

# CLOCK OSCILLATORS

## "HP" series (non-PLL based PECL)

Logic: PECL square wave



"HP" series use fundamental mode (inverted mesa) crystal to achieve stable and clean 10KH or 100KH differential PEC signals. No multiplier, no overtone and no phase lock loop technique is used. Jitter is as low as 1ps for the 155.520 MHz for SONET/SDH applications. The inherent advantage of differential PECL signal transmission provides improved noise immunity and makes the system less susceptible to ground noise.

### PRODUCT SUMMARY:

Package code PECL	Frequency Range	Assembly Technique	Package Size (mm) [inches]. H: Seat height.
<b>Thru-Hole Types</b>			
4 PIN MODELS			
<b>HP14</b>	19.440 ~ 250 MHz	4 pin DIL full size. Hermetically sealed. Can height = 7.5 mm. Sealed crystal inside.	12.8 x 20.2 x 8.3H [0.504 x 0.795 x 0.327]
5 PIN MODELS			
<b>HP514</b>	19.440 ~250 MHz	5 pin DIL full size. Hermetically sealed. Can height = 7.5 mm. Sealed crystal inside.	12.8 x 20.2 x 8.3H [0.504 x 0.795 x 0.327]
6 PIN MODELS			
<b>HP614</b>	19.440 ~250 MHz	6 pin DIL full size. Hermetically sealed. Can height = 7.5 mm. Sealed crystal inside.	12.8 x 20.2 x 8.3H [0.504 x 0.795 x 0.327]
<b>Surface Mount Types – Gull Wing</b>			
4 PIN MODELS			
<b>HP24</b>	19.440 ~250 MHz	4 pin DIL full size. Hermetically sealed. Can height = 7.5 mm. Sealed crystal inside.	12.8 x 20.2 x 9.3H [0.504 x 0.795 x 0.366]
5 PIN MODELS			
<b>HP524</b>	19.440 ~250 MHz	5 pin DIL full size. Hermetically sealed. Can height = 7.5 mm. Sealed crystal inside.	12.8 x 20.2 x 9.3H [0.504 x 0.795 x 0.366]
6 PIN MODELS			
<b>HP624</b>	19.440 ~250 MHz	6 pin DIL full size. Hermetically sealed. Can height = 7.5 mm. Sealed crystal inside.	12.8 x 20.2 x 9.3H [0.504 x 0.795 x 0.366]
<b>Surface Mount Types – Leadless</b>			
<b>HP62</b>	19.440 ~250 MHz	6 pad Leadless.	9.6 x 11.4 x 2.5H [0.378 x 0.449 x 0.098]
<b>HP64</b>	19.440 ~250 MHz	6 pad Leadless.	9.6 x 11.4 x 4.7H [0.378 x 0.449 x 0.185]

**MERCURY** [www.mercury-crystal.com](http://www.mercury-crystal.com)

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### General Specification for "HP" series (low jitter)

$T_A = +25^\circ\text{C}$ , Inclusive of  $25^\circ\text{C}$  calibration tolerance, operating temperature range, Input voltage variation, load change, aging, shock and vibration.

<b>Output Wave Form</b>		<b>PECL 100K square wave</b> Non-PLL based, fundamental mode inverted mesa crystal used.
<b>Frequency Range</b>		19.440 ~ 250 MHz
<b>Standard Frequencies</b>		38.880, 44.736, 50.000, 77.760, 100.000, 106.250, 125.000, 155.520, 166.6286, 200.0, 207.360, 212.500 MHz (partial list)
<b>Frequency Stability</b> Commercial temp. range (code "C")		"A": $\pm 25$ ppm over $0^\circ\text{C}$ to $+70^\circ\text{C}$ "B": $\pm 50$ ppm over $0^\circ\text{C}$ to $+70^\circ\text{C}$ "C": $\pm 100$ ppm over $0^\circ\text{C}$ to $+70^\circ\text{C}$ For non-standard please give desired frequency stability after the "C". For example "C20" is $\pm 20$ ppm over 0 to $+70^\circ\text{C}$
<b>Frequency Stability</b> Industrial temp. range (code "I")		"D": $\pm 25$ ppm over $-40^\circ\text{C}$ to $+85^\circ$ (not available on all packages) "E": $\pm 50$ ppm over $-40^\circ\text{C}$ to $+85^\circ\text{C}$ "F": $\pm 100$ ppm over $-40^\circ\text{C}$ to $+85^\circ\text{C}$ For non-standard please give desired frequency stability after the "I". For example "I20" is $\pm 20$ ppm over $-40$ to $+85^\circ\text{C}$
<b>Frequency Stability</b>		vs Supply voltage $\pm 5\%$ change: $\pm 3$ ppm max. vs Load $\pm 10\%$ change: $\pm 2$ ppm max.
<b>Input Voltage Vcc</b>		+3.3 V $\pm 5\%$ (LVPECL)      +5.0 V $\pm 5\%$ (PECL)
<b>Output Voltage HIGH "1", <math>V_{OH}</math></b> (Relative to ground)		2.25 V min.      3.95 V min. 4.05 typical 4.15 V max
<b>Output Voltage LOW "0", <math>V_{OL}</math></b> (Relative to ground)		1.65 V max.      3.15 min; 3.25 typical; 3.35 V max.
<b>Current Consumption</b> (measured with terminating resistors)		58 mA typical at 155.520 MHz      85 mA typical at 155.520 MHz 54 mA typical at 77.760 MHz      73 mA typical at 77.760 MHz
<b>Load</b>		50 ohms into Vcc-2V or Thevenin equivalent. (terminating resistors required on all outputs)
<b>Rise Time (<math>T_r</math>) and Fall Time (<math>T_f</math>)</b>		1.5 nano sec. max (20% $\leftrightarrow$ 80% Vcc)
<b>Duty Cycle at 50% output swing</b>		50 $\pm$ 2% typical; 50% $\pm$ 5% max. both outputs
<b>Jitter</b>	<b>155.520 MHz, 5V as example</b>	Over 1 Hz to 1 MHz band width: 20 pico seconds RMS max. Over 10 Hz to 1 MHz band width: 1.8 pico seconds RMS max. Over 100 Hz to 1 MHz band width: 0.2 pico seconds RMS max. Over 12 kHz to 20 MHz band width: 1 pico seconds RMS max. Over 10 Hz to 20 MHz band width: 5 pico seconds RMS max.
<b>SSB Phase Noise</b>	<b>155.520 MHz, 5V as example</b>	-50 dBc at 10 Hz offset, -80 dBc at 100 Hz offset, -110 dBc at 1 kHz offset, -135 dBc at 10 kHz offset, -145 dBc at 100 kHz offset, -145 dBc at 1 MHz offset
<b>Start-up Time</b>		10 m sec. max.
<b>Aging</b>		$\pm 2$ ppm / year max.
<b>Storage Temperature</b>		$-55^\circ\text{C}$ to $+100^\circ\text{C}$
<b>Tri-state option</b>		PECL output is disabled and complimentary output remains high when Tri-state pin is "HIGH". Both PECL and complimentary PECL outputs are high when Tri-state pin is "LOW".

# CLOCK OSCILLATORS

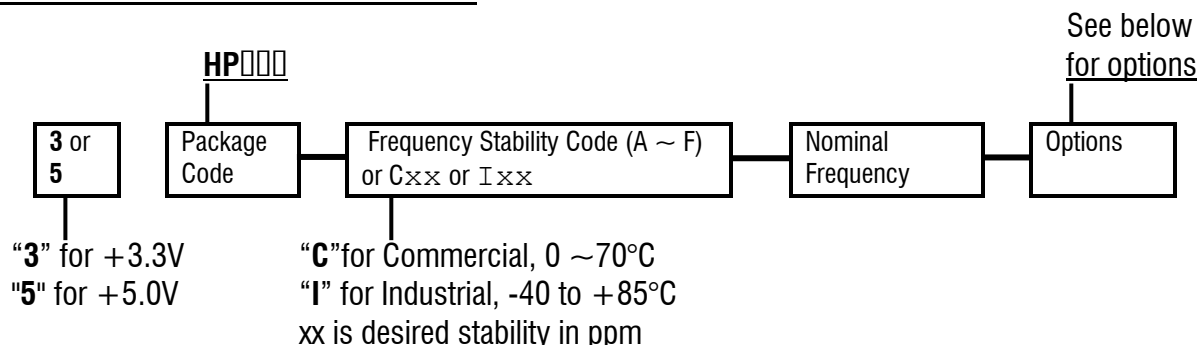
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### PART NUMBER FORMAT AND EXAMPLES:



#### 5HP14-A-125.0

represents +5.0 V non-PLL based PECL clock oscillator, 125.0 MHz in 4 pin DIP full size, frequency stability is  $\pm 25$  ppm over 0 to +70°C. note: 125 MHz fundamental mode inverted mesa crystal used.

#### 3HP614-C20-155.520-3T

represents +3.3 V clock oscillator with non-PLL based PECL output 155.520 MHz in 6 pin full size DIL, frequency stability is  $\pm 20$  ppm over 0 to +70°C (commercial), with Tri-state option on pin 3. note: 155.520 MHz fundamental mode inverted mesa crystal used.

### MODELS WITH OPTIONS

#### 4 pin thru-hole and gull wing models.

Part number suffix	Pin 1	Pin 7	Pin 8	Pin 14
blank	No Connection	Case ground	PECL Output	Supply Voltage
-1C	Complimentary PECL Output	Case ground	PECL Output	Supply Voltage
-1T	Tri-State	Case ground	PECL Output	Supply Voltage

#### 5 pin thru-hole and gull wing models

Part number suffix	Option Pin 1	Pin 7	Pin 8	Option Pin 9	Pin 14
blank	No Connection	Case ground	PECL Output	Complimentary PECL Output	Supply Voltage
- 1T	Tri-State	Case ground	PECL Output	Complimentary PECL Output	Supply Voltage

#### 6 pin thru-hole and gull wing models

Suffix	Pin 1	Option Pin 3	Pin 7	Pin 8	option Pin 12	Pin 14
- 1T	Tri-State	No connection	Case ground	PECL Output	Complimentary PECL output	Supply Voltage
- 3T	No Connection	Tri-State	Case ground	PECL Output	Complimentary PECL output	Supply Voltage

**6 pad leadless surface mount models** : No option available. See package drawing for pin connect

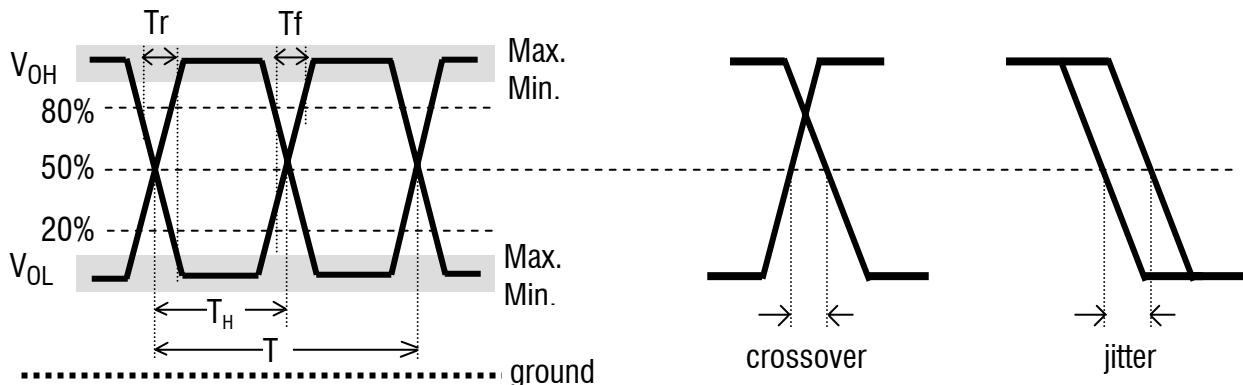
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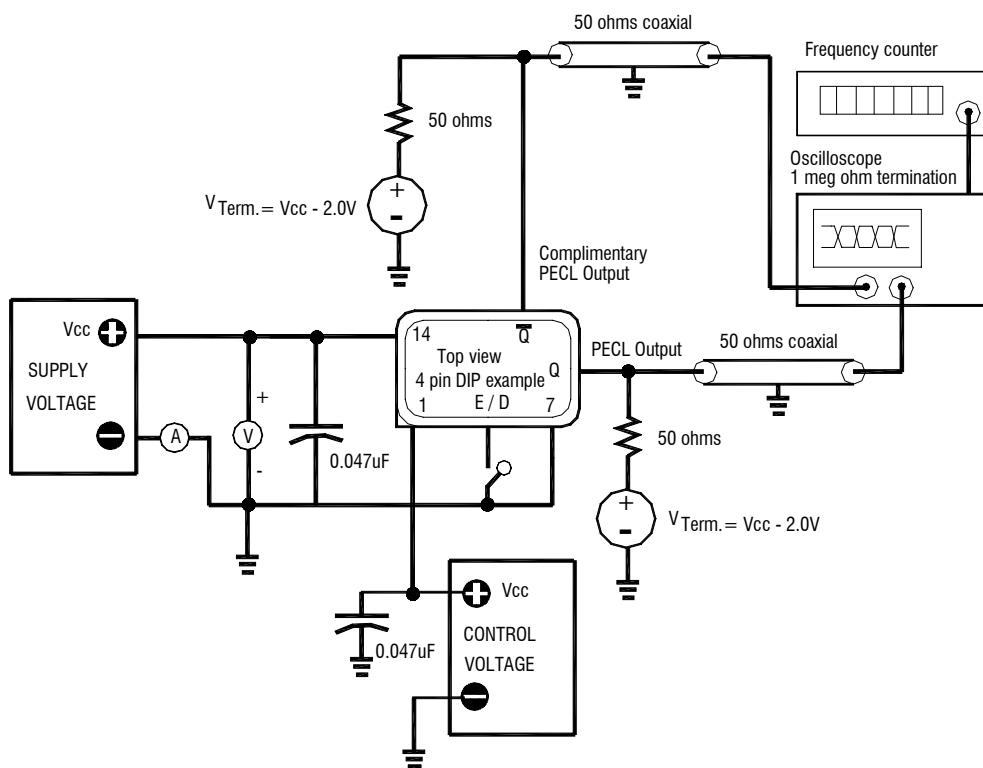


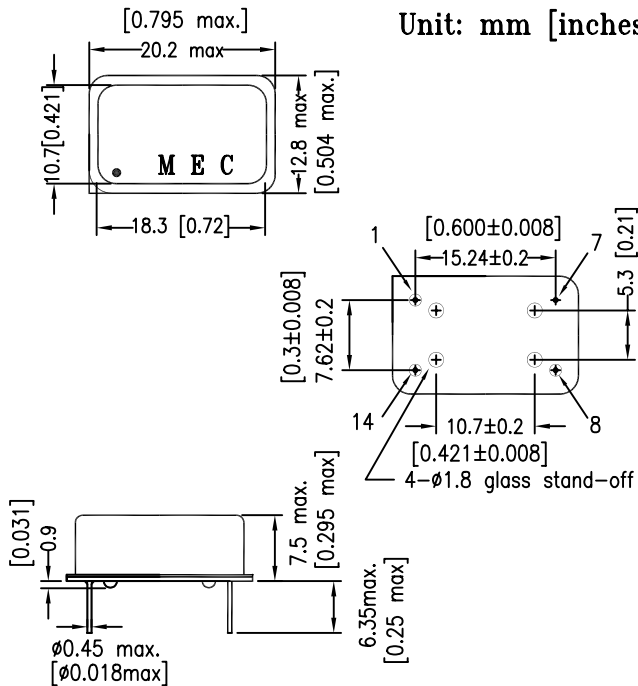
### OUTPUT WAVEFORMS:



$$\text{Duty cycle} = (T_H / T) \times 100$$

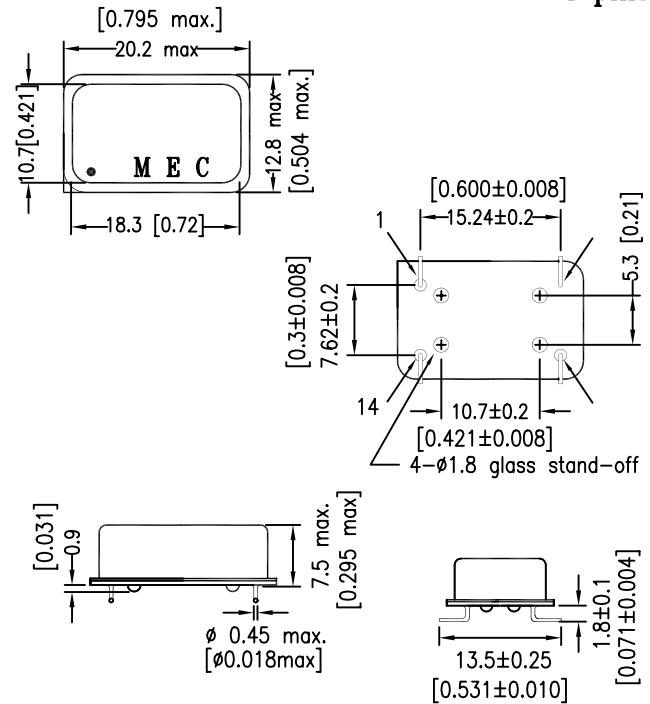
**TEST CIRCUIT** Apply to all models and options. Both PECL and complimentary PECL outputs shown.



**Package: HP14****4 pins****Unit: mm [inches]****Pin Connections**

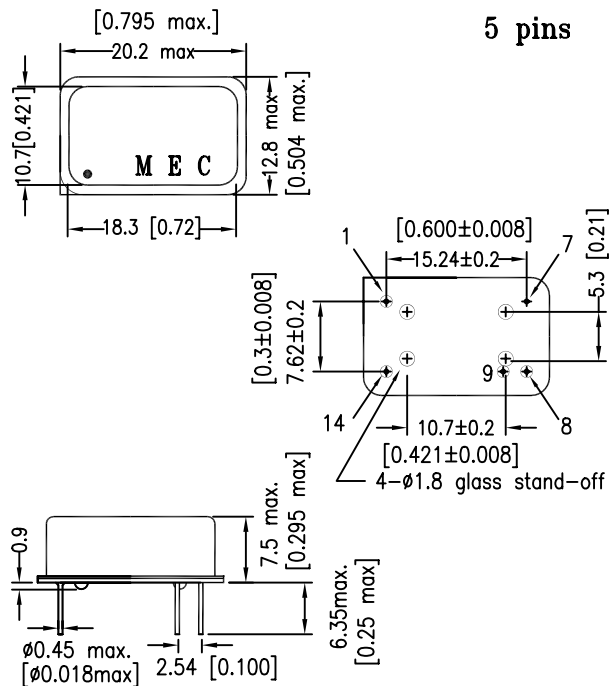
Square corner is pin No.1

- Pin 1: No connection, Tri-state or complimentary output
- Pin 7: Vcc or VEE (refer to model options)
- Pin 8: Output
- Pin 14: Vcc or VEE (refer to model options)

**Package: HP24****4 pins****Pin Connections**

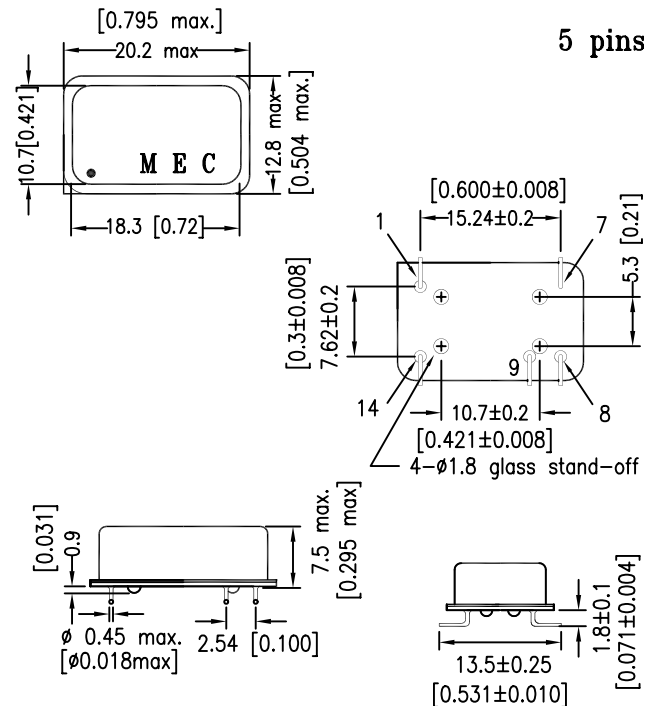
Square corner is pin No.1

- Pin 1: No connection, Tri-state or complimentary output
- Pin 7: Vcc or VEE (refer to model options)
- Pin 8: Output
- Pin 14: Vcc or VEE (refer to model options)

**CLOCK  
PECL****Package: HP514****5 pins****Pin Connections**

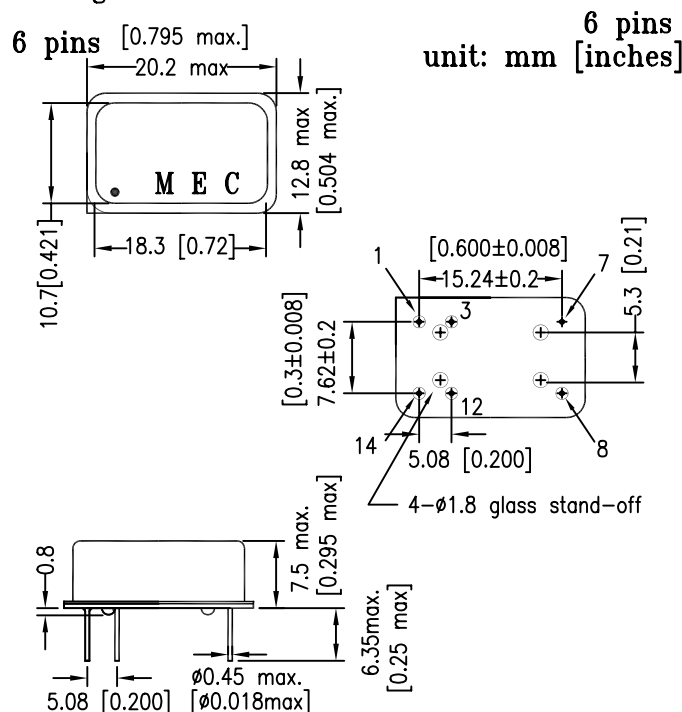
Square corner is pin No.1

- Pin 1: No Connection or Tri-state
- Pin 7: Ground
- Pin 8: Output
- Pin 14: Vcc
- Pin 9: Complimentary output

**Package: HP524****5 pins****Pin Connections**

Square corner is pin No.1

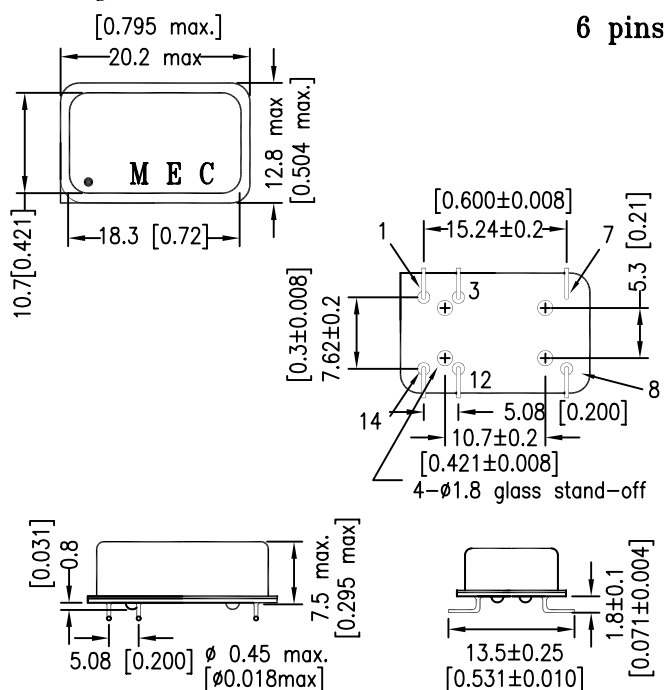
- Pin 1: No Connection or Tri-state
- Pin 7: Ground
- Pin 8: Output
- Pin 14: Vcc
- Pin 9: Complimentary output

**Package: HP614**

Square corner is pin No.1

Pin 3: Tri-state or no connection  
Pin 12: Complimentary Output**Pin Connections**

Pin 1: Tri-state or no Connection  
Pin 7: Ground  
Pin 8: Output  
Pin 14: Vcc

**Package: HP624**

Square corner is pin No.1

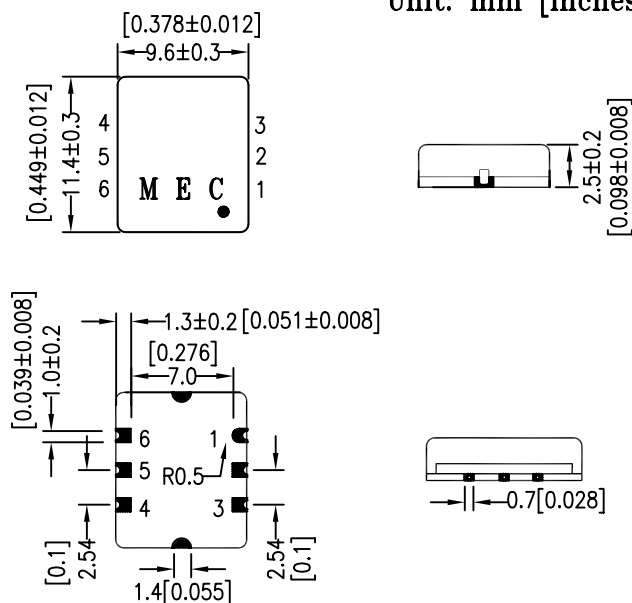
Pin 3: Tri-state or no connection  
Pin 12: Complimentary Output**Pin Connections**

Pin 1: Tri-state or no Connection  
Pin 7: Ground  
Pin 8: Output  
Pin 14: Vcc

**CLOCK  
PECL****Package: HP62**

"62" represents 6 pads and 2.5 mm overall height

Unit: mm [inches]



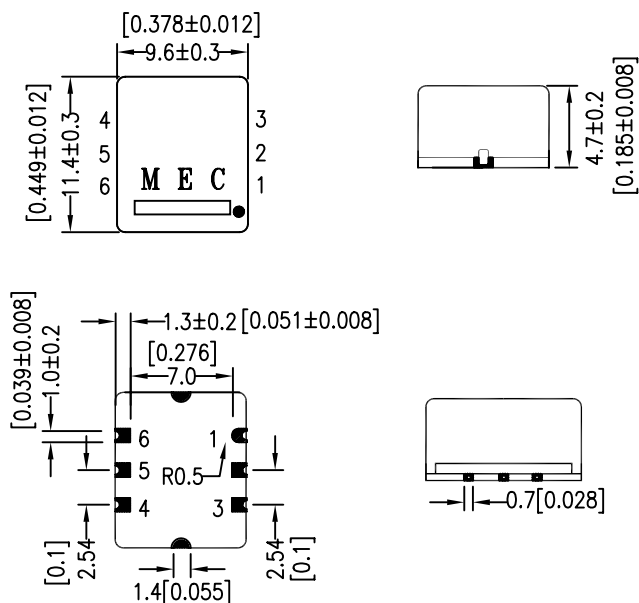
Rounded pad is pad No.1

**Pad Connections:**

Pad 1: No Connection  
Pad 2: Tri-state  
Pad 3: Ground  
Pad 4: Output  
Pad 5: Complimentary output  
Pad 6: Vcc

**Package: HP64**

"64" represents 6 pads and 4.7 mm overall height



Rounded pad is pad No.1

**Pad Connections:**

Pad 1: No Connection  
Pad 2: Tri-state  
Pad 3: Ground  
Pad 4: Output  
Pad 5: Complimentary output  
Pad 6: Vcc