High Precision
TCXO /VCTXCO

CONNOR WINFIELD

HCW

2111 Comprehensive Drive

Aurora, Illinois 60505

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Description:

The Connor-Winfield 5.0x7.0mm Temperature Compensated Crystal Controlled Oscillators and Voltage Controlled Temperature Compensated Crystal Controlled Oscillators are designed for use in applications requiring tight frequency stability in a small package.

Through the use of Analog Temperature Compensation, this device is capable of holding sub 1-ppm stabilities over the commercial or the industrial temperature ranges.

Applications:
- GPS Receivers
- Instrumentation
- Femtocells
- FTTH, FTTC
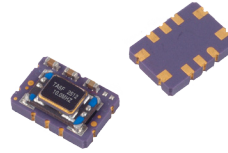
Features:
- 3.3V Operation
- CMOS or Clipped Sinewave Output Logic
- Frequency Stabilities Available:
    Tx5C / Tx6C Series: ±0.25ppm
    Tx5E / Tx6E Series: ±0.50ppm
    Tx5F / Tx6F Series: ±1.00ppm
- Temperature Ranges Available:
    Tx5x Series: 0 to 70°C
    Tx6x Series: -40 to 85°C
- Low Jitter <1pS RMS
- Tri-State Enable/Disable Function
- Miniature 5x7mm Surface Mount Package
- Tape and Reel Packaging
- RoHS Compliant / Lead Free ✓RoHS
- Recommended for new designs

Standard Frequencies Available *

6.4 MHz 9.72 MHz 10.0 MHz 10.24 MHz 12.5 Mhz 19.44 MHz 20.0 MHz 20.48 MHz
12.8 MHz 13.5 MHz 19.2 MHz 25 MHz 27 MHz 38.88 MHz

* Available frequencies from the factory for small quantity orders or quick delivery. Additional frequencies are available.

Ordering Information

T	A	5	C	020.0M

T
Type: Precision

TCXO
VCTCXO
5x7mm

A
Features:

A = TCXO, LVCMOS, 3.3Vdc
B = TCXO, Clipped Sinewave, 3.3Vdc
E = VCTCXO, LVCMOS, 3.3Vdc
F = VCTCXO, Clipped Sinewave, 3.3Vdc

5
Temperature Range:

5 = 0 to 70°C
6 = -40 to 85°C

C
Frequency Stability:

C = ±0.25 ppm
E = ±0.50 ppm
F = ±1.00 ppm

020.0M
Output Frequency:

Frequency Format
-xxx.xM Min.*
-xxx.xxxxxxM Max.*
*Maximum of 6 digits after the decimal point.
M=MHz

Example:
TA5C-020.0M = 5x7mm, TCXO, LVCMOS,
3.3Vdc, 0 to 70C, +/-0.25ppm, Output Frequency 20.0MHz

To order an TA5C with an output frequency of:
6.4 MHz = TA5C-006.4M
10 MHz = TA5C-010.0M
38.88 MHz = TA5C-038.88M

HCW
RoHS
COMPLIANT

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Model Specifications

±0.25ppm Model Specifications

Model Number	TA5C	TB5C	TE5C	TF5C
Output Type	LVCMOS	Clipped Sinewave	LVCMOS	Clipped Sinewave
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO
Supply Voltage	3.3Vdc	3.3Vdc	3.3Vdc	3.3Vdc
Frequency Range	6.4 to 40 MHz			
Frequency Stability vs Temperature [±(Fmax-Fmin)/2Fo]	±0.25ppm			
Temperature Range	0 to 70°C			

Model Number	TA6C	TB6C	TE6C	TF6C
Output Type	LVCMOS	Clipped Sinewave	LVCMOS	Clipped Sinewave
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO
Supply Voltage	3.3Vdc	3.3Vdc	3.3Vdc	3.3Vdc
Frequency Range	6.4 to 40 MHz			
Frequency Stability vs Temperature [±(Fmax-Fmin)/2Fo]	±0.25ppm			
Temperature Range	-40 to 85°C			

±0.50ppm Model Specifications

Model Number	TA5E	TB5E	TE5E	TF5E
Output Type	LVCMOS	Clipped Sinewave	LVCMOS	Clipped Sinewave
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO
Supply Voltage	3.3Vdc	3.3Vdc	3.3Vdc	3.3Vdc
Frequency Range	6.4 to 50 MHz			
Frequency Stability vs Temperature [±(Fmax-Fmin)/2Fo]	±0.50ppm			
Temperature Range	0 to 70°C			

Model Number	TA6E	TB6E	TE6E	TF6E
Output Type	LVCMOS	Clipped Sinewave	LVCMOS	Clipped Sinewave
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO
Supply Voltage	3.3Vdc	3.3Vdc	3.3Vdc	3.3Vdc
Frequency Range	6.4 to 50 MHz			
Frequency Stability vs Temperature [±(Fmax-Fmin)/2Fo]	±0.50ppm			
Temperature Range	-40 to 85°C			

±1.00ppm Model Specifications

Model Number	TA5F	TB5F	TE5F	TF5F
Output Type	LVCMOS	Clipped Sinewave	LVCMOS	Clipped Sinewave
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO
Supply Voltage	3.3Vdc	3.3Vdc	3.3Vdc	3.3Vdc
Frequency Range	6.4 to 50 MHz			
Frequency Stability vs Temperature [±(Fmax-Fmin)/2Fo]	±1.00ppm			
Temperature Range	0 to 70°C			

Model Number	TA6F	TB6F	TE6F	TF6F
Output Type	LVCMOS	Clipped Sinewave	LVCMOS	Clipped Sinewave
TCXO / VCTCXO	TCXO	TCXO	VCTCXO	VCTCXO
Supply Voltage	3.3Vdc	3.3Vdc	3.3Vdc	3.3Vdc
Frequency Range	6.4 to 50 MHz			
Frequency Stability vs Temperature [±(Fmax-Fmin)/2Fo]	±1.00ppm			
Temperature Range	-40 to 85°C			

Absolute Maximum Ratings

Parameter	Minimum	Nominal	Maximum	Units	Notes
Storage Temperature	-55	-	125	°C	
Supply Voltage (Vcc)	-0.6	-	4.6	Vdc	
Input Voltage	-0.5	-	Vcc + 0.6	Vdc	

Operating Specifications

Parameter	Minimum	Nominal	Maximum	Units	Notes
TCXO Frequency Calibration @ 25°C	-1.0	-	1.0	ppm	1
Supply Voltage Variation. (Vcc±5%)	-0.05	-	0.05	ppm	
Load Coefficient, ±5%	-0.05	-	0.05	ppm	
Static Temperature Hysteresis	-0.4	-	0.4	ppm	2
Aging	-1.0	-	1.0	ppm / year	
Frequency shift after reflow soldering	-1.0	-	1.0	ppm	3
Supply Voltage (Vcc)	3.135	3.3	3.465	Vdc	
Supply Current (Icc) LVCMOS:	-	3	6.5	mA	
Clipped Sine:	-	2	3.5	mA	
Jitter:					
Period Jitter	-	3.0	5.0	ps RMS	
Integrated Phase Jitter (12kHz to Fo/2 MHz)	-	0.3	1.0	ps RMS	4
Allan Deviation (1s)	-	1.0E-10	-		
Typical SSB Phase Noise					
For Fo	10.0 MHz	25.0 MHz	50.0 MHz		
@ 10 Hz offset	-103	-90	-90	dBc/Hz	
@ 100 Hz offset	-128	-120	-120	dBc/Hz	
@ 1 KHz offset	-147	-142	-142	dBc/Hz	
@ 10 KHz offset	-157	-157	-157	dBc/Hz	
@ 100 KHz offset	-158	-157	-158	dBc/Hz	
@ 1 MHz offset	-158	-157	-158	dBc/Hz	
Startup Time	-	-	10	ms	

Input Characteristics for Enable / Disable Function (Pin 8)

Parameter	Minimum	Nominal	Maximum	Units	Note
Enable Voltage (High) or open circuit (Vih)	70% Vcc	-	-	Vdc	5
Disable Voltage (Low) Output Tri-stated (Vil)	-	-	30% Vcc	Vdc	

Input Characteristics for Voltage Control (Pin 10)

Parameter	Minimum	Nominal	Maximum	Units	Note
Control Voltage Range (Vcc = 3.3V) (Vc)	0.30	1.65	3.00	Vdc	
Frequency Tuning measured @ 25°C	±10	-	-	ppm	6
Linearity	±5	-	-	%	
Slope		Positive			
Input Impedance	100K	-	-	Ohms	

CMOS Output Characteristics

Parameter	Minimum	Nominal	Maximum	Units	Note
LOAD	-	15	-	pF	7
Voltage (High) (Voh)	90%Vcc	-	-	Vdc	
(Low) (Vol)	-	-	10%Vcc	Vdc	
Current (High) (Ioh)	-	-	-4	mA	
(Low) (Iol)	4	-	-	mA	
Duty Cycle at 50% of Vcc	45	50	55	%	
Rise / Fall Time 10% to 90%	-	4	8	ns	

Clipped Sinewave Output Characteristics

Parameter	Minimum	Nominal	Maximum	Units	Note
Load					8
Output Load Resistance	-	10K	-	Ohms	
Output Load Capacitance	-	10	-	pF	
Output Voltage ($\leq$ 40 MHz)	1.0	1.2	-	V pk-pk	
Output Voltage (>40 MHz)	0.8	1.0	-	V pk-pk	

Package Characteristics

|	
Package	Ceramic Surface Mount Package
Moisture Sensitivity Level	MSL-1
Pad Termination Material and Plating	0.5-1.0um [20-40 micro-inches] Gold over 1.27um [50micro-inches] min Nickel

Environmental Characteristics

Vibration	Vibration per Mil Std 883E Method 2007.3 Test Condition A
Shock	Mechanical Shock per Mil Std 883E Method 2002.4 Test Condition B
Soldering Process	RoHS compliant lead free. See soldering profile on Page 5
Solderability	Solderability per Mil Std 883E Method 2003

Notes:

1) *Initial calibration @ 25°C. ±2°C, for VCTCXO, control voltage must be set to nominal value. Specifications at time of shipment.*
2) *Frequency change after reciprocal temperature ramped over the operating range. Frequency measured before and after at 25°C.*
3) *Two consecutive solder reflows after 1 hour recovery @ 25°C.*
4) *BW = 12 KHz to 20 MHz.*
5) *Leave Pad 8 unconnected if enable / disable function is not required. When tristated, the output stage is disabled but the oscillator and compensation circuit are still active (current consumption < 1 mA).*
6) *Additional pull ranges are available; please contact the factory for additional information.*
7) *Attention: To achieve the frequency stability specified it is required that the circuit connected to this TCXO output must have the equivalent input capacitance that is specified by the nominal load capacitance.*
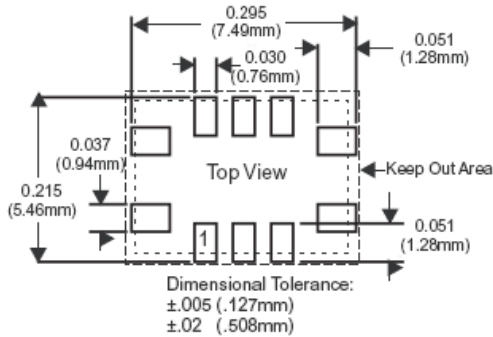8) *Output is AC coupled.*

Package Pad Configuration (all models)
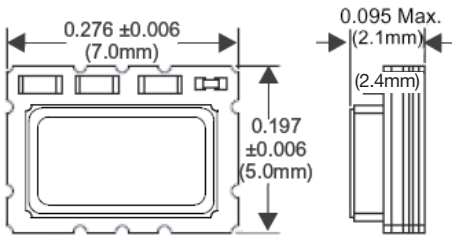

Pad Connections (all models)
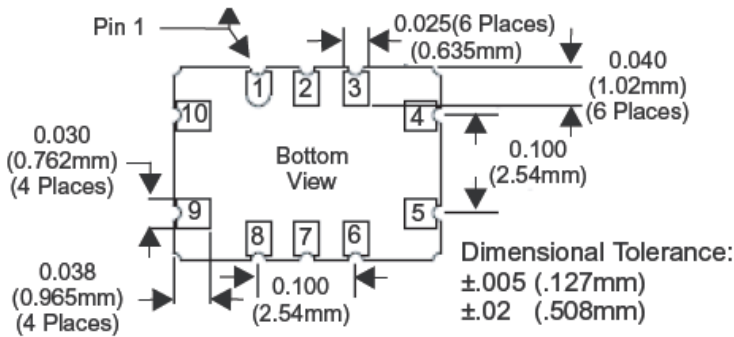
1	Do not connect
2	Do not connect
3	Do not connect
4	Ground
5	Output
6	Do not connect
7	Do not connect
8	Tri-state Enable / Disable
9	Supply, Vcc
10	Voltage Control (VCTCXO)
	N/C (TCXO)

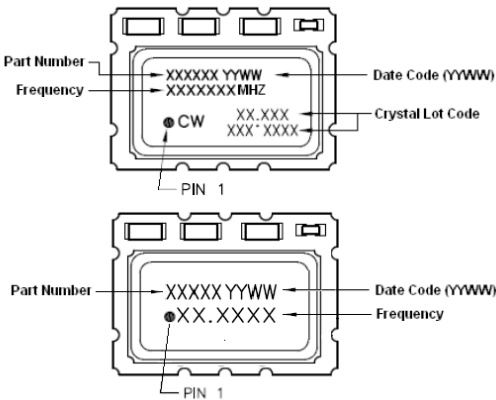## Suggested Pad Layout (all models)

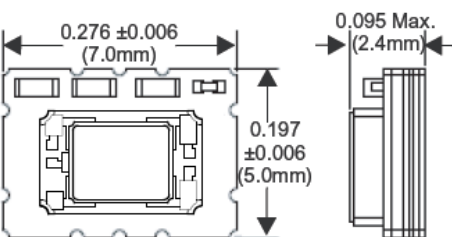## Package Configuration #1

Frequencies

All Frequencies except those listed in configurations 2 and 3 below.
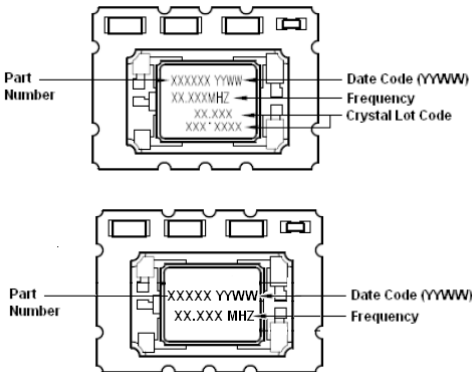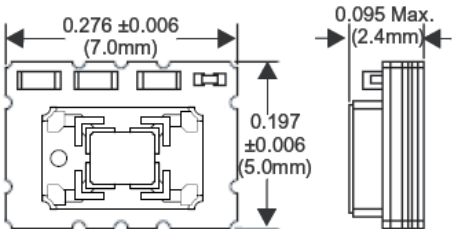
Marking Configurations

Package Configuration #2
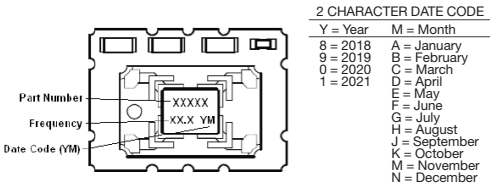
Frequencies

10M, 20M, 24.576M

Marking Configurations

Package Configuration #3

Frequencies

25M, 40M, 50M

Marking Configurations

2 CHARACTER DATE CODE	
Y = Year	M = Month
8 = 2018	A = January
9 = 2019	B = February
0 = 2020	C = March
1 = 2021	D = April
	E = May
	F = June
	G = July
	H = August
	J = September
	K = October
	M = November
	N = December

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Design Recommendations

Vcc, should have a large copper area for reduced inductance. Connect a 0.01uF bypass capacitor <0.1"(2.54mm) from the pad.

0.010"(0.254mm) Recommended clearance inductance for internal copper flood.

Ground, should have a large copper area for reduced inductance.

Top View

Vcc

Ground

50 Ohm trace <1"by design

Buffer

Top View

Ground

OSC | 50 Ohm Trace Without Vias | Output Buffer

TOP LAYER
GROUND LAYER
BOTTOM LAYER

Suggested Pad Layout

0.295 (7.49mm)
0.051 (1.28mm)
0.030 (0.76mm)
0.037 (0.94mm)
Top View
Keep Out Area
0.215 (5.46mm)
0.051 (1.28mm)

Dimensional Tolerance:
±.005 (.127mm)
±.02 (.508mm)

Solder Profile

Temperature
260°C ... 260°C
220°C
180°C
150°C
120°C
0

Up to 120 s Typical
10 s
60 to 90 s Typical

Meets IPC/JEDEC J-STD-020C

CMOS Test Circuit

Enable/Disable · DNC · DNC
Vcc Supply Voltage
Output
Ground
0.1 uF Bypass
10 nF Bypass
TCXO = N/C
VCTCXO = Vc
DNC · DNC · DNC
DNC = Do Not Connect
15 pF

CMOS Output Waveform

T_F · T_R
"1" LEVEL
90%
50%
10%
"0" LEVEL
SYMMETRY
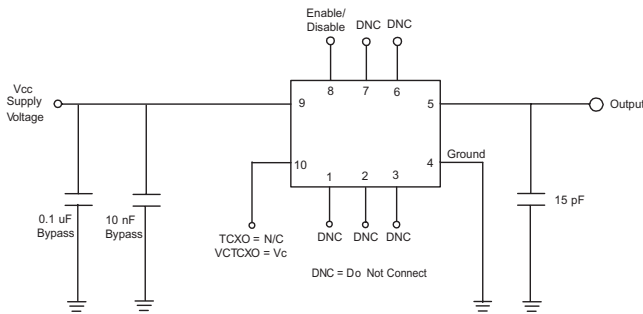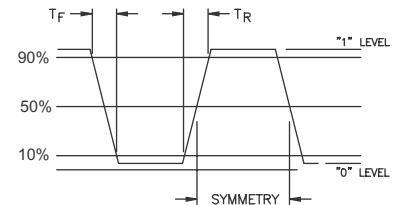
Clipped Sinewave Test Circuit

Enable/Disable · DNC · DNC
Vcc Supply Voltage
Output
Ground
0.1uF Bypass
10nF Bypass
TCXO = N/C
VCTCXO = Vc
DNC · DNC · DNC
DNC = Do Not Connect
10pF
10K Ohm
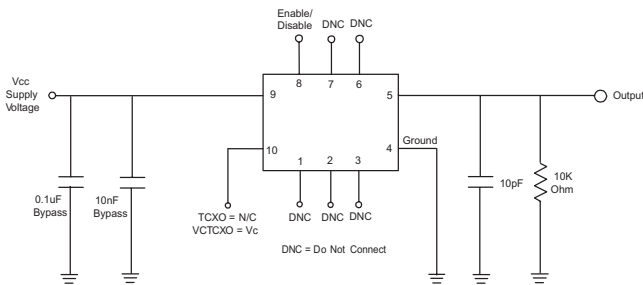
Clipped Sinewave Output Waveform

200 mV/Div

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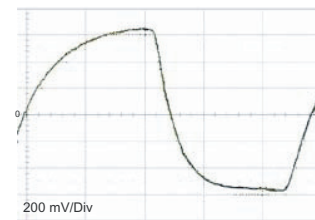
Typical Phase Noise at Fo=10MHz

Phase Noise [dBc/Hz]
RF Atten   5 dB
Top -50 dBc/Hz

10 Hz	-109.18 dBc/Hz
Spot Noise	[T 1]
100.000 Hz	-133.67 dBc/Hz
1.000 kHz	-150.24 dBc/Hz
10.000 kHz	-156.77 dBc/Hz
100.000 kHz	-157.15 dBc/Hz
1.000 MHz	-157.11 dBc/Hz

LoopBW 30 Hz

Frequency Offset
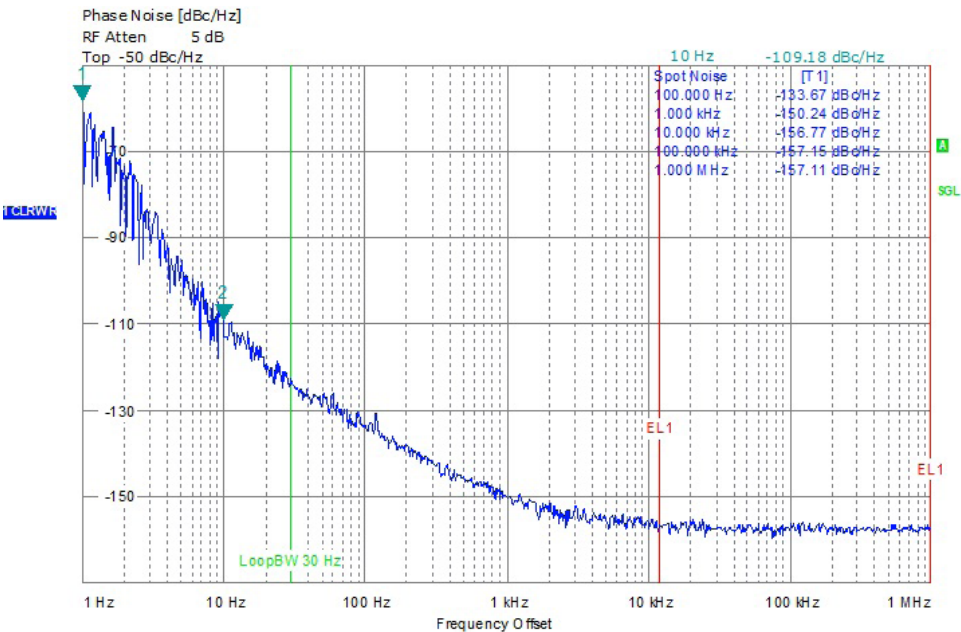
5x7mm Tape and Reel Information

MEETS EIA-481A AND EIAJ-1009B
700 PCS/REEL MAXIMUM.

DIRECTION OF FEED (CUSTOMER)

.157 (4mm)
.079 (2mm)
.020 R. (0.5mm)
.063 (1.6mm) DIA.
.059 (1.5mm) DIA.
.069 (1.75mm)
.295 (7.5mm)
.642 (16.30mm)
.626 (15.90mm)
.315 (8mm)
.059 (1.5mm) DIA. MIN.

8.45 DIA (214.6mm) DIA
1.00 DIA (25.4mm)
.08 (2.0mm)
9.84 (250mm)
3.15 (80mm)
.69 (17.53mm)
.08 (2.0mm)
.08 (2.0mm)
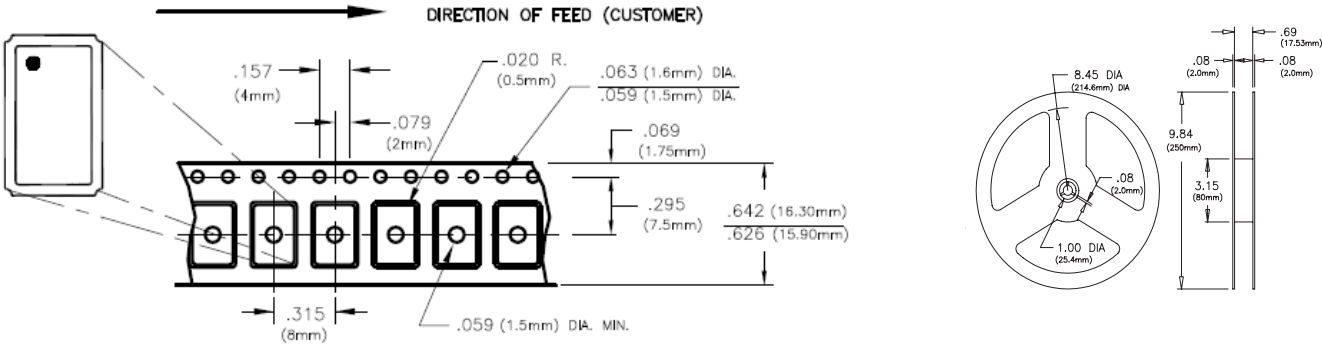
Revision History

Revision	Date	Note
11	09/07/18	Updated package drawing height and T&R information, added marking configurations.
12	10/10/18	Updated package drawings
13	02/07/23	Updated Package Configuration #1
14	11/15/23	Updated Voltage Operation
15	03/27/25	Updated phase noise, package characteristics, and product photo image