SECTION 1.2

PRECISION CRYSTAL OSCILLATORS

fordahl
FREQUENCY CONTROL PRODUCTS

PRECISION CLOCK OSCILLATORS (PXO)

INTRODUCTION

1. Application and Technology Notes:

Precision Clock Oscillators (PXO) utilise a hermetically sealed quartz crystal unit mounted on a printed circuit board (PCB). The PXO is a non-compensated oscillator that relies on the quartz crystal for its stability characteristics. The hermetically sealed crystal unit allows for controlled temperature performance as well as a predefined ageing performance.

The PXO is well suited for applications where long-term reliability coupled with medium to severe temperature ranges are required. More accurate than a simple CXO the PXO is an economical choice when the performance of a TCXO is not required such as Telecom Systems, Avionics Instrumentation, Railway and Test Equipment.

2. Code definition

DFN Φ _ - Φ _ _ 77.76 MHz _ _ _

	Package Code [L x W x H mm]	Output Code	Option Code	Stability Type Code	Temperature Code	Stab. [≤ ± ppm]	Lifetime [Years]
S	**S1** = 15 x 9 x 6	**B** = H and T	**A** = int. trimmer	**void** = stab. vs temp	**A** = 0 to 50°C	**15**	**void** = 1
M	**S2** = 8.2 x 5 x 3.4	**H** = HCMOS	**R** = tight symmetry	**X** = overall stability	**L** = 0 to 60°C	**20**	**A** = 5
D	**S8** = 13 x 20 x H	**T** = TTL	**T** = ext. trimmer	overall includes: temp., cal. @ 25°C, ageing over lifetime, Vcc and load changes	**B** = 0 to 70°C	**25**	**B** = 10
		E = ECL 10KH	**Z** = tri-state output		**D** = -10 to 60°C	**50**	**C** = 15
L		**EC** = PECL 10KH	**P** = compl. output		**I** = -10 to 70°C	**75**	**D** = 20
E	**4** = DIL 8 x H	**LEC** = LVPECL 100K	**G** = inverted pinout		**C** = -20 to 70°C	**100**	
A	**14** = DIL 14 x H	**KEC** = PECL 100K	**I** = enable/disable		**E** = -40 to 85°C		
D		**O** = square wave AC coupled			**H** = -55 to 125°C		
E							
D							

Mil-Std-883 Screening B (SB) or Burn in 168 H @ 125°C (BI) also available on 'H' temperature code devices.
Some codes/options are product specific. Other codes/options also available. Please consult factory for details.
Φ Internal codes for production use only. * A unique specification will be issued for custom requirements.

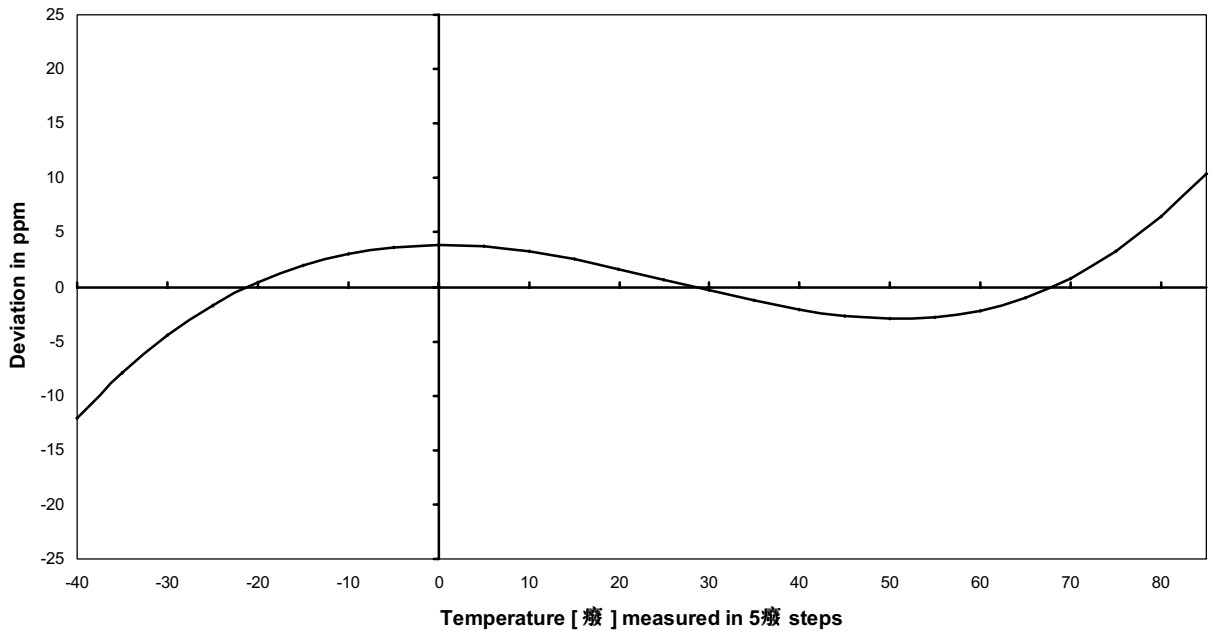
3. Detailed Specifications

Package	Description	Page No.
SMD	HCMOS, +5.0 V supply	16, 17
	HCMOS, +3.3 V supply	
	PECL, +5.0 V supply	18, 19
	LVPECL, +3.3 V supply	
DIL 8	HCMOS, +5.0 V supply	20
DIL 14 *	HCMOS , +5.0 V supply	21
	TTL, +5.0 V supply	
DIL 14	HCMOS or TTL, +5.0 V supply	22
	ECL/PECL or clipped square wave, 16–175 MHz	23

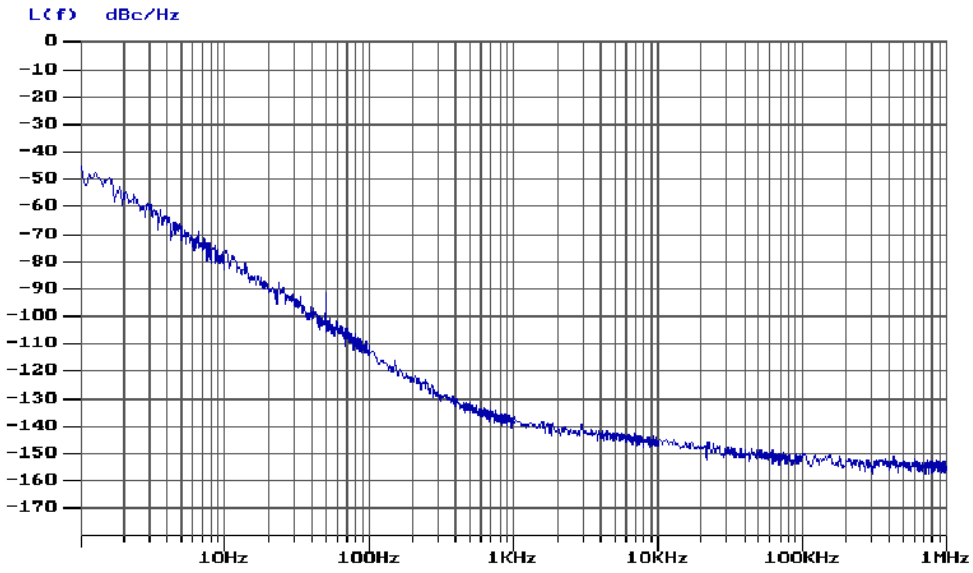
* DIL 14 also available with MIL-STD 14 pin package (DFN 114).

PRECISION CLOCK OSCILLATORS (PXO)
MEASUREMENT DATA

SMD PXO TEMPERATURE CURVE
Typical measurement DFN S1-KH 16.384 MHz XE25



SMD PXO PHASE NOISE
Typical measurement DFN S1-KH 19.440 MHz XE25



fordahl
FREQUENCY CONTROL PRODUCTS

SURFACE MOUNT PRECISION OSCILLATOR

DFN S2-K(5 V) & DFN S2-L(3.3 V)

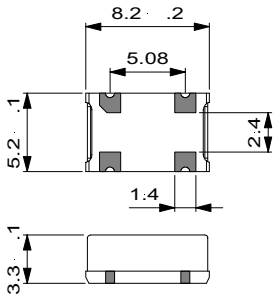
RECOMMENDED FOR NEW DESIGNS

CRYSTAL PACKED INTO ITS OWN HOLDER

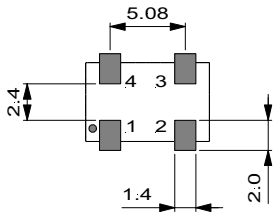
5 V OR 3.3 V SUPPLY VOLTAGE

STANDARD EPOXY PACKAGE

HIGH TEMPERATURE STABILITIES



Function	DFN S2
Enable	1
Gnd	2
Output	3
Vcc	4



PC board footprint

TYPE	DFN S2-KHZ	DFN S2-LHZ
Frequency range	2 to 100 MHz	2 to 130 MHz

ELECTRICAL SPECIFICATIONS			
supply voltage		5 V ± 10 %	3.3 V ± 5 %
supply current (no load)	≤ 25 MHz	≤ 20 mA	≤ 10 mA
	≤ 70 MHz	≤ 40 mA	≤ 15 mA
	> 70 MHz	≤ 70 mA	≤ 35 mA
output load		HCMOS 50 pF or 10 TTL ≤ 25 MHz HCMOS 15 pF > 25 MHz	HCMOS 15 pF
duty cycle		40/60...60/40 % @ 50% level	40/60...60/40 % @ 50% level
rise/fall times (HCMOS @ 15 pF load)		10 to 90 % : ≤ 7 ns up to 25 MHz : ≤ 3 ns > 25 MHz	10 to 90 % : ≤ 7 ns up to 25 MHz : ≤ 3 ns > 25 MHz
high/low levels		≥ 4.5 V/ ≤ 0.5 V	≥ 2.8 V/ ≤ 0.3 V
tri-state output on pin 1		high or open = enable, low = high Z	high or open = enable, low = high Z
start up		≤ 10 ms @ 4.5 V	≤ 10 ms @ 3.15 V

FREQUENCY STABILITY		stability [ppm] and temperature code					
types	temperature range	stability	code	stability	code	stability	code
all types	0 to 70°C	≤ ± 15 ppm	XB15	≤ ± 20 ppm	XB20	≤ ± 25 ppm	XB25
	-40 to 85°C	≤ ± 25 ppm	XE25	≤ ± 50 ppm	XE50	≤ ± 75 ppm	XE75
remarks		includes calibration at 25°C, temperature, ageing, Vcc and load changes 1st year					

OPTIONS	CODE			
tight symmetry (f ≤ 50 MHz)	R	45/55...55/45 %		
Stability over long life time		A = 5 years	B = 10 years	C = 15 years

ORDERING CODE	type + option code + frequency + temperature code
Example	DFN S2-LHZ 44.736 MHz XE25

REMARK	Please consult factory for life time/stabilities possible combinations

fordahl
FREQUENCY CONTROL PRODUCTS

SURFACE MOUNT PRECISION OSCILLATOR

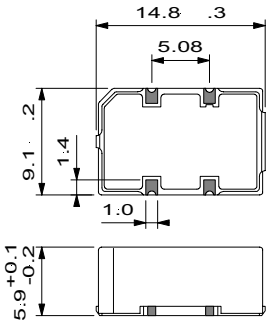
DFN S1-K(5 V) & DFN S1-L(3.3 V)

CRYSTAL PACKED INTO ITS OWN HOLDER

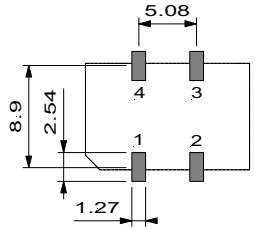
5 V OR 3.3 V SUPPLY VOLTAGE

STANDARD EPOXY PACKAGE

HIGH FREQUENCIES



Function	DFN S1
NC/ Enable	1
GND	2
Output	3
Vcc	4



PC board footprint

TYPE	DFN S1-KH	DFN S1-LH
Frequency Range	1 to 100 MHz	1 to 130 MHz

ELECTRICAL SPECIFICATIONS			
supply voltage		5 V ± 10 %	3.3 V ± 5 %
supply current (no load)	≤ 25 MHz	≤ 20 mA	≤ 10 mA
	≤ 50 MHz	≤ 50 mA	≤ 15 mA
	> 50 MHz	≤ 70 mA	≤ 40 mA
output load		HCMOS 50 pF up to 25 MHz 15 pF > 25MHz	HCMOS 50 pF up to 25 MHz 15 pF > 25MHz
duty cycle		40/60...60/40 % @ 50% level	40/60...60/40 % @ 50% level
rise/fall times (HCMOS @ 15 pF load)		10 to 90 % : ≤ 7 ns up to 25 MHz : ≤ 3 ns > 25 MHz	10 to 90 % : ≤ 7 ns up to 25 MHz : ≤ 3 ns > 25 MHz
high/low levels		≥ 4.5 V/ ≤ 0.5 V	≥ 2.8 V/ ≤ 0.3 V
start up		≤ 10 ms @ 4.5 V	≤ 10 ms @ 3.15 V

FREQUENCY STABILITY		stability [ppm] and temperature code							
types	temperature range	stability	code	stability	code	stability	Code	stability	code
all types	0 to 70°C	≤ ± 15	XB15	≤ ± 20	XB20	≤ ± 25	XB25	≤ ± 50	XB50
	-40 to 85°C	≤ ± 25	XE25	≤ ± 50	XE50	≤ ± 75	XE75	≤ ± 100	XE100
remarks		includes calibration at 25°C, temperature, ageing, Vcc and load changes 1st year							

OPTIONS	CODE			
tight symmetry (f ≤ 50 MHz)	R	45/55...55/45 %		
tri-state output on pin 1	Z	high or open = enable, low = high Z		
Stability over long life time		A = 5 years	B = 10 years	C = 15 years

ORDERING CODE	type + option code + frequency + temperature code
Example	DFN S1-KHZ 49.152 MHz XE25

REMARK	Please consult factory for life time/stabilities possible combinations

fordahl
FREQUENCY CONTROL PRODUCTS

SURFACE MOUNT PRECISION OSCILLATOR

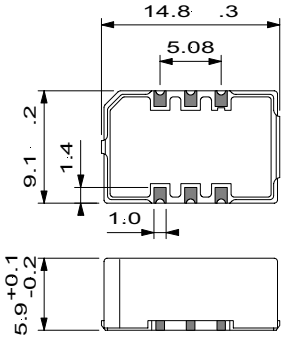
DFN S1-KECPI (5 V) & DFN S1-LECPI (3.3 V)

CRYSTAL PACKED INTO ITS OWN HOLDER

5 V OR 3.3 V SUPPLY VOLTAGE

VERY LOW JITTER

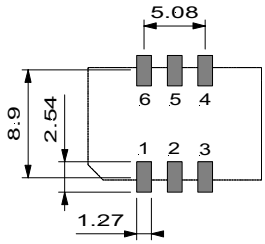
HIGH FREQUENCIES



Marking:

DFN S1-KE/LE
Frequency
Code yrwk

Function	DFN S1-KEC / LEC
Output 2	1
E / D	2
GND	3
Output 1	4
NC	5
Vcc	6



PC board footprint

TYPE	DFN S1-KECPI	DFN S1-LECPI
Frequency Range	16 to 250 MHz	16 to 250 MHz

ELECTRICAL SPECIFICATIONS		
supply voltage	5 V ± 5 %	3.3 V ± 5 %
supply current (no load)	≤ 70 mA	≤ 60 mA
output load	PECL 100 K (50 Ω to 3 V)	LVPECL 100 K (50 Ω to 1.3 V)
duty cycle @ 50% level	45/55...55/45 % (0 to 70°C) 40/60…60/40 % (-40 to 85°C)	45/55...55/45 %
rise/fall times (20 to 80%)	≤ 0.5 ns	≤ 0.5 ns
high/low levels	≥ 3.92 V/ ≤ 3.45 V	≥ 2.22 V/ ≤ 1.7 V
jitter RMS (12 kHz to 5 MHz)	≤ 0.5 ps	≤ 0.5 ps
jitter RMS (50 kHz to 80 MHz)	≤ 2.5 ps (f = 155.52 MHz)	≤ 2.5 ps (f = 155.52 MHz)
enable / disable on pin 2	low or open = enable, high = disable	low or open = enable, high = disable
complementary output on pin 1	180° phase shifted	180° phase shifted
start up	≤ 10 ms @ 4.75 V	≤ 10 ms @ 3.15 V

FREQUENCY STABILITY		stability [ppm] and temperature code							
types	temperature range	stability	code	Stability	code	stability	code	stability	code
all types	0 to 70°C	± 20	XB20	± 25	XB25	± 50	XB50	± 100	XB100
	-40 to 85°C	± 25	XE25	± 50	XE50	± 75	XE75	± 100	XE100
remark		includes calibration at 25°C, temperature, ageing, Vcc and load changes 1st year							

OPTIONS				
Stability over long life time	A = 5 years	B = 10 years	C = 15 years	D = 20 years

ORDERING CODE	type + option code + frequency + stability / temperature code
Example	DFN S1-LECPI 155.52 MHz XB20

REMARK	Please consult factory for life time/stabilities possible combinations

fordahl
FREQUENCY CONTROL PRODUCTS

SURFACE MOUNT PRECISION OSCILLATOR

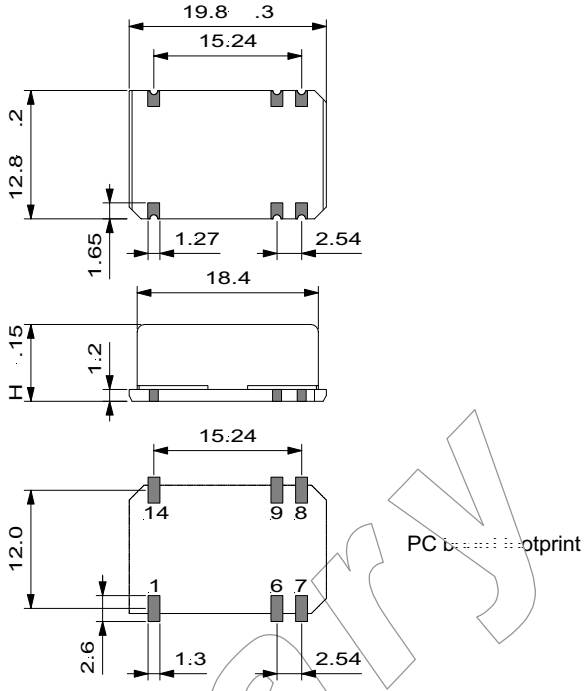
DFN S8-MLECP (3.3 V)

CRYSTAL PACKED INTO ITS OWN HOLDER

3.3 V SUPPLY VOLTAGE

VERY LOW JITTER

STANDARD FREQUENCIES



Function	DFN S8
N/C	1
N/C	6
GND	7
Output 1	8
Output 2	9
Vcc	14

TYPE	DFN S8-ML CP
Frequency Range	62 to 80 MHz
Standard Frequencies	622.08, 644.531 6.3, 669.3266, 693.4828 MHz

ELECTRICAL SPECIFICATIONS	
supply voltage	3.3 V ± 5 %
supply current (no load)	≤ 60 mA
output load	LVPECL 100 K (50 Ω to 1.3 V)
duty cycle @ 50% level	45/55...55/45 %
rise/fall times (20 to 80%)	≤ 0.5 ns
high/low levels	≥ 2.22 V/ ≤ 1.7 V
jitter RMS (12 kHz to 5 MHz)	≤ 0.5 ps
jitter RMS (50 kHz to 80 MHz)	≤ 3.0 ps
complementary output on pin 9	180° phase shifted
start up	≤ 10 ms @ 3.15 V

FREQUENCY STABILITY		stability [ppm] and temperature code							
types	temperature range	stability	code	stability	code	stability	code	stability	code
all types	0 to 70°C	± 20	XB20	± 25	XB25	± 50	XB50	± 100	XB100
	-40 to 85°C	± 25	XE25	± 50	XE50	± 75	XE75	± 100	XE100
Remark		includes calibration at 25°C, temperature, ageing, Vcc and load changes 1st year							

ORDERING CODE	type + option code + frequency + stability / temperature code
Example	DFN S8-MLECP 622.08 MHz XB20

REMARK	Please consult factory for -40 to +85°C versions
	Preliminary data sheet subject to change without notice

fordahl
FREQUENCY CONTROL PRODUCTS

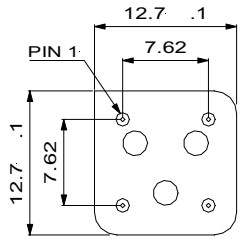
HCMOS PRECISION OSCILLATOR

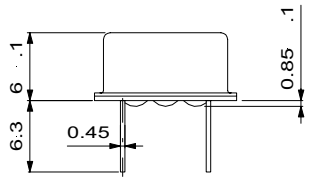
DFN 4-KH

CRYSTAL PACKED INTO ITS OWN HOLDER

STANDARD PACKAGE

HIGH FREQUENCIES





Function	DFN 4
NC/ Enable	1
GND	4
Output	5
Vcc	8

TYPE	DFN 4-KH
Frequency Range	1 to 70 MHz

ELECTRICAL SPECIFICATIONS		
supply voltage		5 V ± 10 %
supply current (no load)	≤ 25 MHz	≤ 20 mA
	> 25 MHz	≤ 50 mA
output load		HCMOS 50 pF up to 25 MHz, 15 pF above, or 10 TTL
duty cycle		40/60...60/40 % @ 50% level
rise/fall times (HCMOS @ 15 pF load)		10 to 90 % : ≤ 7 ns up to 25 MHz
		≤ 3 ns > 25 MHz
high/low levels		≥ 4.5 V/ ≤ 0.5 V
start up		≤ 10 ms @ 4.5 V

FREQUENCY STABILITY		stability [ppm] and temperature code					
types	temperature range	stability	code	stability	code	stability	code
DFN 4-KH	0 to 70°C	≤ ± 15	XB15	≤ ± 25	XB25	≤ ± 50	XB50
	-40 to 85°C	≤ ± 25	XE25	≤ ± 50	XE50	≤ ± 75	XB75
	-55 to 125°C	≤ ± 50	XH50	≤ ± 75	XH75	≤ ± 100	XH100
remark		includes calibration at 25°C, temperature, ageing, Vcc and load changes 1st year					

OPTIONS	CODE	
tight symmetry (f ≤ 50 MHz)	R	45/55...55/45 %
tri-state output on pin 1	Z	high or open = enable, low = high Z (XB, XE and XH[≤50 MHz] codes only)

ORDERING CODE	type + option code + frequency + temperature code
Example	DFN 4-KHZ 64.000 MHz XE50

fordahl
FREQUENCY CONTROL PRODUCTS

TTL OR HCMOS PRECISION OSCILLATORS

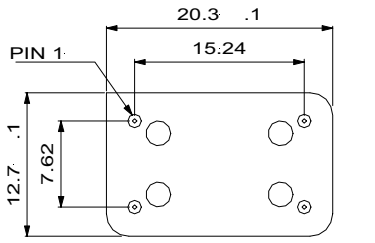
DFN 14-K & DFN 114-K

CRYSTAL PACKED INTO ITS OWN HOLDER

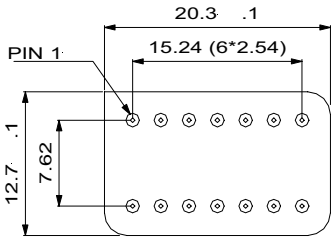
STANDARD PACKAGES

HIGH FREQUENCIES

DFN 14



DFN 114



H = 5.10 mm

Function	DFN 14	DFN 114
NC/Trim/Enable	1	1
GND	7	7
Output	8	8
Vcc	14	14
NC		others

TYPE	DFN 14-KH & DFN 114-KH	DFN 14-KT & DFN 114-KT
Frequency Range	1 to 70 MHz	1 to 70 MHz

ELECTRICAL SPECIFICATIONS			
supply voltage		5 V ± 10 %	5 V ± 10 %
supply current (no load)	≤ 25 MHz	≤ 10 mA (KH), 20 mA (KHZ)	≤ 20 mA
	> 25 MHz	≤ 40 mA (KH), 50 mA (KHZ)	≤ 50 mA
output load		HCMOS 50 pF up to 25 MHz, 15 pF above	10 TTL
duty cycle		40/60 ...60/40 % @ 50% level	40/60...60/40 % @ 1.4 V
rise/fall times (HCMOS @ 15 pF load)		10 to 90 % ≤ 10 ns up to 25 MHz or ≤ 5 ns > 25 MHz	0.4 to 2.4 V ≤ 5 ns up to 25 MHz or ≤ 3 ns > 25MHz
high/low levels		≥ 4.5 V/ ≤ 0.5 V	≥ 2.4 V/ ≤ 0.4 V
start up		≤ 10 ms @ 4.5 V	≤ 10 ms @ 4.5 V

FREQUENCY STABILITY		stability [ppm] and temperature code					
types	temperature range	stability	code	stability	code	stability	code
all types	0 to 70°C	≤ ± 15	XB15	≤ ± 25	XB25	≤ ± 50	XB50
	-40 to 85°C	≤ ± 25	XE25	≤ ± 50	XE50	≤ ± 100	XE100
	-55 to 125°C	≤ ± 50	XH50	≤ ± 75	XH75	≤ ± 100	XH100
remark		includes calibration at 25°C, temperature, ageing, Vcc and load changes 1st year					

OPTIONS	CODE		
external trimmer (f ≤ 50 MHz)	T	≥ ± 5 ppm (3 to 15 pF)	
internal trimmer (f ≤ 50 MHz)	A	≥ ± 5 ppm, package height ≤ 7 mm	
tight symmetry (f ≤ 50 MHz)	R	45/55...55/45 %	45/55...55/45 %
tri-state control (higher current)	Z	high or open = enable, low = high Z	high or open = enable, low = high Z

ORDERING CODE	type + option code + frequency + temperature code	
Example	DFN 14-KH 49.152 MHz XB15	DFN 114-KTR 32.000 MHz XH50

fordahl
FREQUENCY CONTROL PRODUCTS

TTL & HCMOS PRECISION OSCILLATORS

DFN 14-KB & DFN 4-KB

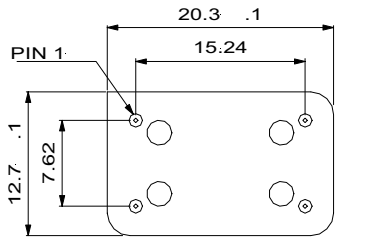
CRYSTAL PACKED INTO ITS OWN HOLDER

TTL AND HCMOS COMPATIBLE OUTPUTS

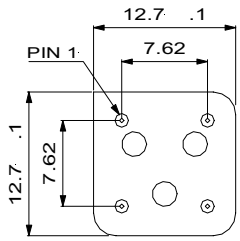
STANDARD PACKAGES

HIGH FREQUENCIES

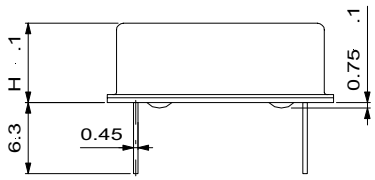
DFN 14

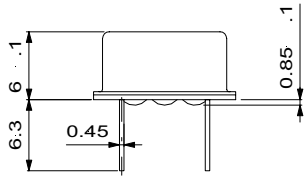


DFN 4



Function	DFN 14	DFN 4
NC/Enable	1	1
GND	7	4
Output	8	5
Vcc	14	8





H = 5.10 mm

TYPE	DFN 14-KB	DFN 4-KB
Frequency Range	1 to 70 MHz	1 to 70 MHz

ELECTRICAL SPECIFICATIONS		
supply voltage		5 V ± 5 %
supply current (no load)	≤ 25 MHz	≤ 20 mA
	> 25 MHz	≤ 50 mA
output load		HCMOS 15 pF or 10 TTL
duty cycle		40/60...60/40 % @ 50% level or 1.4 V
rise/fall times		10 to 90 % ≤ 5 ns
		0.4 to 2.4 V ≤ 3.5 ns
high/low levels		≥ 4.5 V/ ≤ 0.5 V
start up		≤ 10 ms @ 4.75 V

FREQUENCY STABILITY		stability [ppm] and temperature code					
types	temperature range	stability	code	stability	code	stability	code
all types	0 to 70°C	≤ ± 15	XB15	≤ ± 25	XB25	≤ ± 50	XB50
	-40 to 85°C	≤ ± 25	XE25	≤ ± 50	XE50	≤ ± 75	XE75
	-55 to 125°C	≤ ± 50	XH50	≤ ± 75	XH75	≤ ± 100	XH100
remarks		XH codes only available as DFN 14/4-KB type ≤ 50 MHz					
		includes calibration at 25°C, temperature, ageing, Vcc and load changes 1st year					

OPTIONS	CODE	
tri-state output on pin 1	Z	high or open = enable, low = high Z

ORDERING CODE	type + option code + frequency + temperature code	
Example	DFN 14-KB 16.000 MHz XH75	DFN 4-KBZ 50.000 MHz XB15

fordahl
FREQUENCY CONTROL PRODUCTS

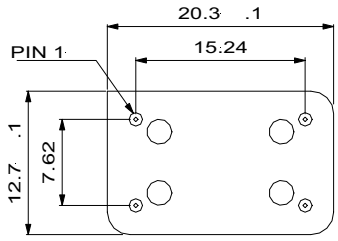
(P)ECL & CLIPPED SQUARE WAVE CLOCK OSCILLATORS

DFN 14-E & DFN 14-O

ECL 10KH OR CLIPPED SQUARE WAVE OUTPUT

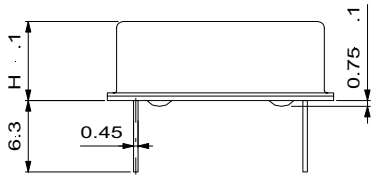
NEGATIVE OR POSITIVE SUPPLY VOLTAGE

OPTIONAL COMPLEMENTARY OUTPUTS



Pin	DFN 14-E	DFN 14-O/EC
1	NC/Output B	NC/Output B
7	Vee	GND
8	Output A	Output A
14	GND	Vcc

H = 7.00 mm



TYPE	DFN 14-E	DFN 14-EC	DFN 14-O
Frequency Range	16 to 175 MHz	16 to 175 MHz	16 to 175 MHz

ELECTRICAL SPECIFICATIONS			
supply voltage	-5.2 V ± 5 %	5 V ± 5 %	5 V ± 5 %
supply current	≤ 50 mA	≤ 50 mA	≤ 50 mA
output load	ECL 10KH (50 Ω to -2 V)	PECL 10 KH (50 Ω to 3 V)	50 Ω, square wave, AC coupled
duty cycle (ECL / PECL @ 50 % level)	40/60...60/40 %	40/60...60/40 %	40/60...60/40 % @ 0 V
rise/fall times (20 to 80 %)	≤ 2 ns	≤ 2 ns	
high/low levels/output amplitude	≥ -1.0 V/ ≤ -1.6 V	≥ 3.97 V/ ≤ 3.45 V	0 dBm ± 2 dB
start up	≤ 10 ms @ -4.94 V	≤ 10 ms @ 4.75 V	≤ 10 ms @ 4.75 V

FREQUENCY STABILITY		stability [ppm] and temperature code							
types	temperature range	stability	code	stability	code	stability	code	stability	code
all types	0 to 70°C	≤ ± 20	XB20	≤ ± 25	XB25	≤ ± 50	XB50	≤ ± 100	XB100
remarks		for codes XB20 and XB25 > 80 MHz please consult factory							
		stability includes calibration at 25°C, temperature, ageing, Vcc and load changes 1st yr.							

OPTIONS	CODE		
inverted pin-out	G	pin 14 : Vee, pin 7 : GND	
complementary output	P	180° phase shifted	180° phase shifted

ORDERING CODE	type + option code + frequency + temperature code
Example	DFN 14-EC 77.760 MHz XB20