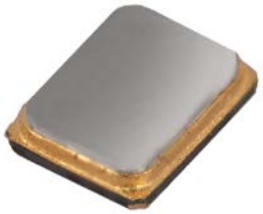
Model 416

Ultra-Miniature Surface Mount Crystal



Part Dimensions:
1.6 × 1.2 × 0.45mm • 2.51054mg

Features

- Hermetic Ceramic Surface Mount Package
- Fundamental Crystal Design
- Frequency Range 24 – 96MHz
- Frequency Tolerance, ±30ppm Standard
- Frequency Stability, ±30ppm Standard
- Operating Temperature Range to -40°C to +105°C
- Tape and Reel Packaging, EIA-418

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

Applications

- IoT and IIoT Applications
- Wireless Communications
- FPGA/Microcontrollers
- USB Interfaces
- Computer Peripherals
- Portable Equipment
- Test and Measurement
- M2M Communications
- Wearables

Description

CTS Model 416 incorporates a high Q quartz resonator and is ideal for supporting a wide range of commercial and industrial applications.

Ordering Information

Model	Mode of Oscillation	Frequency Code [MHz]	Tolerance @ +25°C	Temperature Stability	Temperature Range	Load Capacitance	Packaging
416	F	XXX	3	3	C	K	R

Code	Mode
F	Fundamental

Code	Tolerance
1	±10ppm
X	±15ppm
2	±20ppm
Y	±25ppm
3	±30ppm

Code	Temp. Range
A	-10°C to +60°C [2]
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]

Code	Packing
R	3k pcs./reel

Code	Frequency
Product Frequency Code [1]	

Code	Stability	Code	Stability
1	±10ppm	Y	±25ppm
X	±15ppm	3	±30ppm
2	±20ppm	5	±50ppm

Code	Capacitance	Code	Capacitance
W	5pF	L	12pF
T	6pF	B	13pF
V	7pF	C	16pF
K	8pF	D	18pF
J	9pF	E	20pF
A	10pF	S	Series

Notes:
1] Refer to document 016-1454-0, Frequency Code Tables. 3-digits for frequencies <100MHz.
2] Available with all stability codes.
3] Available with stability codes X, 2, Y, 3 and 5.
4] Available with stability codes 3 and 5.

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

Electrical Specifications

Operating Conditions

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Temperature	T_A	-	-10		+60	°C
			-20		+70	
			-30	+25	+85	
			-40		+85	
			-40		+105	
Storage Temperature	T_{STG}	-	-40	-	+125	°C

Frequency Stability

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Range	f_O	-		24 - 96		MHz
Frequency Tolerance	$\Delta f/f_O$	@ +25°C		10, 15, 20, 25 or 30		±ppm
Frequency Stability	$\Delta f/f_{25}$	Referenced to +25°C reading		10, 15, 20, 25, 30 or 50		±ppm
Aging	$\Delta f/f_0$	Typical per year @ +25°C	-3	-	3	ppm

Crystal Parameters

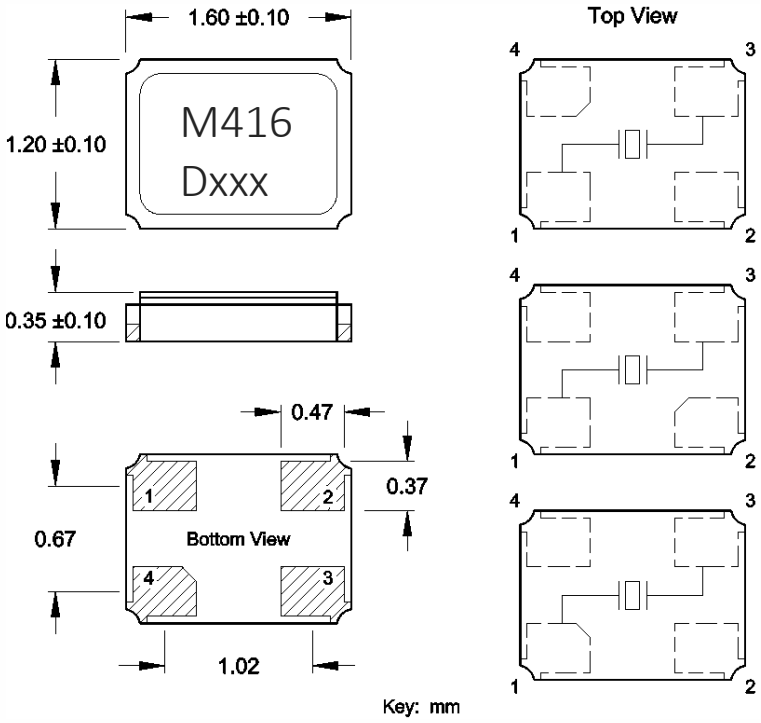
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Mode	-	-		Fundamental		-
Crystal Cut	-	-		AT-Cut Strip		-
Load Capacitance	C_L	-		See Ordering Information		pF
Shunt Capacitance	C_0	-	-	-	3.0	pF
Series Resistance						
Fundamental	R_1	24MHz - <40MHz	-	-	150	Ω
		40MHz - <54MHz	-	-	100	
		54MHz - 96MHz	-	-	60	
Drive Level	DL	-	-	10	120	µW
Insulation Resistance	R_i	+100Vdc ±15Vdc	500	-	-	MΩ

$\Delta f/f_0$ - Frequency deviation referenced to nominal frequency.

$\Delta f/f_{25}$ - Frequency deviation over operating temperature range, referenced to +25°C frequency.

Mechanical Specifications

Package Drawing



Marking Information

Format A – 2 Lines [Preferred]

M416
Dxxx

1. M416 – CTS Model series.
2. D – Date code. See Table I for codes.
3. xxx – Frequency code, 3-digits frequencies below 100MHz.

[See document 016-1454-0, Frequency Code Tables].

Format B – 1 Line [Acceptable]

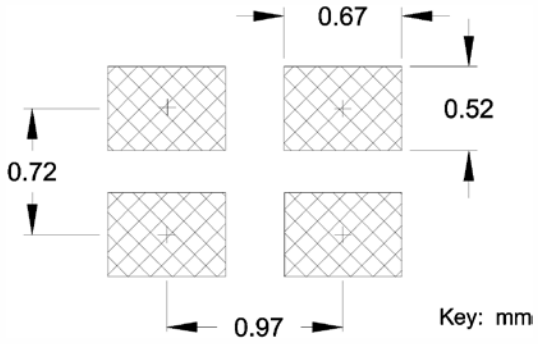
xxxYWW

1. xxx – Frequency code, 3-digits frequencies below 100MHz.

[See document 016-1454-0, Frequency Code Tables].

2. YWW – Date code; Y = year [last digit], WW = week.

Recommended Pad Layout



Notes

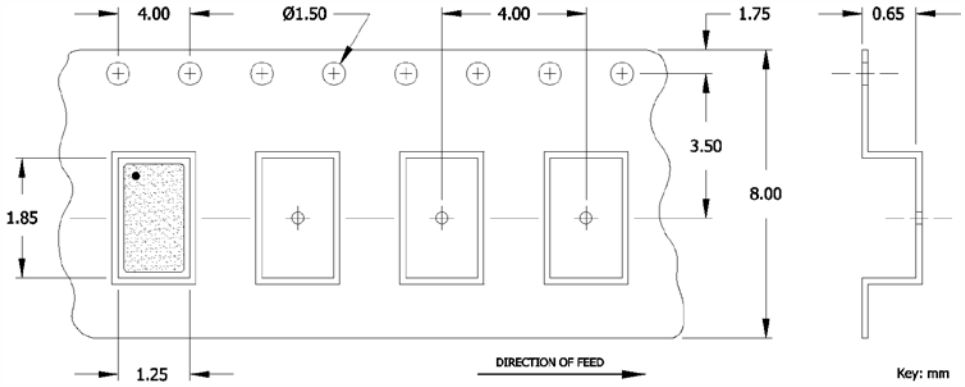
1. JEDEC termination code (e4). Barrier-plating is nickel [Ni] with gold [Au] flash plate.
2. Terminations #2, #4 and the metal lid are connected internally. End user may connect these pins to circuit ground for EMI suppression.
3. Due to package variability, the pad chamfer on the bottom could be located on Pin 1, 2 or 4 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

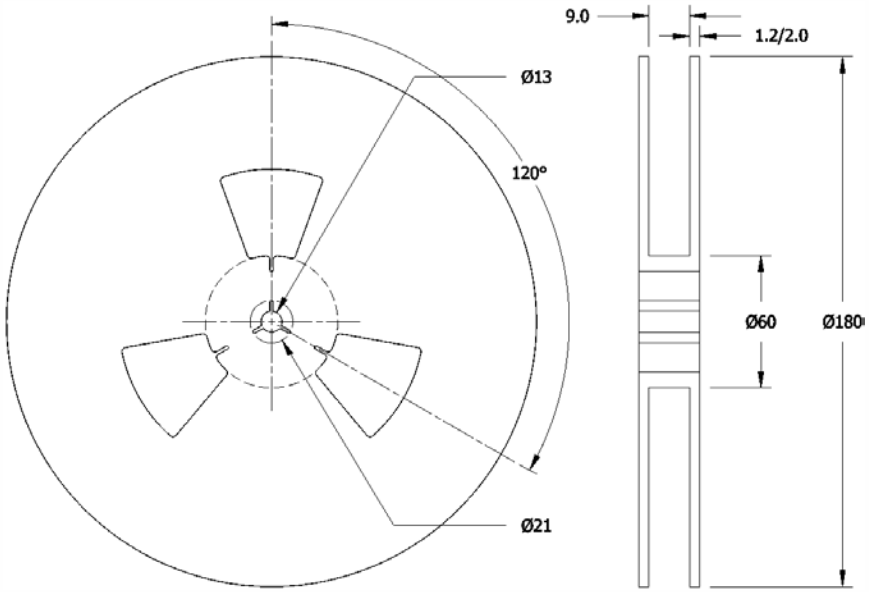
YEAR \ MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2021 2025 2029 2033 2037	A	B	C	D	E	F	G	H	J	K	L	M
2022 2026 2030 2034 2038	N	P	Q	R	S	T	U	V	W	X	Y	Z
2023 2027 2031 2035 2039	a	b	c	d	e	f	g	h	j	k	l	m
2024 2028 2032 2036 2040	n	p	q	r	s	t	u	v	w	x	y	z

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				Other Frequencies			
FREQUENCY	FREQUENCY CODE	FREQUENCY	FREQUENCY CODE	FREQUENCY	FREQUENCY CODE	FREQUENCY	FREQUENCY CODE
32.000000	320	32.768000	327				
37.400000	374	33.000000	330				
38.400000	384	33.330000	333				
40.000000	400	33.333000	33E				
48.000000	480	33.333300	33A				
52.000000	520	33.868800	338				
		35.328000	353				
		36.000000	360				
		38.000000	380				
		38.880000	388				
		39.062500	39A				
		41.600000	41C				
		44.000000	440				
		45.000000	450				
		49.152000	491				
		50.000000	500				
		54.000000	540				