



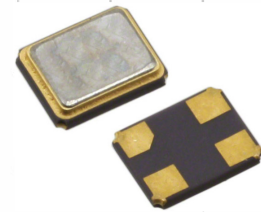
THE DATASHEET OF 403WF12012IMR

Model 403W

IoT Enhanced Quartz Crystal

Features

- Optimized Design for Low Plating Capacitance and ESR
- Improves Start-Up and Power Savings for Low Energy Applications
- Hermetic Ceramic Surface Mount Package
- Fundamental and 3rd Overtone Crystal Design
- Frequency Range 8 – 54MHz
- Operating Temperature Range to -40°C to +125°C
- Tape and Reel Packaging, EIA-481



Part Dimensions:
3.2 × 2.5 × 0.80mm • 20.71627mg

Standard Frequencies – see Page 5 for developed frequencies.
* Check with factory for availability of frequencies not listed.

Applications

- Wireless Communications
- Low Power MCUs, SoCs, RF ICs
- M2M Communications
- WiFi, ZigBee, ZigBee RF4CE, Z-Wave
- Bluetooth, Bluetooth Low Energy
- LoRa, LPWAN, 6LowPan, WLAN
- Near Field Communication
- Low Drive Chipsets
- ISM Band Applications

Description

CTS Model 403W incorporates a high Q quartz resonator and has optimized design parameters for Low ESR and Load Capacitance [C_L]. M403W is ideal for supporting commercial and industrial IoT applications using low power MCUs, portable RF communication ICs and low drive chipsets.

Ordering Information

Model	Mode of Oscillation	Frequency Code [MHz]	Tolerance @ +25°C	Temperature Stability	Temperature Range	Load Capacitance	Packaging																																									
403W	F	XXX	3	5	C	D	R																																									
	<table><tr><th>Code</th><th>Mode</th></tr><tr><td>F</td><td>Fundamental</td></tr></table>	Code	Mode	F	Fundamental		<table><tr><th>Code</th><th>Tolerance</th></tr><tr><td>1</td><td>±10ppm</td></tr><tr><td>X</td><td>±15ppm</td></tr><tr><td>2</td><td>±20ppm</td></tr><tr><td>Y</td><td>±25ppm</td></tr><tr><td>3</td><td>±30ppm</td></tr></table>	Code	Tolerance	1	±10ppm	X	±15ppm	2	±20ppm	Y	±25ppm	3	±30ppm		<table><tr><th>Code</th><th>Temp. Range</th></tr><tr><td>C</td><td>-20°C to +70°C²</td></tr><tr><td>D</td><td>-30°C to +85°C²</td></tr><tr><td>I</td><td>-40°C to +85°C³</td></tr><tr><td>G</td><td>-40°C to +105°C⁴</td></tr><tr><td>H</td><td>-40°C to +125°C⁵</td></tr></table>	Code	Temp. Range	C	-20°C to +70°C ²	D	-30°C to +85°C ²	I	-40°C to +85°C ³	G	-40°C to +105°C ⁴	H	-40°C to +125°C ⁵		<table><tr><th>Code</th><th>Packing</th></tr><tr><td>R</td><td>3k pcs./reel</td></tr></table>	Code	Packing	R	3k pcs./reel									
Code	Mode																																															
F	Fundamental																																															
Code	Tolerance																																															
1	±10ppm																																															
X	±15ppm																																															
2	±20ppm																																															
Y	±25ppm																																															
3	±30ppm																																															
Code	Temp. Range																																															
C	-20°C to +70°C ²																																															
D	-30°C to +85°C ²																																															
I	-40°C to +85°C ³																																															
G	-40°C to +105°C ⁴																																															
H	-40°C to +125°C ⁵																																															
Code	Packing																																															
R	3k pcs./reel																																															
		<table><tr><th>Code</th><th>Frequency</th></tr><tr><td colspan="2">Product Frequency Code¹</td></tr></table>	Code	Frequency	Product Frequency Code ¹		<table><tr><th>Code</th><th>Stability</th></tr><tr><td>1</td><td>±10ppm</td></tr><tr><td>X</td><td>±15ppm</td></tr><tr><td>2</td><td>±20ppm</td></tr><tr><td>Y</td><td>±25ppm</td></tr></table>	Code	Stability	1	±10ppm	X	±15ppm	2	±20ppm	Y	±25ppm	<table><tr><th>Code</th><th>Stability</th></tr><tr><td>3</td><td>±30ppm</td></tr><tr><td>5</td><td>±50ppm</td></tr><tr><td>6</td><td>±100ppm</td></tr></table>	Code	Stability	3	±30ppm	5	±50ppm	6	±100ppm	<table><tr><th>Code</th><th>Capacitance</th></tr><tr><td>M</td><td>4pF</td></tr><tr><td>W</td><td>5pF</td></tr><tr><td>T</td><td>6pF</td></tr><tr><td>V</td><td>7pF</td></tr></table>	Code	Capacitance	M	4pF	W	5pF	T	6pF	V	7pF	<table><tr><th>Code</th><th>Capacitance</th></tr><tr><td>K</td><td>8pF</td></tr><tr><td>J</td><td>9pF</td></tr><tr><td>A</td><td>10pF</td></tr><tr><td>L</td><td>12pF</td></tr></table>	Code	Capacitance	K	8pF	J	9pF	A	10pF	L	12pF
Code	Frequency																																															
Product Frequency Code ¹																																																
Code	Stability																																															
1	±10ppm																																															
X	±15ppm																																															
2	±20ppm																																															
Y	±25ppm																																															
Code	Stability																																															
3	±30ppm																																															
5	±50ppm																																															
6	±100ppm																																															
Code	Capacitance																																															
M	4pF																																															
W	5pF																																															
T	6pF																																															
V	7pF																																															
Code	Capacitance																																															
K	8pF																																															
J	9pF																																															
A	10pF																																															
L	12pF																																															

Notes:

- Refer to document 016-1454-0, Frequency Code Tables. 3-digits for frequencies <100MHz.
- Available with all stability codes.
- Available with stability codes X, 2, Y, 3, 5 and 6.
- Available with stability codes 3, 5 and 6.
- Available with stability codes 5 and 6. Contact factory for availability.

**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
Operating Temperature	T _A	-	-20		+70	
			-30		+85	
			-40	+25	+85	°C
			-40		+105	
			-40		+125	
Storage Temperature	T _{STG}	-	-55	-	+125	°C

Frequency Stability

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Range	f ₀	-		8 - 54		MHz
Frequency Tolerance	Δf/f ₀	@ +25°C		10, 15, 20, 25 or 30		±ppm
Frequency Stability	Δf/f ₂₅	Referenced to +25°C reading		10, 15, 20, 25, 30, 50 or 100		±ppm
Aging	Δf/f ₀	Typical per year @ +25°C	-3	±2	3	ppm

Crystal Parameters

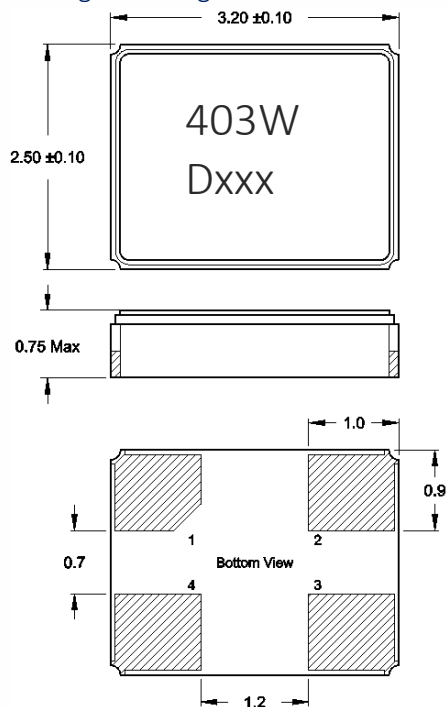
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Mode	-	-		Fundamental		-
Crystal Cut	-	-		AT-Cut Strip		-
Load Capacitance	C _L	-		See Ordering Information		pF
Shunt Capacitance	C ₀	-	-	1.0	<3.0	pF
Series Resistance						
Fundamental	R ₁	8MHz - <12MHz	-	100	150	
		12MHz - <16MHz	-	60	100	
		16MHz - <20MHz	-	40	70	Ω
		20MHz - <30MHz	-	25	50	
		30MHz - <40MHz	-	20	40	
		40MHz - 54MHz	-	15	35	
Drive Level	DL	-	-	10	100	μW
Insulation Resistance	R _i	+100Vdc ±15Vdc	500	-	-	MΩ

Δf/f₀ - Frequency deviation referenced to nominal frequency.

Δf/f₂₅ - Frequency deviation over operating temperature range, referenced to +25°C frequency.

Mechanical Specifications

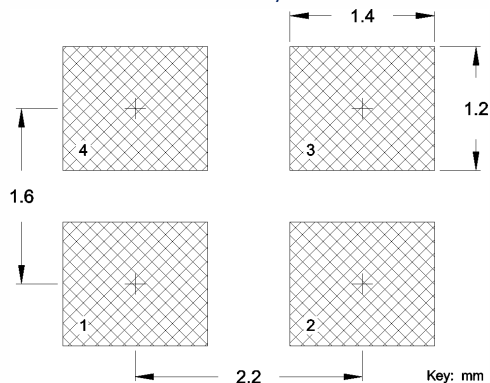
Package Drawing



Marking Information

1. 403W – CTS model.
2. D – Date Code. See Table I for codes.
3. xxx – Frequency Code, 3-digits for frequencies below 100MHz.
[See document 016-1454-0, Frequency Code Tables.]

Recommended Pad Layout



Notes

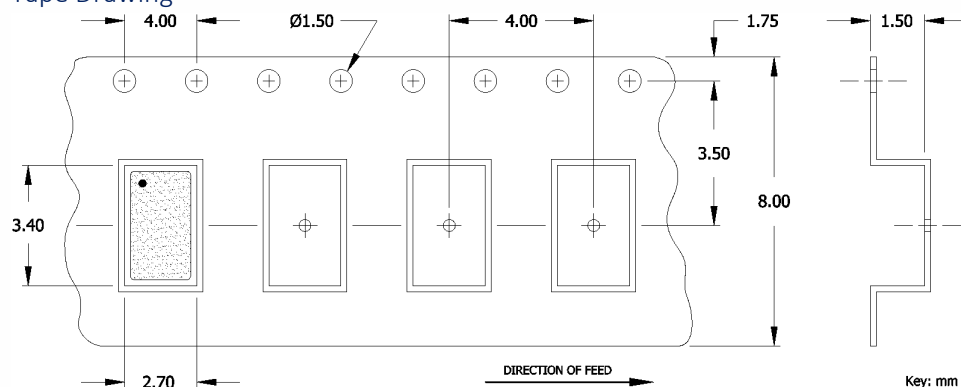
1. JEDEC termination code (e4). Barrier-plating is nickel [Ni] with gold [Au] flash plate.
2. Terminations #2, #4 and the metal lid are connected internally. End user may connect these pins to circuit ground for EMI suppression.
3. Due to package variability, the pad chamfer on the bottom could be located on Pin 1 in a given lot. Layout orientation should be based on the top view [marking side], as indicated in package drawing. The chamfer location does not affect the electrical performance of the device.
4. Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
5. MSL = 1.

Table I - Date Code, Beginning year 2021

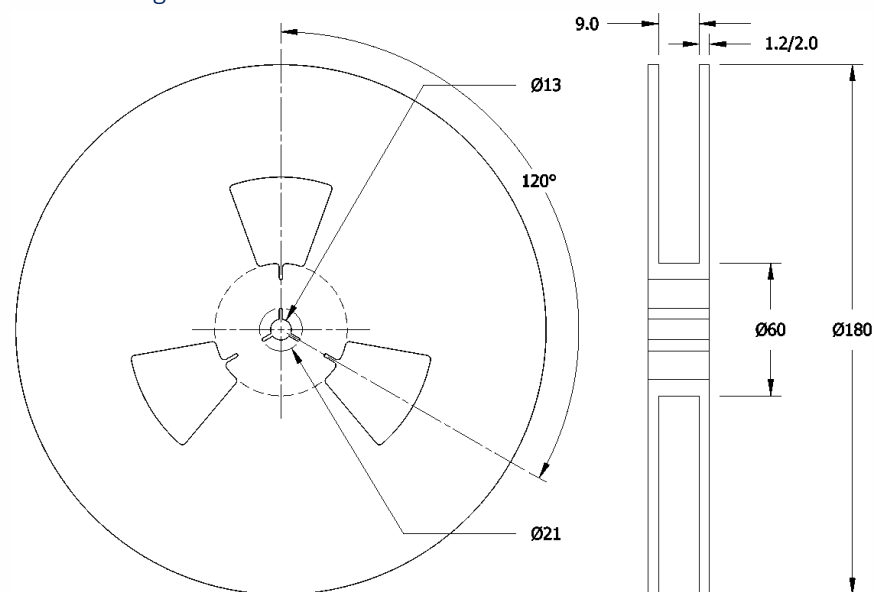
MONTH					JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
YEAR																
2021	2025	2029	2033	2037	A	B	C	D	E	F	G	H	J	K	L	M
2022	2026	2030	2034	2038	N	P	Q	R	S	T	U	V	W	X	Y	Z
2023	2027	2031	2035	2039	a	b	c	d	e	f	g	h	j	k	l	m
2024	2028	2032	2036	2040	n	p	q	r	s	t	u	v	w	x	y	z

Packaging - Tape and Reel

Tape Drawing



Reel Drawing



Notes

1. Device quantity is 1k pieces minimum and 3k pieces maximum per 180mm reel.
2. Complete CTS part number, frequency value, date code and manufacturing site code information must appear on reel and carton labels.



Addendum

Common Frequencies and Frequency Codes – MHz

Common Wireless Frequencies Additional Frequencies

FREQUENCY	FREQUENCY CODE	FREQUENCY	FREQUENCY CODE	FREQUENCY	FREQUENCY CODE	FREQUENCY	FREQUENCY CODE
12.000000	120	8.000000	080	20.736000	207	35.328000	353
13.560000	13C	10.000000	100	22.118400	221	36.000000	360
16.000000	160	11.059200	111	22.579200	225	38.000000	380
19.200000	192	12.288000	122	24.305000	243	38.880000	388
20.000000	200	12.500000	125	24.545400	24F	39.062500	39A
24.000000	240	12.800000	128	24.545454	24G	41.600000	41C
25.000000	250	13.000000	130	24.553500	24B	44.000000	440
26.000000	260	13.500000	135	24.576000	24C	45.000000	450
27.120000	271	13.553750	13B	25.000625	25A	49.152000	491
30.000000	300	13.824000	138	26.041660	26F	50.000000	500
32.000000	320	14.318180	143	27.000000	270	54.000000	540
37.400000	374	14.400000	144	28.224000	282		
38.400000	384	14.745600	147	28.322000	28C		
40.000000	400	15.360000	153	28.375000	283		
48.000000	480	16.367600	16E	28.636360	286		
52.000000	520	16.384000	163	29.491200	29B		
		16.666700	16N	30.400000	304		
		16.800000	168	30.720000	307		
		16.934400	169	31.250000	312		
		18.000000	180	32.768000	327		
		18.432000	184	33.000000	330		
		19.440000	194	33.330000	333		
		19.660800	19B	33.333000	33E		
		19.680000	196	33.333300	33A		
		20.480000	204	33.868800	338		