



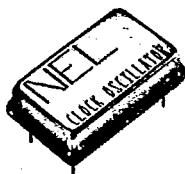
## Crystal Clock Oscillators

### DUAL, TWO-PHASE COMPLEMENTARY OUTPUT

**HS-2150/2160 Series**  
**HS-2250/2260 Series**  
**62.5 kHz-20.0 MHz**

### DUAL INDEPENDENT

**HS-2400 Series**  
**HS-2420 Series**  
**500 kHz-36.0 MHz**



HS-2150/2160

HS-2250/2260

HS-2400/2420

### Description

The **HS-2150/2160 Series** of quartz crystal clock oscillators, using hybrid technology, complements our HS-100/350 Series oscillators by providing two-phase complementary TTL or CMOS compatible output capability. HS-2150 is for TTL outputs. HS-2160 is for CMOS outputs.

The **HS-2250/2260 Series** of quartz crystal clock oscillators use hybrid technology to provide both clock output (Pin 1 =  $F_{CK}$ ) and clock output divided by N (Pin 8 =  $F_{CK}/N$ )\* in the same package. Thus two distinct, discrete, synchronous TTL or CMOS compatible clock sources are available in the same package. The HS-2250 Series is TTL compatible; the HS-2260 Series is CMOS compatible.

\*N = 2, 4, 8, 16, 32, or 64

The **HS-2400 Series** of quartz crystal clock oscillators are general purpose, TTL compatible oscillators. HS-2420 Series oscillators are general purpose MOS compatible devices (4000 Series, CMOS, 74C, 74HC, and NMOS driving up to 15 pf). Both series offer two independent output frequencies, not related by division or multiplication to each other.

### Suggested Applications

HS-2150/2160 Series oscillators are intended for applications such as differential receivers where a complementary output is required. HS-2250/2260 Series oscillators are intended for complex digital systems applications requiring two control frequencies, one divided from the other.

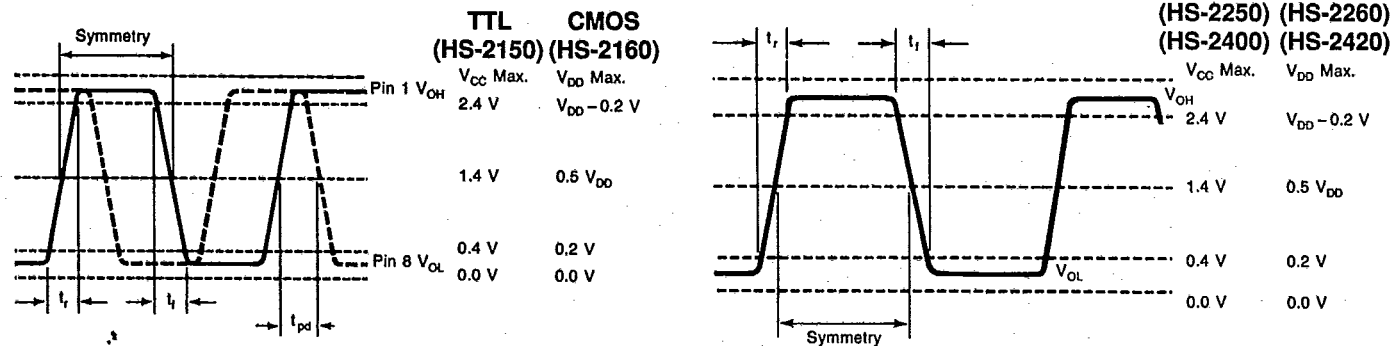
HS-2400/2420 Series oscillators can be used for microprocessor timing control, instrument timing control, and TTL or CMOS based systems.

### Features

- ☐ Wide Frequency Range  
HS-2150/2160 & HS-2250/2260  
62.5 kHz to 20.0 MHz
- HS-2400/2420  
500 kHz to 36.0 MHz for either output
- ☐ Case at electrical ground
- ☐ User specified tolerance, from  $\pm 0.0025\%$
- ☐ Low power consumption
- ☐ High shock resistance, to 3,000 G's
- ☐ Occupies half the board space of two separate oscillators
- ☐ All metal resistance weld, hermetically sealed package, offering RFI shielding. Designed to withstand standard wave soldering operations.

Consult factory for higher frequency requirements.

### Output Waveforms



(Cont. on next page)

## Crystal Clock Oscillators



## Specifications

| PARAMETER                              | CONDITIONS                                              | MINIMUM          | MAXIMUM                 |
|----------------------------------------|---------------------------------------------------------|------------------|-------------------------|
| <b>General Characteristics</b>         |                                                         |                  |                         |
| Supply voltage ( $V_{CC}$ , $V_{DD}$ ) | Supply                                                  | 4.5 V            | 5.5 V                   |
|                                        | Breakdown                                               | -0.5 V           | 7.0 V                   |
| Supply current ( $I_{CC}$ , $I_{DD}$ ) | Supply                                                  | —                | 50 mA                   |
|                                        |                                                         |                  | 60 mA (HS-2400/2420)    |
| Operating temperature ( $T_A$ )        | —                                                       | 0° C             | 70° C                   |
| Storage temperature ( $T_S$ )          | —                                                       | -55° C           | +125° C                 |
| Output current ( $I_O$ )               | High or low level                                       | —                | ± 25.0 mA               |
| Lead temperature ( $T_L$ )             | Soldering, 10 s                                         | —                | 300° C                  |
| <b>Output Characteristics</b>          |                                                         |                  |                         |
| Frequency                              | —                                                       | 62.5 kHz         | 20.5 MHz                |
|                                        |                                                         | 500 kHz          | 36.0 MHz (HS-2400/2420) |
| Tolerance                              | User specified                                          | ± 0.0025%        | —                       |
| Symmetry                               | TTL @ 1.4 V                                             | 40/60%           | 60/40%                  |
|                                        | CMOS, @ 0.5 $V_{DD}$                                    | 40/60%           | 60/40%                  |
|                                        | Optional                                                | 45/55%           | 55/45%                  |
|                                        | @ ≤ 18.0 MHz (HS-2400/2420)                             |                  |                         |
| Logic 0 ( $V_{OL}$ )                   | TTL, driving                                            | —                | 0.4 V                   |
|                                        | equiv. load                                             |                  |                         |
|                                        | CMOS, driving                                           | —                | 0.2 V                   |
|                                        | equiv. load                                             |                  |                         |
| Logic 1 ( $V_{OH}$ )                   | TTL, driving                                            | 2.4 V            | —                       |
|                                        | equiv. load                                             |                  |                         |
|                                        | CMOS, driving                                           |                  |                         |
|                                        | equiv. load                                             |                  |                         |
| Logic 0 ( $I_{OL}$ sink)               | TTL, driving                                            | $V_{DD} - 0.2$ V | 16.0 mA                 |
|                                        | equiv. load                                             |                  |                         |
|                                        | CMOS, driving                                           | —                | 600 $\mu$ A             |
|                                        | equiv. load                                             |                  |                         |
| Logic 1 ( $I_{OH}$ source)             | TTL, driving                                            | —                | 0.4 mA                  |
|                                        | equiv. load                                             |                  |                         |
|                                        | CMOS, driving                                           | —                | 600 $\mu$ A             |
|                                        | equiv. load                                             |                  |                         |
| Rise & fall time ( $t_r$ , $t_f$ )     | TTL, @ 0.4 to 2.4 V                                     | —                | 10 ns                   |
|                                        | CMOS, @ 10% to 90% of $V_{DD}$                          | —                | 10 ns                   |
| Start time ( $t_{on}$ )                | @ 0.9 $V_{CC}$ or $V_{DD}$ to + 2.0 V at Pin 1 or Pin 8 | —                | 5 ms                    |
|                                        | 2ms (HS-2400/2420)                                      |                  |                         |
| Propagation delay                      | HS-2150/2160                                            |                  |                         |
|                                        | TTL, @ 1.4 $V_{CC}$ , Pin 8                             | —                | 18 ns                   |
|                                        | output relative to Pin 1 output                         |                  |                         |
|                                        | CMOS, @ 0.5 $V_{DD}$ Pin 8                              | —                | 18 ns                   |
|                                        | output relative to Pin 1 output                         |                  |                         |
|                                        | HS-2250/2260                                            |                  |                         |
|                                        | TTL, @ 1.4 $V_{CC}$ , Pin 8                             | —                | 51 ns                   |
|                                        | output relative to Pin 1 output                         |                  |                         |
|                                        | CMOS, @ 0.5 $V_{DD}$ Pin 8                              | —                | 51 ns                   |
|                                        | output relative to Pin 1 output                         |                  |                         |

DUAL, TWO-PHASE  
COMPLEMENTARY  
OUTPUT

HS-2150/2160 Series  
HS-2250/2260 Series  
62.5 kHz-20.0 MHz

DUAL  
INDEPENDENT

HS-2400 Series  
HS-2420 Series  
500 kHz-36.0 MHz

(Continued)

Outline drawings and Equivalent Load  
please see pages 16 and 18.

## HS-2100/2200 Series

| Pin | Connection          |
|-----|---------------------|
| 1   | Output              |
| 7   | grd and case        |
| 8   | Output              |
| 14  | $V_{CC}$ , $V_{DD}$ |

## HS-2250/2260 Series

| Pin | Connection          |
|-----|---------------------|
| 1   | Output $F_{CK}$     |
| 7   | grd and case        |
| 8   | Output $F_{CK}/N$   |
| 14  | $V_{CC}$ , $V_{DD}$ |

## HS-2400/2420 Series

| Pin | Connection          |
|-----|---------------------|
| 1   | Output 2            |
| 7   | grd and case        |
| 8   | Output 1            |
| 14  | $V_{CC}$ , $V_{DD}$ |

## Options

- ☐ Gull wing surface mount package  
available on all dual, two-phase  
complementary output oscillators.  
(Dimensions-see page 35).



## NEW PRODUCTS

In our continued effort to provide quality products to meet the needs of the changing electronics market, NEL is in the process of developing several new products.

Among these are:

### TTL/CMOS Oscillator

Frequency range 70 to 100 MHz. User tolerance available from  $\pm .005\%$ .

### 3-State CMOS/TTL

Frequency range extended to 80MHz. User tolerance available from  $\pm .005\%$ .

### Z80/8000/80A/80B Oscillator

Frequency range on HS-380/2890 Series extended to 40.0MHz. User tolerance available from  $\pm .0025\%$ .

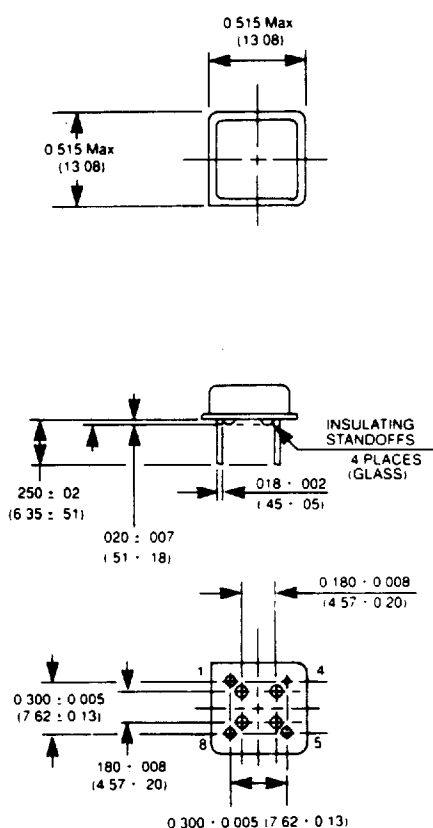
### Programmable Video Clock Generator

For use in the computer graphics, disk drive (zone locator) and fiber optics markets.

This product simplifies operations by using phase-locked loop techniques to generate, from the crystal oscillator, all the necessary clocks used in a typical graphics system.

## OSCILLATOR METAL HALF PACK AND SURFACE MOUNT DIMENSIONS

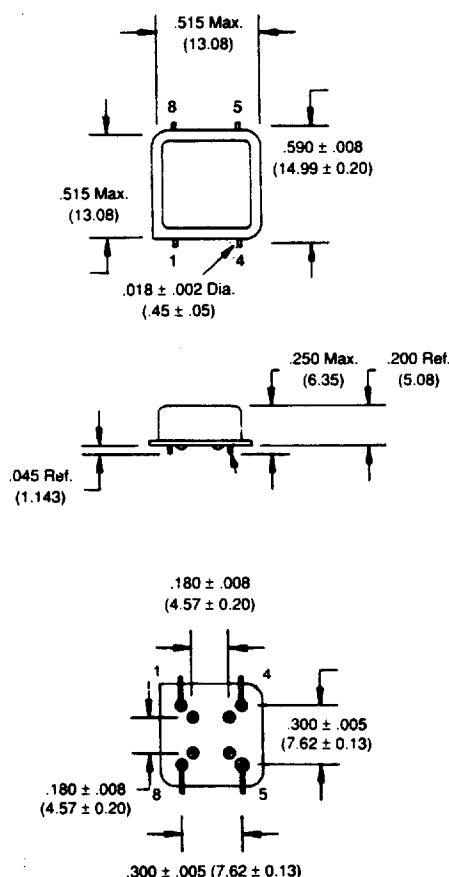
### HA Series



Pin number 4 connected to case.

The metal half pack oscillator is available in TTL, CMOS, and Z80 logics. See options on pages 17, 20, 29, and 33 for details.

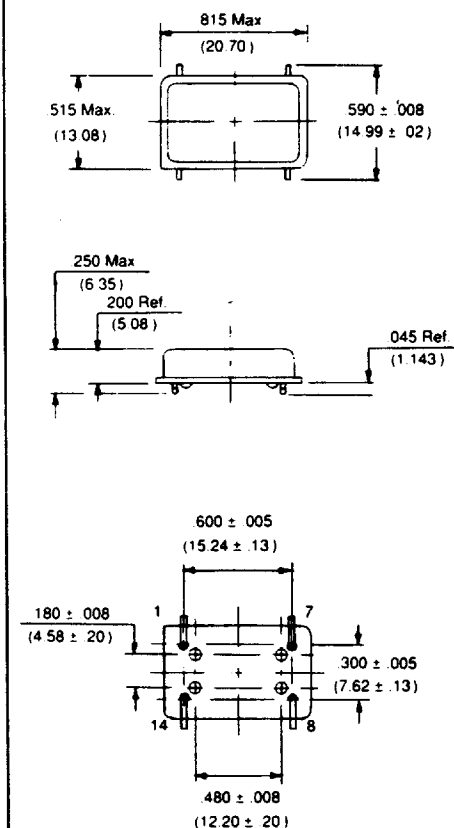
### SA Series



Pin number 4 connected to case.

Seating plane =  $.005 \text{ Max. (.127)}$   
Wire leads to be formed to a  $90^\circ$  angle.

### SM Series



Pin number 7 connected to case.

Seating plane =  $.005 \text{ Max. (.127)}$   
Wire leads to be formed to a  $90^\circ$  angle.

Dimensions are for reference only, inches (mm).