



# MXO45 & MXO45HS

## HCMOS/TTL Clock Oscillators

### Features

- Standard 14-Pin or 8-Pin Metal DIP Packages
- Fundamental and 3<sup>rd</sup> Overtone Crystal Designs
- Low Phase Jitter Performance
- Frequency Range 1 – 200MHz
- +5.0V Operation
- Output Enable Option Available
- Three Approved Packing Methods.



Part Dimensions:  
20.8 × 13.2 × 5.1mm • 3.774537g  
13.2 × 13.2 × 5.1mm • 2.206637g

### Applications

- Computers & Peripherals
- Storage Area Networking
- Broadband Access
- Microcontrollers/FPGAs
- Networking Equipment
- Ethernet/Gigabit Ethernet
- Fiber Channel
- Test and Measurement

### Description

CTS MXO45 and MXO45HS are legacy thru-hole clock oscillators that offer a low cost design supporting older HCMOS/TTL applications. MXO45/MXO45HS is not recommended for new design activity, but is available to support existing applications developed for the full and half-size metal DIP packages.

### Ordering Information

| Model                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Package Type/<br>Output Enable    | Frequency<br>Stability | Temperature<br>Range | Frequency Code<br>[MHz] |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------------|----------------------|-------------------------|------|----------------|----|-----------------------------------|-----|--------------------------|------|----------------------------------|-------|-------------------------|------|-------------|---|----------------|---|----------------|------|-----------|---|---------------------|---|--------|---|--------|---|---------|------|-----------|-------------------------------------|--|
| MXO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 45                                | - 3                    | C                    | - XXXMXXXXXX            |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| <div><div><div>↓</div><table><tr><th>Code</th><th>Package/Enable</th></tr><tr><td>45</td><td>14-Pin DIP/STD Output [no enable]</td></tr><tr><td>45T</td><td>14-Pin DIP/Output Enable</td></tr><tr><td>45HS</td><td>8-Pin DIP/STD Output [no enable]</td></tr><tr><td>45HST</td><td>8-Pin DIP/Output Enable</td></tr></table></div><div><div>↓</div><table><tr><th>Code</th><th>Temp. Range</th></tr><tr><td>C</td><td>-20°C to +70°C</td></tr><tr><td>I</td><td>-40°C to +85°C</td></tr></table></div><div><div>↓</div><table><tr><th>Code</th><th>Stability</th></tr><tr><td>6</td><td>±20ppm<sup>1</sup></td></tr><tr><td>5</td><td>±25ppm</td></tr><tr><td>3</td><td>±50ppm</td></tr><tr><td>2</td><td>±100ppm</td></tr></table></div><div><div>↓</div><table><tr><th>Code</th><th>Frequency</th></tr><tr><td colspan="2">Product Frequency Code<sup>2</sup></td></tr></table></div></div> |                                   |                        |                      |                         | Code | Package/Enable | 45 | 14-Pin DIP/STD Output [no enable] | 45T | 14-Pin DIP/Output Enable | 45HS | 8-Pin DIP/STD Output [no enable] | 45HST | 8-Pin DIP/Output Enable | Code | Temp. Range | C | -20°C to +70°C | I | -40°C to +85°C | Code | Stability | 6 | ±20ppm <sup>1</sup> | 5 | ±25ppm | 3 | ±50ppm | 2 | ±100ppm | Code | Frequency | Product Frequency Code <sup>2</sup> |  |
| Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Package/Enable                    |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 14-Pin DIP/STD Output [no enable] |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| 45T                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 14-Pin DIP/Output Enable          |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| 45HS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 8-Pin DIP/STD Output [no enable]  |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| 45HST                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 8-Pin DIP/Output Enable           |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Temp. Range                       |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -20°C to +70°C                    |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -40°C to +85°C                    |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Stability                         |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ±20ppm <sup>1</sup>               |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ±25ppm                            |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ±50ppm                            |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ±100ppm                           |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Frequency                         |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |
| Product Frequency Code <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                   |                        |                      |                         |      |                |    |                                   |     |                          |      |                                  |       |                         |      |             |   |                |   |                |      |           |   |                     |   |        |   |        |   |         |      |           |                                     |  |

Notes:

- Consult factory for availability of 6C Stability/Temperature combination. The 6I combination is not available.
- Frequency is recorded with 1, 2 or 3 leading significant digits before and 6 significant digits [including zeroes] after the "M".  
[Ex. 3.579545MHz = 3M57954, 14.31818MHz = 14M318180, 25MHz = 25M000000, 125MHz = 125M000000]

**Not all performance combinations and frequencies may be available.**  
**Contact your local CTS Representative or CTS Customer Service for availability.**

This product is specified for use only in standard commercial applications. Supplier disclaims all express and implied warranties and liability in connection with any use of this product in any non-commercial applications or in any application that may expose the product to conditions that are outside of the tolerances provided in its specification.



## Electrical Specifications

## Operating Conditions

| PARAMETER              | SYMBOL    | CONDITIONS                                     | MIN        | TYP | MAX        | UNIT               |
|------------------------|-----------|------------------------------------------------|------------|-----|------------|--------------------|
| Maximum Supply Voltage | $V_{CC}$  | -                                              | -0.5       | -   | 7.0        | V                  |
| Supply Voltage         | $V_{CC}$  | $\pm 10\%$                                     | 4.5        | 5.0 | 5.5        | V                  |
| Supply Current         |           | Freq Range [tested load noted for TYP values.] |            |     |            |                    |
|                        |           | 1.0MHz to 20MHz [ $C_L = 30\text{pF}$ ]        | -          | 10  | 26         |                    |
|                        |           | 20.001MHz to 40MHz [ $C_L = 30\text{pF}$ ]     | -          | 20  | 40         |                    |
|                        | $I_{CC}$  | 40.001MHz to 80MHz [ $C_L = 30\text{pF}$ ]     | -          | 30  | 60         | mA                 |
|                        |           | 80.001MHz to 125MHz [ $C_L = 15\text{pF}$ ]    | -          | 40  | 70         |                    |
|                        |           | 125.001MHz to 200MHz [ $C_L = 15\text{pF}$ ]   | -          | 55  | 80         |                    |
| Operating Temperature  | $T_A$     | -                                              | -20<br>-40 | +25 | +70<br>+85 | $^{\circ}\text{C}$ |
| Storage Temperature    | $T_{STG}$ | -                                              | -40        | -   | +100       | $^{\circ}\text{C}$ |

## Frequency Stability

| PARAMETER                       | SYMBOL            | CONDITIONS                                             | MIN | TYP               | MAX | UNIT            |
|---------------------------------|-------------------|--------------------------------------------------------|-----|-------------------|-----|-----------------|
| Frequency Range                 | $f_O$             | -                                                      |     | 1 - 200           |     | MHz             |
| Frequency Stability<br>[Note 1] | $\Delta f/f_O$    | -                                                      |     | 20, 25, 50 or 100 |     | $\pm\text{ppm}$ |
| Aging                           | $\Delta f/f_{25}$ | First Year @ +25 $^{\circ}\text{C}$ , nominal $V_{CC}$ | -5  | $\pm 3$           | 5   | ppm             |

1.] Inclusive of initial tolerance at time of shipment, changes in supply voltage, load, temperature and 1st year aging.

## Output Parameters

| PARAMETER             | SYMBOL                             | CONDITIONS                                           | MIN          | TYP   | MAX          | UNIT |
|-----------------------|------------------------------------|------------------------------------------------------|--------------|-------|--------------|------|
| Output Type           | -                                  | -                                                    |              | HCMOS |              | -    |
| Output Load           |                                    | 1.0MHz to 50MHz [CMOS Load]                          | -            | 15    | 50           |      |
|                       | $C_L$                              | 50.001MHz to 80MHz [CMOS Load]                       | -            | 15    | 30           | pF   |
|                       |                                    | 80.001MHz to 200MHz [CMOS Load]                      | -            | 15    | 15           |      |
|                       |                                    | 1.0MHz to 200MHz [TTL Load]                          | -            | -     | 10           | TTL  |
| Output Voltage Levels | $V_{OH}$                           | CMOS Load                                            | 0.9 $V_{CC}$ | -     | -            |      |
|                       |                                    | 10TTL Load                                           | 2.4          | -     | -            | V    |
|                       | $V_{OL}$                           | CMOS Load                                            | -            | -     | 0.1 $V_{CC}$ |      |
|                       |                                    | 10TTL Load                                           | -            | -     | 0.4          |      |
| Output Current Levels | $I_{OH}$                           | $V_{OH} = 3.9\text{V}$ , $V_{CC} = 4.5\text{V}$      | -            | -     | -16          | mA   |
|                       | $I_{OL}$                           | $V_{OL} = 0.4\text{V}$ , $V_{CC} = 4.5\text{V}$      | -            | -     | 16           |      |
| Output Duty Cycle     | SYM                                | @ 50% Level                                          | 45           | -     | 55           | %    |
| Rise and Fall Time    |                                    | @ 10%/90% Levels [tested load noted for TYP values.] |              |       |              |      |
|                       |                                    | 1.0MHz to 20MHz [ $C_L = 30\text{pF}$ ]              | -            | 8     | 10           |      |
|                       | $T_{R\downarrow}, T_{F\downarrow}$ | 20.001MHz to 80MHz [ $C_L = 30\text{pF}$ ]           | -            | 5     | 8            | ns   |
|                       |                                    | 80.001MHz to 125MHz [ $C_L = 15\text{pF}$ ]          | -            | 2.5   | 5            |      |
|                       |                                    | 125.001MHz to 200MHz [ $C_L = 15\text{pF}$ ]         | -            | -     | 2            |      |
| Start Up Time         | $T_S$                              | Application of $V_{CC}$ , $C_L = 15\text{pF}$        | -            | 5     | 10           | ms   |

### Electrical Specifications

#### Output Parameters

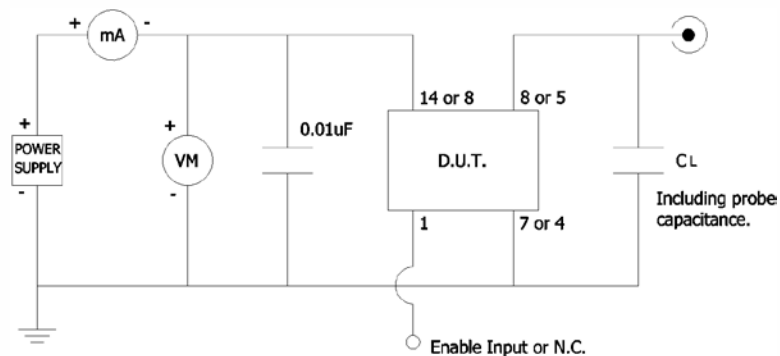
| PARAMETER              | SYMBOL    | CONDITIONS                       | MIN | TYP | MAX | UNIT |
|------------------------|-----------|----------------------------------|-----|-----|-----|------|
| <b>Enable Function</b> |           |                                  |     |     |     |      |
| Enable Input Voltage   | $V_{IH}$  | Pin 1 Logic '1', Output Enabled  | 2.0 | -   | -   | V    |
| Disable Input Voltage  | $V_{IL}$  | Pin 1 Logic '0', Output Disabled | -   | -   | 0.8 | V    |
| Disable Current        | $I_{IL}$  | Pin 1 Logic '0', Output Disabled | -   | 10  | 15  | mA   |
| Enable Time            | $T_{PLZ}$ | Pin 1 Logic '1', Output Enabled  | -   | -   | 200 | ns   |
| Phase Jitter, RMS      | tjrms     | Bandwidth 12 kHz - 20 MHz        | -   | 0.7 | 1.0 | ps   |

#### Enable Truth Table

| Pin 1     | Pin 8 or Pin 5 |
|-----------|----------------|
| Logic '1' | Output         |
| Open      | Output         |
| Logic '0' | High Imp.      |

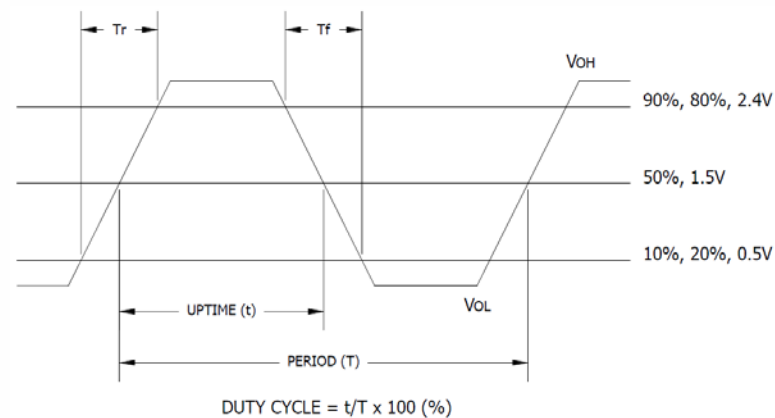
#### Test Circuit

HCMOS



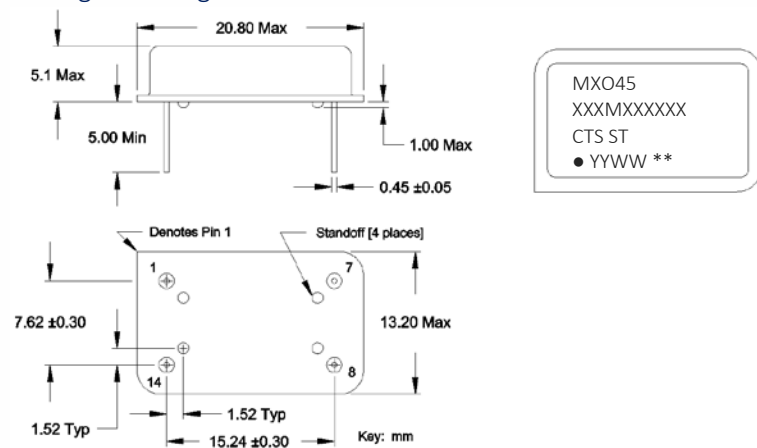
#### Output Waveform

HCMOS



### Mechanical Specifications

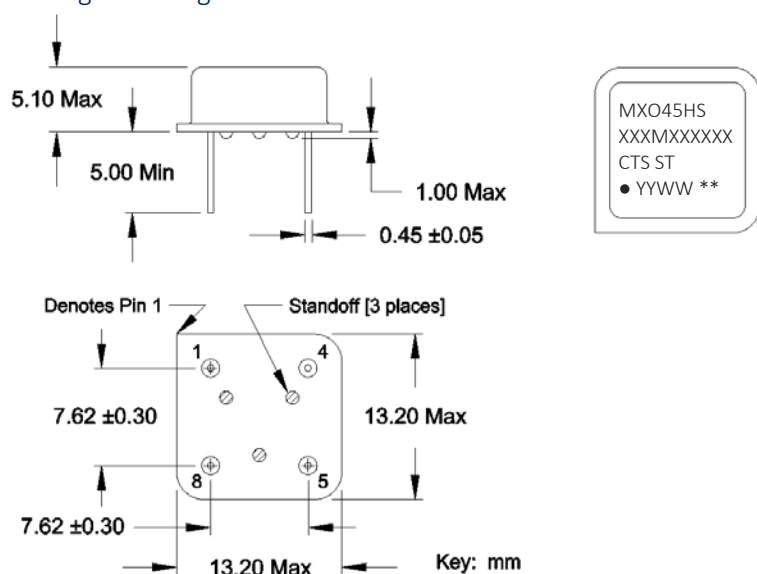
#### Package Drawing – DIP-14



#### Marking Information

- Model Name:  
DIP-14 – MXO45 or MXO45T  
DIP-8 – MXO45HS or MXO45HST
- xxxMxxxxxx – Frequency is marked with 1,2 or 3 leading significant digits before the “M” and 6 digits after the “M” [including zeroes].  
Ex. xMxxxxxx [3M579545]  
xxMxxxxxx [14M318180]  
xxMxxxxxx [25M000000]  
xxxMxxxxxx [125M000000]
- ST – Frequency Stability/Temperature Code.  
[Refer to Ordering Information]
- YYWW – Date Code; YY – year, WW – week.
- \*\* - Manufacturing Site Code.

#### Package Drawing - DIP-8



#### Notes

- JEDEC termination code (e1). Lead finish is tin-silver-copper [SnAgCu].
- Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
- Hand soldering conditions; solder iron temperature +350°C maximum, 10 seconds.
- MSL = 1.

#### Pin Assignments

| Pin     | Symbol          | Function                 |
|---------|-----------------|--------------------------|
| 1       | EOH             | Enable                   |
| 7 or 4  | GND             | Circuit & Package Ground |
| 8 or 5  | Output          | RF Output                |
| 14 or 8 | V <sub>CC</sub> | Supply Voltage           |



### Packaging - CTS Approved Methods

#### Anti-Static Foam in Cardboard Carton

Typical packing format:

1. 50pcs. per anti-static foam layer.
2. 2 layers of anti-static foam [100pcs.] per inner cardboard carton.  
Carton size is approximately 170mm x 120mm x 45mm [LxWxH].
3. An anti-static foam sheet layer is placed as a buffer on top of each layer containing oscillators.
4. Master-pack multiple inner cartons in a larger outer cardboard carton.  
20 inner cartons [100pcs. per carton] per outer carton, is approximately 550mm x 350mm x 180mm [LxWxH].

#### Anti-Static Plastic Trays

Typical packing format:

1. 50pcs. per plastic tray.  
Tray size is approximately 180mm x 136mm x 18mm [LxWxH].
2. 2 trays per anti-static bag [100pcs.] or 10 trays per anti-static bag [500pcs.]  
Bag height for 10 trays is approximately 175mm.
3. One anti-static bag per inner cardboard carton.
4. Master-pack multiple inner cartons in a larger outer cardboard carton.  
8 inner cartons [10 trays per carton] per outer carton, is approximately 460mm x 380mm x 400mm [LxWxH].

#### Anti-Static Plastic Tubes

Typical packing format:

1. 10pcs. per plastic tube – Full-Size package.  
15pcs. per plastic tube – Half-Size package.
2. Plastic tubes are master packed in cardboard carton.  
Carton is approximately 35mm x 35mm x 20mm [LxWxH].