

# CTS CORPORATION

SPECIALISTS IN FREQUENCY MANAGEMENT

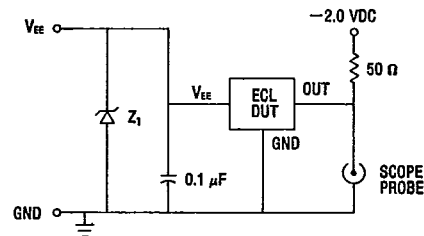
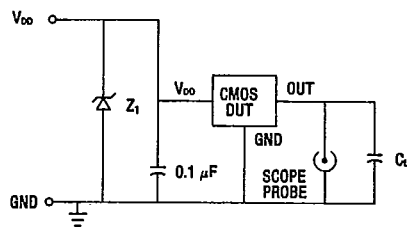
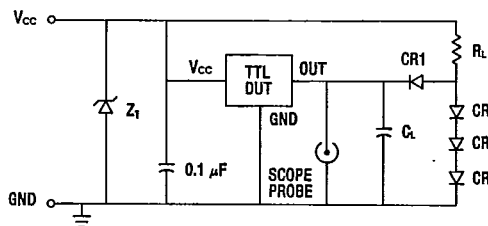
**KNIGHTS DIVISION** 400 Reimann Ave., Sandwich, IL 60548 • 815/786-8411 • TWX 910-642-0860 Cable CTS  
FAX 815-786-9743

## Engineering Data For Hybrid Oscillators

### TYPICAL CHARACTERISTICS

- STORAGE TEMPERATURE: -65°C to +150°C.
- TEMPERATURE CYCLE: 25 cycles, -55°C to +125°C, per method 1010 of MIL-STD-883.
- CONSTANT ACCELERATION: 5000 G, Y1 direction, per method 2001 of MIL-STD-883.
- MECHANICAL SHOCK: 1500 G, 0.5 ms, 3 shocks per direction, per method 2002 of MIL-STD-883.
- SINUSOIDAL VIBRATION: 0.06" D.A., 10 to 55 Hz and 30 G, 55 to 2000 Hz, 3 cycles per direction, per method 2007 of MIL-STD-883.
- RANDOM VIBRATION: 20 G<sub>RMS</sub>, 20 to 2000 Hz, per method 2026 of MIL-STD-883.
- LEAD INTEGRITY: Per conditions B1 and B2 in method 2004 of MIL-STD-883.
- HERMETICITY: 1 x 10<sup>-8</sup> ATC-cc/sec, per conditions A1 and C in method 1014 of MIL-STD-883.
- MOISTURE RESISTANCE: 10 cycles, per method 1004 of MIL-STD-883 with step 7 subcycle omitted.
- CORROSION RESISTANCE: 24 hours, per condition A in method 1009 of MIL-STD-883.
- SOLDERABILITY: Per method 2003 of MIL-STD-883, or method 208 of MIL-STD-202.
- QUALITY: In accordance with MIL-I-45208.
- RESISTANCE TO SOLDERING HEAT: Per conditions A and C in method 210 of MIL-STD-202.
- MARKING PERMANENCE: Per method 2015 of MIL-STD-883.
- THERMAL RESISTANCE: Per method 1012.1 of MIL-STD-883:  
 MXO-55 style package = 12°C/watt typical.  
 TO-5/TO-8 style package = 8°C/watt typical.  
 CCXO style package = 7°C/watt typical.
- ELECTROSTATIC DISCHARGE SENSITIVITY: Per method 3015 of MIL-STD-883:  
 TTL output models — > 4 KV (Class B — not sensitive)  
 ECL output models — > 4 KV (Class B — not sensitive)  
 CMOS output models — < 2 KV (Class A — sensitive)
- STEADY-STATE LIFE: 1000 hrs. @ 125°C per method 1005 of MIL-STD-883, disregarding frequency shift.
- Frequency Aging: <10 ppm shift in 30 days @ 85°C ambient.
- No External Connection Allowed on N/C Pinouts.

### EQUIVALENT TEST LOAD DIAGRAMS

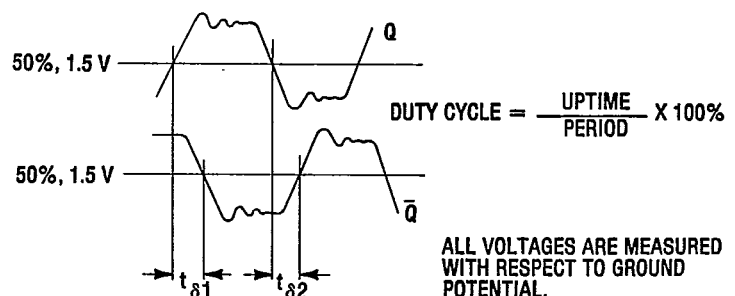
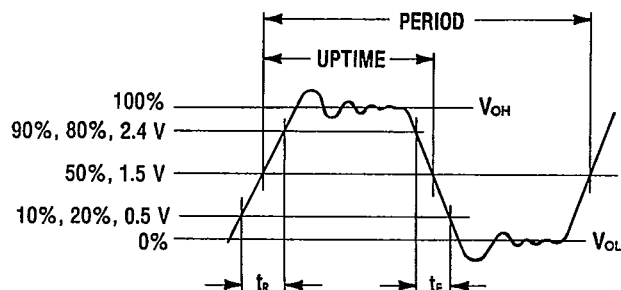


- CL = 15 pF (including probe and fixture)
- CR1-CR4 = 1N3064 or equivalent
- RL = 270Ω for 10 STTL
- 390Ω for 10 TTL
- 560Ω for 5 STTL
- 2kΩ for 10 LSTTL

#### NOTES:

1. All lead length should be kept as short as possible.
2. Waveform measurement system should have a minimum bandwidth of 5 times the frequency being tested.
3. Z1 is a transient surge suppressor recommended on all test fixturing. Diode should clamp within 20% of the maximum rated operating voltage in less than 10 picoseconds.

### WAVEFORM CONDITIONS



ALL VOLTAGES ARE MEASURED WITH RESPECT TO GROUND POTENTIAL.

**CTS CORPORATION**  
**KNIGHTS DIVISION**

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400 Reimann Ave., Sandwich, IL 60548 • 815/786-8411 • TWX 910-642-0860 Cable CTS  
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**Standard Distributor Hybrid Clock Oscillators**

Choice of Three Logic Types:  
 TTL, H-CMOS, ECL  
 Fully Hermetic

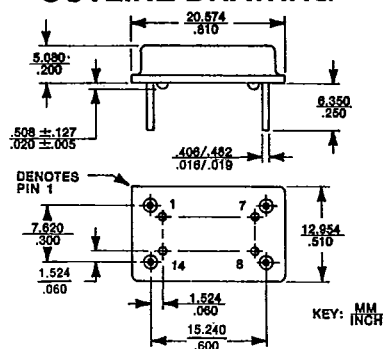
Resistance Weld package, 14 PIN DIP Compatible.

**FREQUENCY STABILITY:** Inclusive of calibration tolerance @ 25°C, operating temperature range, environmental conditions, input voltage, aging and load change; ±.01%. Other stabilities available upon request.

**OPERATING CONDITIONS:**

Supply Voltage: 5.0V ± 10%  
 Operating Temperature: 0 to 70°C  
 Fan Out: 10 TTL loads  
 Storage Temperature: -55 to +125°C  
 Popular frequencies of CTS Hybrid Clock Oscillators are available as "off-the-shelf" items from authorized CTS distributors under the following part numbers:

**OUTLINE DRAWING**



**FIG. 9 MXO-55 PACKAGE**

**MX0-55 SERIES**

TTL Logic ±.01% Stability

CTS P/N	FREQUENCY
MX055GB-2C	1.8432 MHz
MX055GB-2C	3.6864 MHz
MX055GB-2C	4.0000 MHz
MX055GA-2C	4.9152 MHz
MX055GA-2C	5.0688 MHz
MX055GA-2C	7.3728 MHz
MX055GA-2C	8.0000 MHz
MX055GA-2C	10.0000 MHz
MX055GA-2C	12.0000 MHz

CTS P/N	FREQUENCY
MX055GA-2C	14.31818 MHz
MX055GA-2C	16.0000 MHz
MX055GA-2C	16.257 MHz
MX055GA-2C	18.432 MHz
MX055GA-2C	19.6608 MHz
MX055GA-2C	20.0000 MHz
MX055GA-2C	24.0000 MHz
MX055GA-2C	32.0000 MHz
MX055GA-2C	40.0000 MHz

**CX065 SERIES**

HCMOS Logic ±.01% Stability

FREQUENCY	PART NUMBER
4.0000 MHz	CX065GA-2C-4.0 MHz
4.9152 MHz	CX065GA-2C-4.9152 MHz
8.0000 MHz	CX065GA-2C-8.0 MHz
10.0000 MHz	CX065GA-2C-10.0 MHz
12.0000 MHz	CX065GA-2C-12.0 MHz
16.0000 MHz	CX065GA-2C-16.0 MHz
20.0000 MHz	CX065GA-2C-20.0 MHz
24.0000 MHz	CX065GA-2C-24.0 MHz

**EX055 SERIES**

10KH ECL Logic ±0.01% Stability

FREQUENCY	PART NUMBER
80.0 MHz	EX055GO-2C-80.0 MHz
100.0 MHz	EX055GO-2C-100.0 MHz
110.0 MHz	EX055GO-2C-110.0 MHz
120.0 MHz	EX055GO-2C-120.0 MHz

See Data Sheets to Follow for Pin Connections and Complete Electrical Specifications.

Consult factory for new frequencies available in HCMOS logic.

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FAX 815-786-9743

## Hybrid Clock Oscillators

### ORDERING INFORMATION

#### MXO-55 SERIES

TTL logic outputs  
14 pin DIP compatible  
19.2 KHz to 100 MHz

#### PIN CONNECTIONS

Pin 1: N/C, enable, or output  
Pin 7: Ground/case  
Pin 8: Output  
Pin 14: +5 VDC

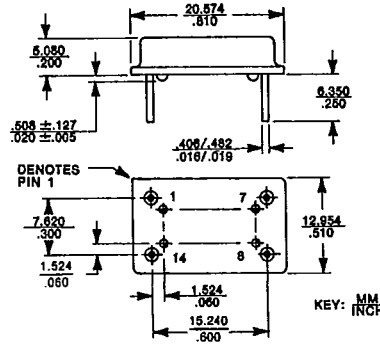


FIG. 9 MXO-55 PACKAGE



FREQUENCY, MODEL & OPTIONS	CODE
4.9152 MHz to 100 MHz Basic oscillator No enable	GA
4.9152 MHz to 70 MHz Basic oscillator with enable (NOTE 3, 5)	GAE
19.2 KHz to 4.9151 MHz Basic oscillator w/dividers	GB
307.2 KHz to 4.9151 MHz Divider output with enable	GBE
2.4576 MHz to 60 MHz Complementary outputs	GC
Dual outputs Pin 8: 307.2 KHz to 1.25 MHz Pin 1: 16X Pin 8	GD16
Dual outputs Pin 8: 614 KHz to 2.5 MHz Pin 1: 8X Pin 8	GD18
Dual outputs Pin 8: 1.228 MHz to 5 MHz Pin 1: 4X Pin 8	GD28
Dual outputs Pin 8: 2.457 MHz to 10 MHz Pin 1: 2X Pin 8	GD48

FREQUENCY TOLERANCE (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
-40°C to +85°C	I
-55°C to +105°C	P
-55°C to +125°C	M

#### NOTE:

- When ordering screening similar to MIL-O-55310, Class B, add -MLB after frequency.
- Tolerances include 25°C accuracy, changes in operating temperature, supply voltage, load, environmental conditions, and aging.
- ENABLE FUNCTION (50 nsec max response time)  
HI: ENABLES OSCILLATOR  
LO: Disables oscillator (output latches HI)
- On frequencies below 307.2 KHz the crystal frequency will be on Pin 1.
- See MX053 Series for TRISTATE Output option.
- Short Circuit Output current = 100ma max and 5 minutes max duration at RMT

### ELECTRICAL SPECIFICATIONS (MXO-55 SERIES)

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMPERATURE RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS				
Operating Voltage	A, B, C, D	19.2 KHz to 100 MHz	-55°C to +125°C	V <sub>cc</sub>	4.75	5.00	5.25	V				
			-40°C to +85°C		4.50	5.00	5.50					
Maximum Supply Voltage			-55°C to +125°C	V <sub>cc</sub> Max.			7.00					
Supply Current	A	4.9152 to 25 MHz	-55°C to +125°C	I <sub>cc</sub>		20	35	mA				
		>25 to <70 MHz			33	65						
		70 to 100 MHz			60	110						
	B	2.4576 to <4.9152 MHz			30	50						
		307.2 KHz to <2.4576 MHz			45	75						
	C	19.2 to <307.2 KHz			70	125						
		>12 to 60 MHz			15	22	75					
		2.4576 to 12 MHz			30	50						
D	307.2 KHz to 10 MHz	45	75									
Output Voltage — HI	A, B, C, D	19.2 KHz to 100 MHz	-55°C to +125°C	V <sub>OH</sub>	2.40	3.60		V				
Output Voltage — LO			-40°C to +85°C			0.30	0.50					
Rise & Fall Time (measured between 0.5V & 2.4V)	A	4.9152 to 25 MHz	-55°C to +125°C	t <sub>r</sub> & t <sub>f</sub>		3	5	nS				
		>25 to 100 MHz			2	4						
	B	2.4576 to <4.9152 MHz			3	5						
		19.2 KHz to <2.4576 MHz			8	18						
	C	2.4576 to 60 MHz			3	5						
		307.2 KHz to 10 MHz			8	18						
	Start-up Time	A, B, C, D			19.2 KHz to 25 MHz	-55°C to +125°C	t <sub>s</sub>			2	5	mS
		A			>25 to 100 MHz					8	15	
Duty Cycle (uptime) (measured @ 1.5V)	A	4.9152 to 25 MHz	0°C to +70°C		45	50	55	%				
			-55°C to +125°C		40	50	60					
		>25 to 100 MHz		35	50	65						
	B	2.4576 to <4.9152 MHz	-55°C to +125°C		45	50	55					
		19.2 KHz to <2.4576 MHz		40	50	60						
	C	2.4576 to 12 MHz	0°C to +70°C		45	50	55					
		>12 MHz to 60 MHz	-55°C to +125°C		35	50	65					
			0°C to +70°C		45	50	55					
	D	307.2 KHz to 10 MHz	-55°C to +125°C		40	50	60					
			0°C to +70°C		45	50	55					
			0°C to +70°C		6	10						
	Phase Delay (measured @ 1.5V)	C	>12 to 60 MHz	0°C to +70°C	t <sub>d1</sub> & t <sub>d2</sub>		6		12	nS		
-55°C to +125°C					3	5						
2.4576 to 12 MHz			0°C to +70°C		3	5						
			-55°C to +125°C		3	8						
Enable Input Load Factor	AE	4.9152 to 70 MHz	-60°C to +125°C	F <sub>1</sub>			1					
		2.4576 to 70 MHz	-55°C to +125°C				10					
Fanout (per output)	A, B, C	2.4576 to 70 MHz	-40°C to +85°C	F <sub>o</sub>			2	S-TTL Gates				
		>70 MHz to 100 MHz	-55°C to +125°C				5					
	A	19.2 KHz to <2.4576 MHz	-55°C to +125°C				10	TTL Gates				
		307.2 KHz to 10 MHz	-55°C to +125°C				10					

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### JKTO-79 SERIES

TTL logic outputs  
"A" MODELS are electrically similar to MXO55GA Models  
"B" MODELS are electrically similar to MXO55GB Models from 307.2 KHZ to <2.4576 MHZ

TO-8 compatible  
500 KHZ to 70 MHZ

#### ENABLE FUNCTION

4 MHz to 12 MHz:

HI: Enables oscillator

LO: Disables oscillator  
(Q<sub>A</sub> latches LO,  
Q<sub>B</sub> latches HI)

500 KHZ to <4 MHZ:

LO: Enables oscillator

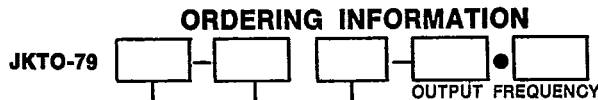
HI: Disables oscillator  
(Q<sub>A</sub> & Q<sub>B</sub> latch LO)

CE MODEL now available from 3.5 to 25.0 MHZ

Enable and latch as above except from 12.01 to 25.0 MHZ

HI: Enables oscillator

LO: Disables oscillator  
Q<sub>A</sub> latches HI  
Q<sub>B</sub> latches LO



FREQUENCY AND MODEL AND OPTION	CODE
7.0 MHz to 70.0 MHz Basic oscillator No enable	A
500 KHz to 7.0 MHz Oscillator with divider No enable	B
3.5 MHz to 25 MHz Oscillator with Complementary output - No enable	C
Oscillator with dual outputs and no enable Q <sub>A</sub> = 4X Q <sub>B</sub> Q <sub>B</sub> = 1 to 3 MHz	D28
Oscillator with dual outputs and no enable Q <sub>A</sub> = 2X Q <sub>B</sub> Q <sub>B</sub> = 1 to 3 MHz	D48
Any of above (below 12 MHz) with enable For CE MODEL see note at left	AE BE D28E D48E

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
-40°C to +85°C	I
-55°C to +105°C	P
-55°C to +125°C	M

NOTE 2:  
Tolerance includes 25°C accuracy, changes in operating temperature, supply voltage, load, environmental conditions, and aging.

PIN	CONNECTION
1	Enable/disable option (otherwise NC)
2	Internal connection
3	Output A (Q <sub>A</sub> ) (otherwise NC)
4	Ground
5	Output B (Q <sub>B</sub> )
6	Internal connection
7	NC (Model A) Internal connection (Model B, C, D) Crystal frequency (Model C, D)
8	Vcc

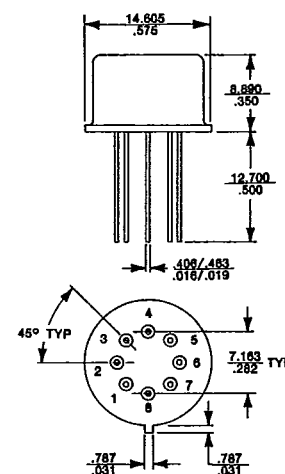


FIG. 11 TO-8 PACKAGE

NOTE: Screening Similar to MIL-0-55310, Class B Available by Adding -MLB to the End of the P/N.

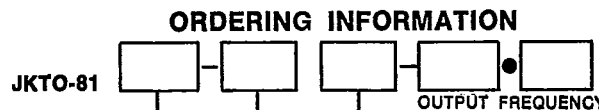
### JKTO-81 SERIES

TTL logic output  
"A" MODELS are electronically similar to MXO55GA Models  
"B" MODELS are electronically similar to MXO55GB Models from 307.2 KHZ to <2.4576 MHZ

TO-5 compatible  
1 MHz to 25 MHz

#### PIN CONNECTION

- Pin 1: N/C
- Pin 2: Internal connection
- Pin 3: N/C
- Pin 4: Ground/case
- Pin 5: Output
- Pin 6: Internal connection
- Pin 7: N/C
- Pin 8: +5 VDC



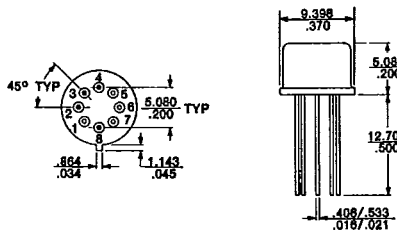
FREQUENCY AND MODEL AND OPTION	CODE
12 to 25MHz Basic oscillator	A
1 to <12 MHz Basic oscillator with dividers	B

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
-40°C to +85°C	I
-55°C to +105°C	P
-55°C to +125°C	M

See NOTE 2 above.

FIG. 10 TO-5 PACKAGE



NOTE: Screening Similar to MIL-0-55310, Class B Available by Adding -MLB to the End of the P/N.

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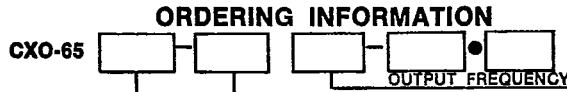
## C-MOS Compatible Hybrid Clock Oscillators

### CXO-65 SERIES

High speed CMOS logic output  
14-pin DIP compatible  
(MXO-55 style)  
200 Hz to 50 MHz

**PIN CONNECTIONS**  
Pin 1: N/C or Enable  
Pin 7: Ground/Case  
Pin 8: Output  
Pin 14: +5 VDC

ENABLE INPUT	OUTPUT
Open or High	Oscillator Output
Low	Latches High



FREQUENCY AND MODEL	CODE
3.0 to 50 MHz Basic oscillator	GA
200 Hz to <3.0 MHz Basic oscillator with dividers	GB
3.0 to 50.0 MHz Basic oscillator with enable (active high)	GAE

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
-40°C to +85°C	I
-55°C to +105°C	P
-55°C to +125°C	M

NOTE: Screening Similar to MIL-C-55310, Class B Available by Adding -MLB to the End of the P/N.

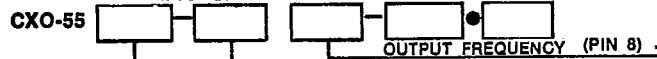
### CX065G SERIES ELECTRICAL CHARACTERISTICS

SPECIFICATION	MODEL	FREQ. RANGE	TEMP. RANGE	CONDITIONS	SYMBOL	MIN.	TYPICAL	MAX.	UNITS
Operating Voltage	A, B	200 Hz - 25 MHz	-40°C to +85°C		V <sub>DD</sub>	4.50	5.00	5.50	VDC
		25 MHz - 50 MHz	-55°C to +125°C			4.75		5.25	
Max. Supply Voltage		200 Hz - 50 MHz			V <sub>DD</sub> (max.)			7.00	
Input Current vs. Frequency	B	200 Hz - <3 MHz	-55°C to +125°C	C <sub>L</sub> = 50 pf	I <sub>DD</sub>		6.0	10.0	mA
	A	3 MHz - 50 MHz				1.0	1.2		
Output Voltage - Hi	A, B	200 Hz - 50 MHz	-55°C to +125°C	C <sub>L</sub> = 50 pf FO = 10 LS TTL	V <sub>OH</sub>	V <sub>DD</sub> - 0.2	V <sub>DD</sub> - 0.1		V
						3.5	4.5		
Output Voltage - Lo	A, B			C <sub>L</sub> = 50 pf FO = 10 LS TTL	V <sub>OL</sub>		0.1	0.2	V
							0.2	0.4	
Rise & Fall Times	B	200 Hz - 2.9 MHz	-40°C to +85°C	C <sub>L</sub> = 50 pf 10% to 90% of Waveform	t <sub>r</sub> & t <sub>f</sub>		14	20	nS
			-55°C to +125°C				25		
	A	3 MHz - 25 MHz	-40°C to +85°C			9	12		
			-55°C to +125°C				15		
	A, B	>25 MHz - 50 MHz	-40°C to +85°C			5	8		
							10		
(FO = Fan Out)	A, B	200 Hz - 50 MHz	-55°C to +125°C	FO = 10 LS TTL 0.5V to 2.4V			2	.5	
Duty Cycle (% Uptime)	B	200 Hz - <3 MHz	-55°C to +125°C	C <sub>L</sub> = 50 pf @ 50% of Waveform		45		55	%
	A	3 MHz - 50 MHz	-40°C to +85°C			40	50	60	
			-55°C to +125°C						
A, B	200 Hz - 50 MHz	-55°C to +125°C	10 LS TTL @ 1.5V Level	40	51	60			
Output Current - Hi	A, B	200 Hz - 50 MHz	-55°C to +125°C	V <sub>OH</sub> = 3.7V	I <sub>OH</sub>	4.0			mA
Input Current - Lo				V <sub>OL</sub> = 0.4V	I <sub>OL</sub>	4.0			
Fan Out	A, B	200 Hz - 50 MHz	-55°C to +125°C		C <sub>L</sub>	50			pf
						FO	10		
Enable Input Volt	AE	3 MHz - 50 MHz	-55°C to +125°C			V <sub>IH</sub>	3.20	5.50	V
Disable Input Volt						V <sub>IL</sub>	-0.50	1.30	

### CXO-55 SERIES

Low power consumption  
CMOS logic output  
14-pin DIP compatible  
(MXO-55 style)  
200 Hz to 5 MHz  
**PIN CONNECTIONS**  
Pin 1: N/C  
Pin 7: Ground/Case  
Pin 8: Output  
Pin 14: +5 VDC to + 15 VDC

### ORDERING INFORMATION (SEE NOTE)



FREQUENCY AND MODEL	CODE
3 to 5 MHz Basic oscillator	GA
200 Hz to <3 MHz Basic oscillator with dividers	GB

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
-40°C to +85°C	I
-55°C to +105°C	P
-55°C to +125°C	M

### ELECTRICAL SPECIFICATIONS

SPECIFICATION	MODEL	FREQ. RANGE	TEMP. RANGE	CONDITIONS	SYMBOL	MIN.	TYPICAL	MAX.	UNITS
Operating Voltage	A, B	200 Hz to 5 MHz	-55°C to +125°C		V <sub>DD</sub>	4.50	5.00	15.50	V
Max. Supply Voltage					V <sub>DD</sub> Max.			18	
Supply Current	B	200 Hz to <3 MHz	-55°C to +125°C	C <sub>L</sub> = 15 pf	I <sub>DD</sub>	V <sub>DD</sub> = 5V		3	mA
						V <sub>DD</sub> = 10V		5	
	V <sub>DD</sub> = 15V					8			
	V <sub>DD</sub> = 5V					4			
A	3 MHz to 5 MHz	V <sub>DD</sub> = 10V		7					
		V <sub>DD</sub> = 15V		12					
Output Voltage—HI	A, B	200 Hz to 5 MHz	-55°C to +125°C	C <sub>L</sub> = Max.	V <sub>OH</sub>	V <sub>DD</sub> - .5	V <sub>DD</sub> - .1		V
Output Voltage—LO						V <sub>OL</sub>		.1	
Rise & Fall Times (measured from 10% to 90% waveform)	A, B	200 Hz to 5 MHz	-55°C to +125°C	C <sub>L</sub> = Max.	t <sub>r</sub> & t <sub>f</sub>	V <sub>DD</sub> = 5V		130	nS
						V <sub>DD</sub> = 10V		70	
						V <sub>DD</sub> = 15V		45	
Duty Cycle (uptime) (@ 50% of waveform)	A, B	200 Hz to 5 MHz	-55°C to +125°C	C <sub>L</sub> = Max.		40	50	60	%
Output Load	B	200 Hz to <3.0 MHz	-55°C to +125°C		C <sub>L</sub>			50	pf
	A	3.0 MHz to 5 MHz					15		
Output Current—HI (source)	A, B	200 Hz to 5 MHz	-55°C to +125°C	V <sub>OH</sub> = 4.5V V <sub>OH</sub> = 9.5V V <sub>OH</sub> = 14.5V	I <sub>OH</sub>	V <sub>DD</sub> = 5V		-100	μA
						V <sub>DD</sub> = 10V		-250	
						V <sub>DD</sub> = 15V		-800	
Output Current—Lo (Sink)	A, B	200 Hz to 5 MHz	-55°C to +125°C	V <sub>OL</sub> = .5V	I <sub>OL</sub>	V <sub>DD</sub> = 5V		300	μA
						V <sub>DD</sub> = 10V		900	
						V <sub>DD</sub> = 15V		2000	

NOTE: Frequency stability is guaranteed for ±10% supply voltage tolerance. Although the CXO-55 may operate from 5 to 15 VDC, standard frequency calibration is done at V<sub>DD</sub>=5 VDC. If your application requires V<sub>DD</sub> to be other than 5 VDC, please specify nominal V<sub>DD</sub>, when ordering, to insure proper frequency accuracy and stability.

# CTS CORPORATION

## KNIGHTS DIVISION

SPECIALISTS IN FREQUENCY MANAGEMENT

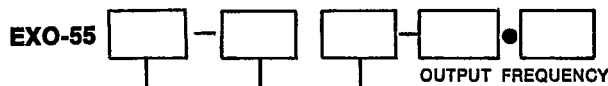
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FAX 815-786-9743

### ECL Compatible Hybrid Clock Oscillators

#### EXO-55 SERIES

10KH ECL logic output  
14-pin DIP compatible  
8 MHz to 130 MHz  
Standard Frequencies Available  
thru Franchised Distributors.

#### ORDERING INFORMATION



CASE GROUND	CODE
ISOLATED CASE	G0
PIN 1 CASE	G1
PIN 7 CASE	G7
PIN 14 CASE	G14

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
-40°C to +85°C	I

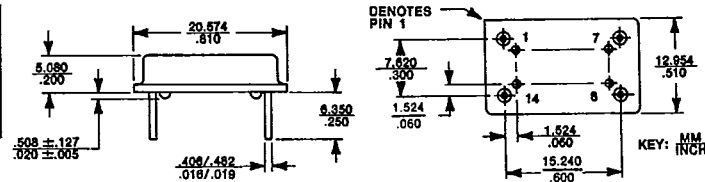
#### ELECTRICAL CHARACTERISTICS (INTO 50 Ω TO -2.0 VDC LOAD)

FREQUENCY RANGE	OPERATING TEMPERATURE	SPECIFICATION	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
8.0 to 130 MHz	-40°C to +85°C	Operating Voltage	V <sub>EE</sub>	-4.94	-5.20	-5.46	V
		Max. Supply Voltage	V <sub>EE</sub> Max.			-7.0	
		Supply Current	I <sub>EE</sub>		50	75	mA
		Output Voltage—HI	V <sub>OH</sub>	-1.05	-.95	-.75	V
		Output Voltage—LO	V <sub>OL</sub>	-2.05	-1.80	-1.60	
		Rise & Fall Times (measured between 20% & 80%)	t <sub>r</sub> & t <sub>f</sub>		1.5	2.5	nS
		Duty Cycle (uptime) (measured @ 50%)		40	50	60	%
		Output Current—HI @ -.95V	I <sub>OH</sub>	-19.0	-22.0		mA
		Output Current—LO @ -1.75V	I <sub>OL</sub>	-1.0	-5.0		
		Output Load				50 Ω to -2.0 VDC	

PIN CONNECTIONS				
PIN	STANDARD	EX055G1	(OPTIONAL) EX055G7	EX055G14
1	N/C	CASE	N/C	N/C
7	-V <sub>EE</sub>	-V <sub>EE</sub>	GND/CASE	-V <sub>EE</sub>
8	OUTPUT	OUTPUT	OUTPUT	OUTPUT
14	GROUND	GROUND	-V <sub>EE</sub>	GND/CASE

Note: Military Designs Available  
Complementary output available as G0C, G7C or G14C only

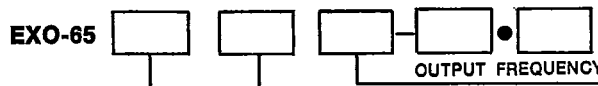
#### OUTLINE DRAWING



#### EXO-65 SERIES

100K ECL logic output  
14-pin DIP compatible  
25 MHz to 200 MHz

#### ORDERING INFORMATION



CASE GROUND	CODE
ISOLATED CASE	G0
PIN 1 CASE	G1
PIN 7 CASE	G7
PIN 14 CASE	G14

FREQUENCY TOL. (NOTE 2)	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C

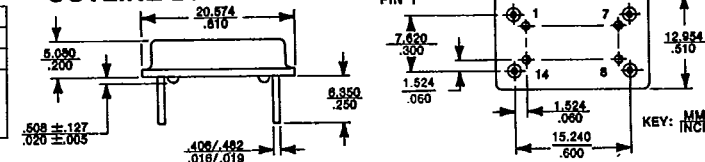
#### ELECTRICAL CHARACTERISTICS (INTO 50 Ω TO -2.0 VDC LOAD)

FREQUENCY RANGE	OPERATING TEMPERATURE	SPECIFICATION	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
25.0 to 200 MHz	-40°C to +85°C	Operating Voltage	V <sub>EE</sub>	-4.20	-4.50	-5.46	V
		Max. Supply Voltage	V <sub>EE</sub> Max.			-5.70	
		Supply Current	I <sub>EE</sub>		85	100	mA
		Output Voltage—HI	V <sub>OH</sub>	-1.04	-.95	-.85	V
		Output Voltage—LO	V <sub>OL</sub>	-1.90	-1.80	-1.60	
		Rise & Fall Times (measured between 20% & 80%)	t <sub>r</sub> & t <sub>f</sub>		1.0	1.5	nS
		Duty Cycle (uptime) (measured @ 50%)		40	50	60	%
		Output Current—HI @ -1.0V	I <sub>OH</sub>	-19.2	-21.0		mA
		Output Current—LO @ -1.7V	I <sub>OL</sub>	-2.0	-6.0		
		Output Load				50 Ω to -2.0 VDC	

PIN CONNECTIONS				
PIN	STANDARD	EX065G1	(OPTIONAL) EX065G7	EX065G14
1	N/C	CASE	N/C	N/C
7	-V <sub>EE</sub>	-V <sub>EE</sub>	GND/CASE	-V <sub>EE</sub>
8	OUTPUT	OUTPUT	OUTPUT	OUTPUT
14	GROUND	GROUND	-V <sub>EE</sub>	GND/CASE

Note: Military Designs Available Composit same as EXO55 series

#### OUTLINE DRAWING



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## Voltage Controlled Hybrid Clock Oscillator

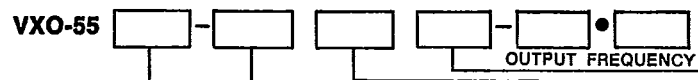
### VXO-55 SERIES

TTL logic output\*  
14 pin DIP compatible  
(MXO-55 style/.290" Max Height)  
765 KHz to 25 MHz  
\*HCMOS Logic Models also available, consult factory for VXO65 Model

#### PIN CONNECTIONS

Pin 1: Frequency control voltage  
Pin 7: Ground/case  
Pin 8: Output  
Pin 14: +5 VDC

#### ORDERING INFORMATION



FREQUENCY AND MODEL	CODE
12.25 to 25.0 MHz Basic Oscillator	GA
765 KHz to <12.25 MHz Basic oscillator with dividers	GB

FREQUENCY DEVIATION*	CODE
±120 ppm min.	1
±200 ppm min.	2

\* Positive slope

FREQUENCY TOLERANCE Vc = 2.50V	CODE
±.01% (100 ppm)	2
±.005% (50 ppm)	3

OPERATING TEMPERATURE RANGE	CODE
0°C to 70°C	C
-40°C to 85°C	I

#### ELECTRICAL SPECIFICATIONS

SPECIFICATION	MODEL	FREQUENCY RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	A, B	765 KHz to 25 MHz	Vcc	4.50	5.00	5.50	V
Maximum Supply Voltage			Vcc Max.			7.00	
Supply Current	A	12.25 MHz to 25 MHz	Icc		18	25	mA
	B	3.0625 MHz to <12.25 MHz			30	60	
		765 KHz to <3.0625 MHz			45	75	
Output Voltage — HI	A, B	765 KHz to 25 MHz	VoH	2.40	3.60		V
Output Voltage — LO			VoL		0.25	0.40	
Rise & Fall Time (measured between 0.5V to 2.4V)	A, B	3.0625MHz to 25 MHz	tr, tf		3	5	nS
		765 KHz to <3.0625 MHz			8	18	
Duty Cycle (measured @ 1.5V)	A, B	12.25 MHz to 25 MHz		40	50	60	%
		765 KHz to <12.25 MHz		45	50	55	
Control Voltage	A, B	765 KHz to 25 MHz	Vc	0.0	2.5	5.0	V
Start-up Time	A, B	765 KHz to 25 MHz	ts		5	15	mS
Control Voltage Input Impedance	A, B	765 KHz to 25 MHz		100K			Ω
Fanout	A	12.25 MHz to 25 MHz	Fo			10	TTL Loads
	B	765 KHz to <12.25 MHz				10	

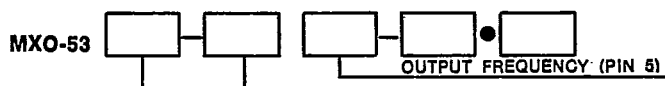
## Tri-State Hybrid Clock Oscillators

### MXO-53 SERIES

3-state, TTL logic output\*  
14-pin DIP compatible  
(MXO-55 style)  
200 Hz to 70 MHz  
\*HCMOS Logic also available, consult factory for CXO63 Model.

Designed for automated, in-circuit, and functional board test applications where a high impedance output state is required to allow the injection of external test signals.

#### ORDERING INFORMATION



FREQUENCY & MODEL	CODE
4.9152 to 70 MHz Basic 3-state oscillator	GA
200 Hz to 4.9151 MHz 3-state oscillator with dividers	GB

FREQUENCY TOLERANCE	CODE
±.1% (1000 ppm)	1
±.01% (100 ppm)	2
±.005% (50 ppm)	3
±.05% (500 ppm)	4
±.0025% (25 ppm) (0°C to 70°C only)	5

OPERATING TEMP. RANGE	CODE
0°C to +70°C	C
-40°C to +85°C	I

#### PIN CONNECTIONS

Pin 1: Enable  
Pin 7: Ground/case  
Pin 8: Output  
Pin 14: +5 VDC

#### ENABLE FUNCTION

HI: Enables oscillator  
LO: Disables oscillator  
(HI impedance output)

#### ELECTRICAL SPECIFICATIONS (SIMILAR TO MXO-55 EXCEPT AS NOTED BELOW)

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMPERATURE RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Supply Current	A	4.9152 to 25 MHz	-40°C to +85°C	Icc		35	55	mA
		>25 to 70 MHz				50	80	
	200 Hz to <4.9151 MHz				60	100		
Duty Cycle (uptime) (measured @ 1.5V)	A, B	200 Hz to 70 MHz	-40°C to +85°C		40	50	60	%
High Impedance Output Current	A, B	200 Hz to 70 MHz	-40°C to +85°C	Io (OFF)			50	μA

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### Surface Mount Hybrid Clock Oscillators

■ **SURFACE MOUNT APPLICATIONS**—CTS Knights presently offers a number of options to suit your surface mount needs. Besides the CCXO series, leadless chip carriers, we are offering the MXO-55 style package in an economical surface mountable configuration, through a simple lead formation operation. The surface mount option is specified by adding an "S" to the part number (eg. SMXO-55, SCXO-65).

■ **VAPOR PHASE REFLOW**—CTS Knights' standard hybrid oscillators are capable of withstanding hand and wave soldering processes, but are not manufactured to survive vapor phase reflow profiles without degradation to device reliability. All surface mountable products are built with a special, high-temperature construction process to allow vapor phase reflow.

#### Standard DIP SERIES

The Standard DIP surface mount series squarewave crystal oscillator is contained in a rugged, economical .500" x .800", hermetically sealed metal package. The leads are shaped for surface mounting in a fullwing design.

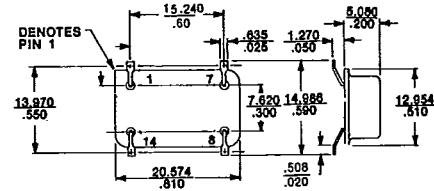


FIG. 6 SMXO-55

#### AVAILABLE MODELS:

SURFACE MOUNT	EQUIVALENT STANDARD SERIES	LOGIC	FREQUENCY RANGE
SMX055	MX055	TTL	19.2 KHz TO 100 MHz
SCX055	CX055	CMOS	200 Hz TO 5 MHz
SCX065	CX065	HCMOS	1 MHz TO 25 MHz
SVX055	VX055	TTL VXCO	765 KHz TO 25 MHz
SEX055	EX055	10KH ECL	8 MHz TO 125 MHz
SEX065	EX065	100K ECL	25 MHz TO 150 MHz
SMX065	MX065	MOS OR MOS/TTL	2.4576 MHz TO 12 MHz
SMX053	MX053	TTL TRI-STATE	200 Hz TO 70 MHz

#### Mini-DIP SERIES

The Mini-DIP surface mount series of squarewave crystal oscillators are contained in a rugged, economical .500" x .500", hermetically sealed metal package. The leads are shaped for surface mounting in a gullwing design.

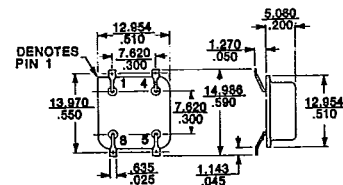


FIG. 6 SMXO-25

#### AVAILABLE MODELS:

SURFACE MOUNT	ELECTRICALLY EQUIVALENT STANDARD SERIES	LOGIC	FREQUENCY RANGE
SMX025	MX055	TTL	307.2 KHz TO 70 MHz
SCX025	CX065	HCMOS	3 MHz TO 25 MHz

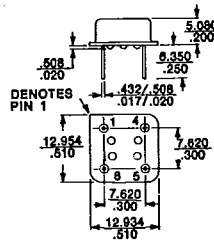
### MINIATURE DUAL-IN-LINE OSCILLATORS

#### MX0-25 SERIES

TTL logic output  
electrically similar to MX0-55  
310 KHz to 70 MHz

#### CX0-25 SERIES

Hi-speed CMOS logic output  
Electrically similar to CX0-65  
200 Hz to 50 MHz



Pin 1—N/C  
Pin 4—Ground/case  
Pin 5—Output  
Pin 8—+5 VDC supply

FIG. 5 Mini-DIP PACKAGE



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### Military Hybrid Clock Oscillators

CTS Knights is a Qualified Products List (QPL) supplier for MIL-O-55310/8, 14, 16, 17, 14-pin dual-in-line package  
TTL logic output  
Frequencies from 50 Hz to 60 MHz  
Class B screening

**PIN CONNECTIONS**

In accordance with appropriate slash sheet

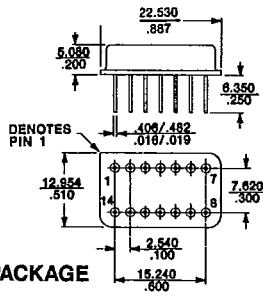


FIG. 8 MILITARY PACKAGE

CTS Knights also supplies product equivalent to the following MIL-O-55310 specification with qualification anticipated soon:

SPECIFICATION	TYPE
M55310/9	TTL, TO-5
M55310/10	TTL, TO-8
M55310/11	CMOS, 14-pin DIP
M55310/15	CMOS, 14-pin DIP
M55310/18	CMOS, 14-pin DIP
M55310/19	TTL, 40-pin LCC
M55310/20	TTL, 44-pin LCC

**M55310/16 SERIES ORDERING INFORMATION**

M55310/16-

-(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE	
CODE	FREQUENCY
0	50 Hz to <250 Hz
1	250 Hz to <150 KHz
2	150 KHz to <5.0 MHz
3	4.0 MHz to <20 MHz
4	20 MHz to 60MHz

TOLERANCE (PPM)				
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.	AGING (PER YEAR)
1A	-55°/125°C	15 ppm	50	5 ppm
1B	-55°/105°C		40	
1C	-20°/70°C		25	
4A	-55°/125°C	25 ppm	100	10 ppm
4B	-55°/105°C		80	
4C	-20°/70°C		50	

**M55310/08 SERIES ORDERING INFORMATION**

M55310/08-

-(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE		AGING (PER YEAR)
CODE	FREQUENCY	
01	1.0 KHz to <150.0 KHz	5
02	150.0 KHz to <300.0 KHz	
03	300.0 KHz to <600.0 KHz	
04	600.0 KHz to <2.5 MHz	
05	2.5 MHz to <5.0 MHz	
06	5.0 MHz to <10.0 MHz	
07	10.0 MHz to <20.0 MHz	10
08	20.0 MHz to <30.0 MHz	
09	30.0 MHz to <50.0 MHz	
10	50.0 Hz to <1.0 KHz	

TOLERANCE (PPM)			
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.
A	-55 to +125°C	15 ppm (TYP)	± 50ppm
B	-55 to +105°C		± 40ppm
C	-20 to +70°C		± 25ppm

**M55310/14 SERIES ORDERING INFORMATION**

M55310/14-

-(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE	
CODE	FREQUENCY
01	50 Hz to <1.0 KHz
02	1.0 KHz to <150.0 KHz
03	150.0 KHz to <300.0 KHz
04	300.0 KHz to <600.0 KHz
05	600.0 KHz to <2.5 MHz
06	2.5 MHz to <5.0 MHz
07	5.0 MHz to <10.0 MHz
08	10.0 MHz to <15.0 MHz
09	15.0 MHz to ≤25.0 MHz

TOLERANCE (PPM)				
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.	AGING (PER YEAR)
A	-55 to +125°C	15 ppm	± 50 ppm	5 ppm
B	-55 to +105°C		± 40 ppm	
C	-20 to +70°C		± 25 ppm	

**M55310/17 SERIES ORDERING INFORMATION**

M55310/17-

-(EXACT FREQUENCY)

SCREENING	
CODE	CLASS
B	CLASS B

FREQUENCY RANGE	
CODE	FREQUENCY
0	250.0 KHz to <5.0 MHz
1	4.0 MHz to <20.0 MHz
2	20.0 MHz to ≤50.0 MHz

TOLERANCE (PPM)				
CODE	TEMP. RANGE	FREQ. ACCURACY @ 23°C	FREQ. STABILITY VS TEMP.	AGING (PER YEAR)
1A	-55°/125°C	15 ppm*	50	5 ppm
1B	-55°/105°C		40	
1C	-20°/70°C		25	
4A,BorC	as above	25 ppm	100	10 ppm

**NOTE:**  
■ HIGH RELIABILITY SCREENING—All hybrid oscillators, at your option, can be screened similar to the Class B requirements of MIL-O-55310. To request this option, add "MLB" after the part number (e.g. MXO-55GA-2C-16.0 MHz-MLB).

\*01 is 10 ppm

