output Level	-6	dBm	Ta=25±5°C Vcc=2.5±0.05[V]
Tuning Voltage Sensitivity	46±7	MHz/V	[f(2.4)-f(0.3)] / 2.1
C/N (Phase Noise)	98	dBc/Hz	off set 25kHz 1Hz B.W.
PSU Stability	±1000	kHz	Vcc=2.6V ±0.1V
Temperature Stability	±3	MHz	-10 ~ 60°C ref 25°C
Pulling Stability	±1.5	MHz	VSWR=2 All Phase
Spurious Level	-10	dBc	Reference is fundamental
Operating Temp Range	-10 ~ 60	°C	—

\*Covering frequency range is between 700MHz ~ 1600MHz

### DIMENSIONS and PAD CONNECTION



### RECOMMENDED LAND PATTERN



# Voltage Control Oscillator

## RK Series - Surface Mount

$f_o$ : 1.3 to 2.0 GHz

### FEATURES

- 1) Ultraminiature size based on low temperature co-firable laminated substrate technology
- 2) Printed conductive line on inner layer contributes to ultra high density mounting
- 3) Reflow soldering available
- 4) 2000 pieces per reel
- 5) Sold in increments of 2000 pieces

### HOW TO ORDER

## RK - 405 R 1668 A1 W

- ① ② ③ ④ ⑤ ⑥
- ① Series: RK=1300~2000MHz
  - ② Dimensions
  - ③ Applications: R=RX
  - ④ Frequency: 1668=1668Mhz
  - ⑤ Individual specification
  - ⑥ Packaging: W=Tape and reel

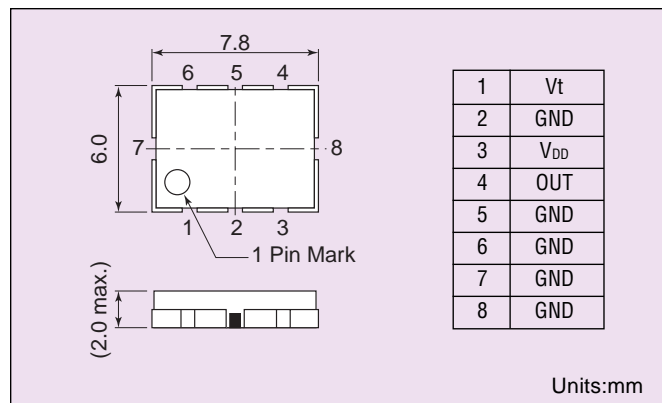


### ELECTRICAL CHARACTERISTICS

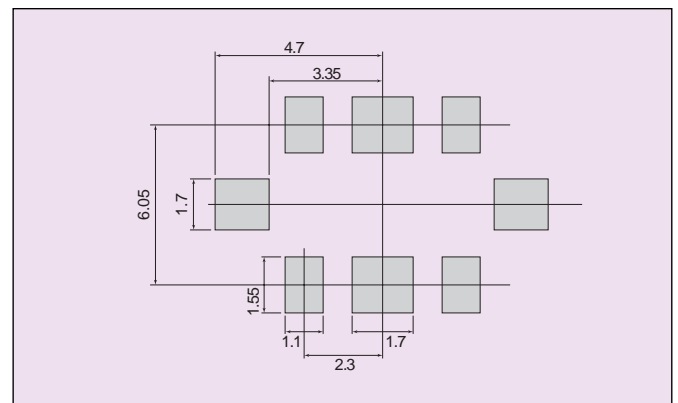
Type		Frequency (MHz)	Part No.	Specifications (Ta=25°C)						
System	Module			Vcc (V)	Icc (mA)	Po (dBm)	f <sub>tu</sub> (MHz/V)	C/N		Top (°C)
								Min	Typ	
PHS	RX	1647 ~ 1669	RK-405R1658	3.0 ±0.15	6.5 max.	-1±3	24±5 Vt=0.5 ~ 2.5V	123 min (600kHz off)	128	-20°C ~ +60°C
PHS	RX	1651 ~ 1685	RK-405R1668	3.0 ±0.15	6.5 max.	-1±3	31±6 Vt=0.5 ~ 2.5V	123 min. (600kHz off)	127	-20°C ~ +60°C

Vcc: Power supply, Icc: current consumption, Po: Output level, f<sub>tu</sub>: tuning voltage sensitivity, Top: Operation temperature

### DIMENSIONS and PAD CONNECTION



### RECOMMENDED LAND PATTERN

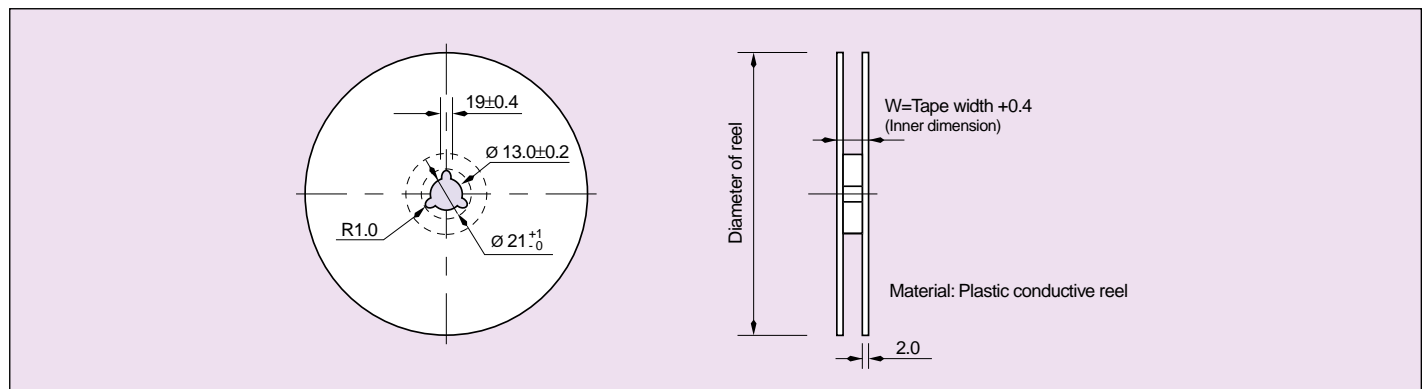


# Voltage Control Oscillator

## TAPE DIMENSIONS

Part No.	Specifications		
	Tape width, guide pitch	Diameter of Reel	Unit
VK-120		Ø 330	2000pcs
EK-304		Ø 330	2000pcs
YK-501		Ø 330	2000pcs
RK-405		Ø 330	2000pcs

## REEL DIMENSIONS



# KXO-01 Series Crystal Clock Oscillators

TTL Drive - TTL Compatible

$f_o$ : 8.0 to 50 MHz

## FEATURES

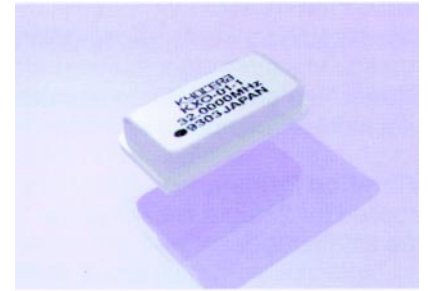
- 1) Lower Cost
- 2) 14 pin DIP compatible
- 3) Wide frequency range (8MHz - 50MHz)
- 4) All metal package minimizes RF radiation
- 5) Meets FCC EMI specifications
- 6) Solder coated pins
- 7) 25 pieces per tube
- 8) Sold in increments of 100 pieces

## HOW TO ORDER

**KXO-01 - 1 - 32.0000M T**

①                      ②                      ③                      ④

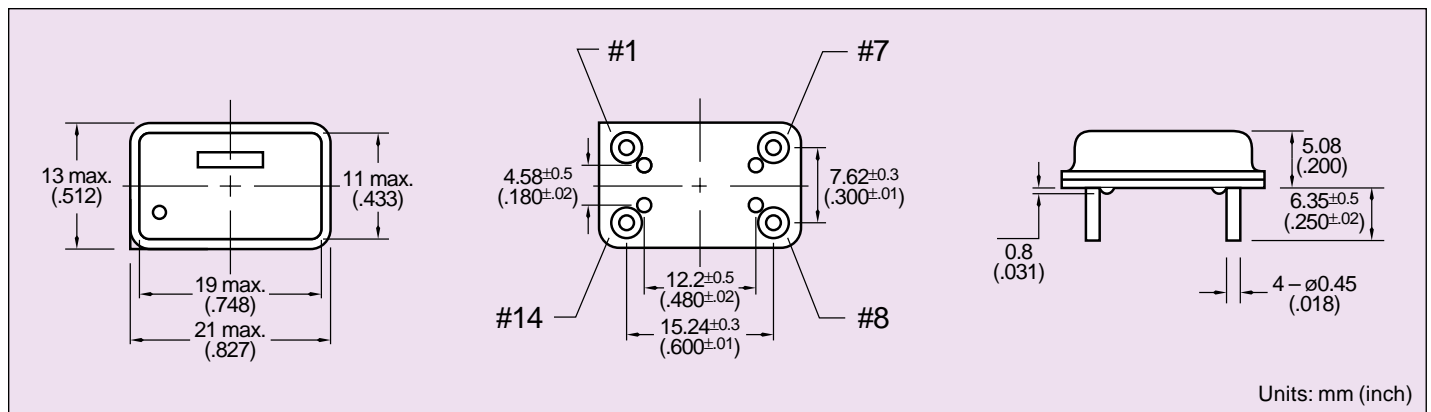
- ① Type: (Kyocera Crystal Oscillators)
- ② Frequency precision:  
0 =  $\pm 50$ ppm (special)  
1 =  $\pm 100$ ppm
- ③ Frequency
- ④ Packaging: T = Tube



## SPECIFICATIONS (KXO-01)

Parameters		Code	Rating	Unit	Remarks
Output Frequency		$f_{out}$	8 to 50	MHz	
Frequency Precision		$\Delta f/f_o$	0: $\pm 50$	ppm	0 to 70°C
			1: $\pm 100$	ppm	4.5V to 5.5V
Aging Rate		$\Delta f/f$	$\pm 5$	ppm/y	
Operating Temperature Range		$T_{opr}$	0 to $\pm 70$	°C	
Storage Temperature Range			-55 to +125	°C	
Voltage		$V_{DD}$	5 $\pm$ 0.5	VDC	
Electrical Current Consumption		$I_{DD}$	35 max	mA	
Output	Duty Ratio	$S_y$	40 to 60	%	1.4V DC level
	"0" Level	$V_{OL}$	0.4 max	V	At $I_{OL}=16$ mA
	"1" Level	$V_{OH}$	2.4 min	V	At $I_{OH}=400\mu$ A
	Rise and Fall Time	$T_R, T_F$	15 max	nsec	8 to 32MHz
10 max			nsec	32.1 to 50MHz	
Fan Out			1 to 10	TTL	

## DIMENSIONS



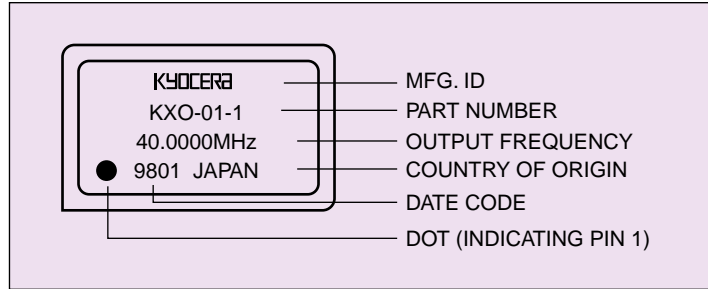


# KXO-01 Series Crystal Clock Oscillators

TTL Drive - TTL Compatible

$f_o$ : 8.0 to 50 MHz

## MARKING



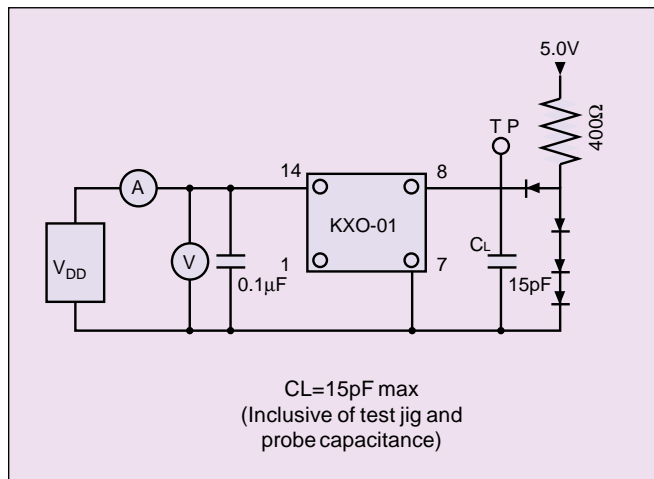
## PIN CONNECTION

PIN #	FUNCTION
1	N.C.
7	Case /GND
8	Output
14	+5.0V D.C.

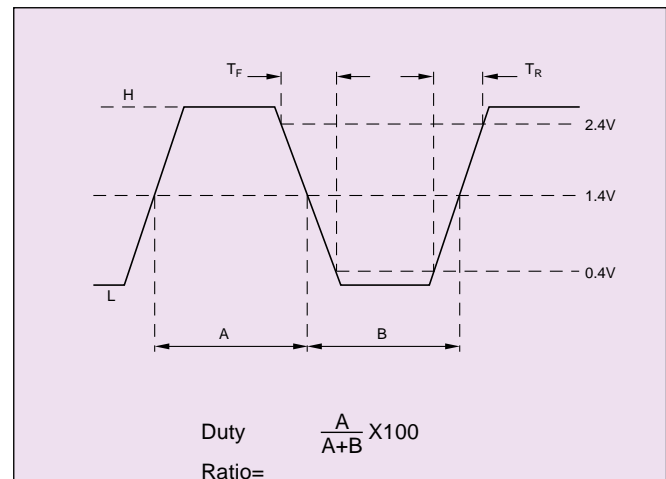
## POPULAR FREQUENCY LIST

8.0000MHz	16.0000MHz	25.0000MHz
10.0000MHz	19.6608MHz	32.0000MHz
12.0000MHz	20.0000MHz	40.0000MHz
14.31818MHz	24.0000MHz	50.0000MHz

## TEST CIRCUIT



## SHAPE OF OUTPUT WAVE



# KXO-HC/KHO-HC Series Crystal Clock Oscillators

HCMOS Drive - TTL or CMOS Compatible

$f_o$ : 1 to 72 MHz

## FEATURES

- 1) High speed CMOS clock oscillator
- 2) High power drive level
- 3) Low current consumption
- 4) Output available with TTL or CMOS compatibility
- 5) Enable/disable option
- 6) KHO-HC: 8 pin DIP
- 7) KXO-HC: 14 pin DIP
- 8) KXO: 25 pieces per tube  
KHO: 40 pieces per tube
- 9) KXO: Sold in increments of 100 pieces  
KHO: Sold in increments of 120 pieces

## HOW TO ORDER

**KXO-HC 1 - T S E - 32.0000M T**

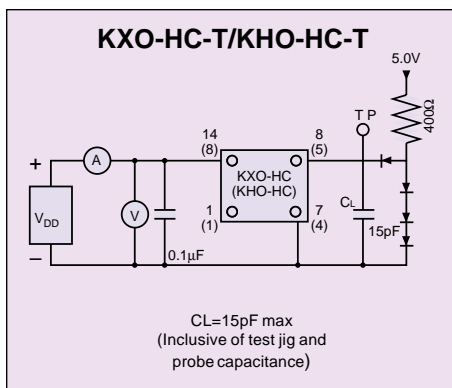
- ① ② ③ ④ ⑤ ⑥
- ① Type: KXO = 14 pin DIP; KHO = 8 pin DIP
  - ② Frequency precision:  
S =  $\pm 25$ ppm, 0 =  $\pm 50$ ppm, 1 =  $\pm 100$ ppm
  - ③ Output level/Duty cycle:  
TS = TTL compatible/45 to 55%  
CS = CMOS compatible/45 to 55%
  - ④ Enable/Disable function:  
 = without function, E = with function
  - ⑤ Frequency
  - ⑥ Packaging: T = Tube



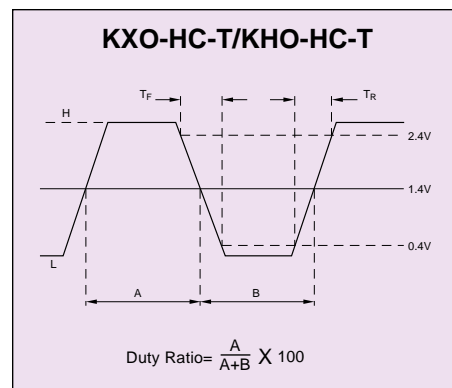
## SPECIFICATIONS: TTL COMPATIBLE (KXO-HC-T/KHO-HC-T)

Parameters		Code	Rating		Unit	Remarks
Output Frequency		$f_{OUT}$	1 to 50	>50	MHz	
Frequency Precision		$f/f_o$	S: $\pm 25$ 0: $\pm 50$ 1: $\pm 100$	S: $\pm 25$ 0: $\pm 50$ 1: $\pm 100$	ppm ppm ppm	0 to 70°C 4.5V to 5.5V
Operating Temperature Range		$T_{OPR}$	0 to +70	0 to +70	°C	
Storage Temperature		$T_{STR}$	-55~+125	-55~+125	°C	
Voltage		$V_{DD}$	5 $\pm 0.5$	5 $\pm 0.25$	V	
Electrical Current Consumption		$I_{DD}$	50 max	70 max	mA	$f=50$ MHz, $C_L=15$ pF (10TTL load)
Output	Duty Cycle	$S_Y$	45 to 55	45 to 55	%	1.4V DC level
	"0" Level	$V_{OL}$	0.4 max	0.4 max	V	At $I_{OL}=16$ mA
	"1" Level	$V_{OH}$	2.4 min	2.4 min	V	At $I_{OH}=-1$ mA
	Rise and Fall Time	$T_R, T_F$	5.0 max	3.5 max	nsec	0.4V to 2.4V, $C_L=15$ pF (10TTL load)
Fan Out			TTL 10 gates	TTL 10 gates		CMOS level OK
Time to Enable/Disable			100 max	100 max	nsec	Tristate output
Input Current		$I_{IH}$ $I_{IL}$	10 max -150 max	10 max -150 max	$\mu$ A $\mu$ A	
Input Voltage		$V_{IH}$ $V_{IL}$	2.2 min 0.8 max	2.2 min 0.8 max	V V	
Aging		$f/f$	$\pm 5$	$\pm 5$	ppm/yr	

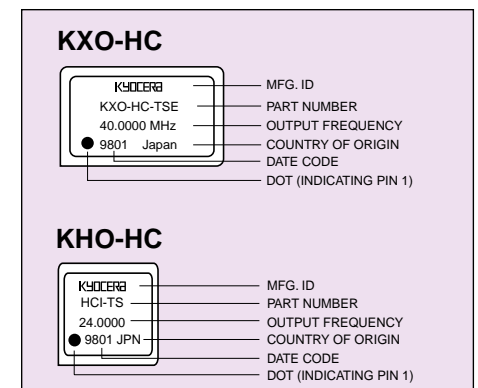
## TEST CIRCUIT



## SHAPE OF OUTPUT WAVE



## MARKINGS



# KXO-HC/KHO-HC Series Crystal Clock Oscillators

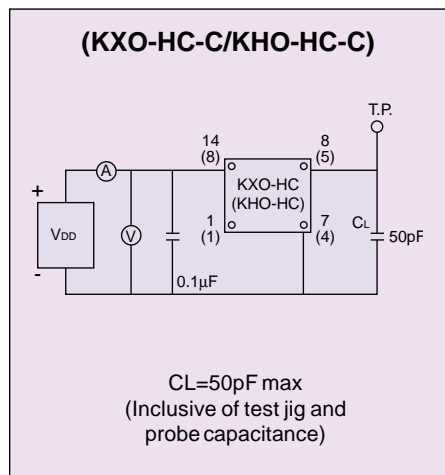
HCMOS Drive - TTL or CMOS Compatible

$f_o$ : 1 to 72 MHz

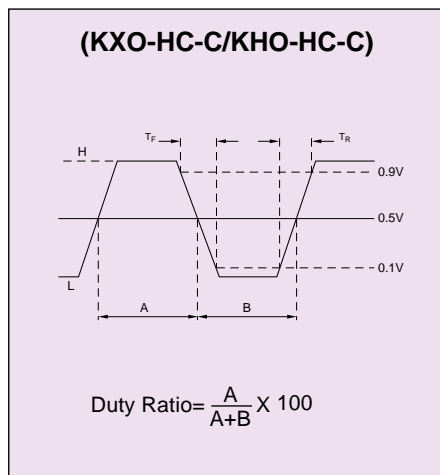
## SPECIFICATIONS: CMOS COMPATIBLE (KXO-HC-C/KHO-HC-C)

Parameters		Code	Rating		Unit	Remarks
Output Frequency		$f_{OUT}$	1 to 50	>50	MHz	
Frequency Precision		$f/f_o$	S:±25 0:±50 1:±100	S:±25 0:±50 1:±100	ppm ppm ppm	0 to 70°C 4.5V to 5.5V
Operating Temperature Range		$T_{OPR}$	0 to +70	0 to +70	°C	
Storage Temperature Range		$T_{str}$	-55~+125	-55~+125	°C	
Voltage		$V_{DD}$	5±0.5	5±0.25	V	
Electrical Current Consumption		$I_{DD}$	50 max	80 max	mA	$f > 50\text{MHz}$ , $C_L = 15\text{pF}$ $f < 50\text{MHz}$ , $C_L = 50\text{pF}$
Output	Duty Cycle	$S_Y$	45 to 55	45 to 55	%	1/2 $V_{DD}$ level
	"0" Level	$V_{OL}$	0.1 $V_{DD}$ max	0.1 $V_{DD}$ max	V	At $I_{OL} = 16\text{mA}$
	"1" Level	$V_{OH}$	0.9 $V_{DD}$ min	0.9 $V_{DD}$ min	V	At $I_{OH} = -1\text{mA}$
	Rise and Fall Time	$T_R, T_F$	10 max	6 max	nsec	10% $V_{DD}$ to 90% $V_{DD}$ $C_L = 50\text{pF}$
Time to Enable Disable			100 max	100 max	nsec	Tristate Output
Input Current		$I_{IH}$	10 max	10 max	μA	
		$I_{IL}$	-150 max	-150 max	μA	
Input Voltage		$V_{IH}$	2.2 min	2.2 min	V	
		$V_{IL}$	0.8 max	0.8 max	V	
Aging		$f/f$	±5	±5	ppm/yr	

### TEST CIRCUIT



### SHAPE OF OUTPUT WAVE



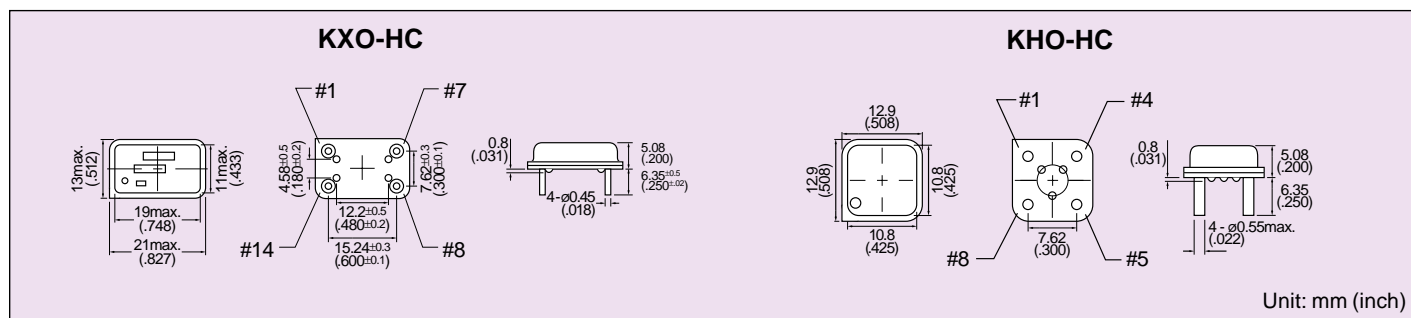
### PIN CONNECTION

KXO	KHO	
1	1	N.C. or Control
7	4	Case /GND
8	5	Output
14	8	+5.0V D.C.

### ENABLE/DISABLE FUNCTION CHART

Pin 1	Pin 8
High or Open	Oscillation
Low	High Impedance

### DIMENSIONS



# 386 Series Clock Oscillators

HCMOS Drive - CMOS Compatible

$f_o$ : 24, 32, 40, 50 MHz

## FEATURES

- 1) Capable of driving the 80386 and surrounding LSI directly up to 150pF load
- 2) Replaces existing clock generator and/or buffer
- 3) 45/55 symmetry for all standard frequencies even at 150pF load
- 4) Enable/disable function as standard
- 5) 25 pieces per tube
- 6) Sold in increments of 100 pieces

## HOW TO ORDER

**386-HC 1 - C S E - 40.0000M T**

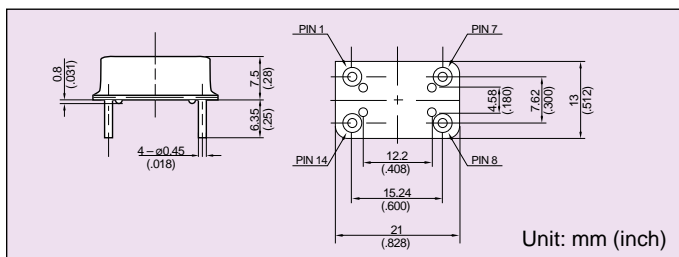
- ① Type: 386 = 14 pin DIP  
 ② Frequency precision: 1 =  $\pm 100$ ppm  
 ③ Output level/Duty cycle  
 CS = CMOS compatible/45 to 55%  
 ④ Enable/disable function:  
 □ = without function, E = with function  
 ⑤ Frequency  
 ⑥ Packaging: T = Tube



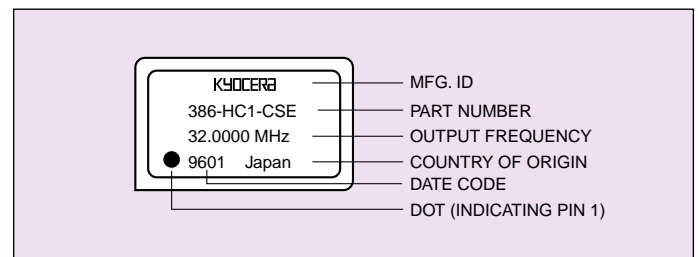
## SPECIFICATIONS (386-HC)

Parameters		Code	Rating	Unit	Remarks
Output Frequency		$f_{OUT}$	24, 32, 40 50	MHz MHz	CL=150pFmax CL=80pFmax
Frequency Precision (Inclusive of Temp. Voltage variation)		$\Delta f/f$	1: $\pm 100$	ppm	Ta=0~70°C
Aging Rate		$\Delta f/f$	$\pm 5$	ppm/yr	
Operating Temperature		T <sub>OPR</sub>	0~+70	°C	
Storage Temperature Range		T <sub>STR</sub>	-55~+125	°C	
Supply Voltage		V <sub>DD</sub>	5 $\pm 0.25$	V	
Supply Current		I <sub>CC</sub>	65 max	mA	Cl=150pF, Ta=25°C
Output	Duty Ratio	Sy	45~55	%	1/2 V <sub>DD</sub> level
	"0" Level	V <sub>OL</sub>	0.1V <sub>DD</sub> max	V	I <sub>OL</sub> =12mA
	"1" Level	V <sub>OH</sub>	0.9V <sub>DD</sub> min	V	I <sub>OL</sub> =-1mA
	Rise and Fall Time	T <sub>R</sub> , T <sub>F</sub>	See Clock Time Table	nsec	
Enable/Disable Time			100 max 100 max	nsec nsec	Type E Tristate Output
Input	Current	I <sub>IH</sub>	10 max	$\mu$ A	V <sub>DD</sub> = 5.25V
		I <sub>IL</sub>	-150 max	$\mu$ A	V <sub>DD</sub> =5.25V
	Voltage	V <sub>IH</sub>	2.2 min	V	
		V <sub>IL</sub>	0.8 max	V	
Fan Out			7	TTL	
Load Capacitance		C <sub>L</sub>	150 80	pF pF	f=12.0MHz~40MHz f=40.1MHz~50MHz

## DIMENSIONS



## MARKINGS

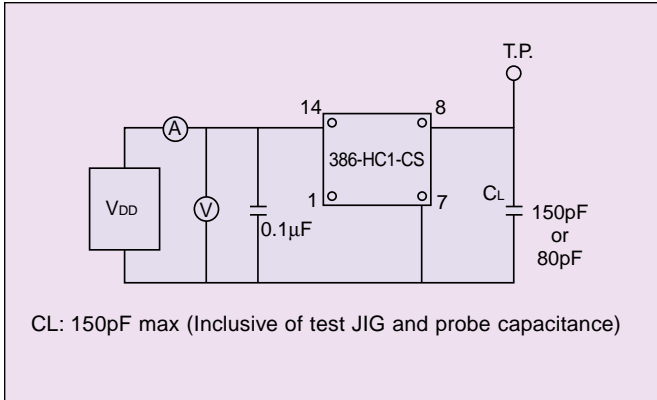


# 386 Series Clock Oscillators

HCMOS Drive - CMOS Compatible

$f_o$ : 24, 32, 40, 50 MHz

## TEST CIRCUIT



## PIN CONNECTION

386	Function
1	N.C. or Control
7	Case GND
8	Output
14	V <sub>DD</sub>

## CLOCK TIME TABLE (32MHz, 40MHz)

Frequency	32MHz		40MHz	
	Min	Max	Min	Max
Clock time (ns)				
Clock high time t <sub>2a</sub>	9	-	8	-
Clock high time t <sub>2b</sub>	5	-	5	-
Clock low time t <sub>3a</sub>	9	-	8	-
Clock low time t <sub>3b</sub>	7	-	6	-
Clock tall time t <sub>4</sub>	-	7.5	-	8
Clock tall time t <sub>5</sub>	-	7.5	-	8

## CLOCK TIME TABLE (50MHz)

Frequency	50MHz	
Clock time(ns)	Min	Max
Clock high time t <sub>2a</sub>	7	-
Clock high time t <sub>2b</sub>	4	-
Clock low time t <sub>3a</sub>	7	-
Clock low time t <sub>3b</sub>	5	-
Clock tall time t <sub>4</sub>	-	7
Clock tall time t <sub>5</sub>	-	7