Model 416
Ultra-Miniature Surface Mount Crystal

Connect

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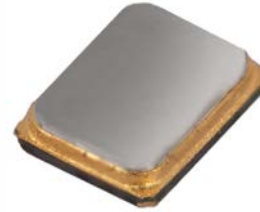
Part Dimensions:
1.6 × 1.2 × 0.45mm • 2.51054mg

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	+25	+60	°C
			-20		+70	
			-30		+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	$\Delta f/f_O$	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

Key: mm
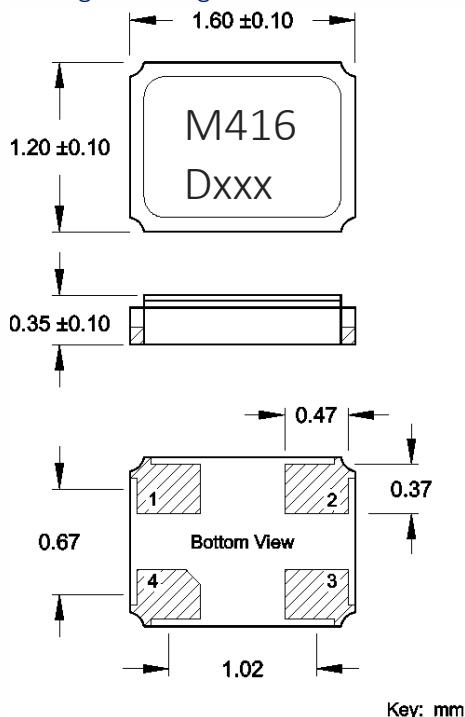
Marking Information

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

Key: mm
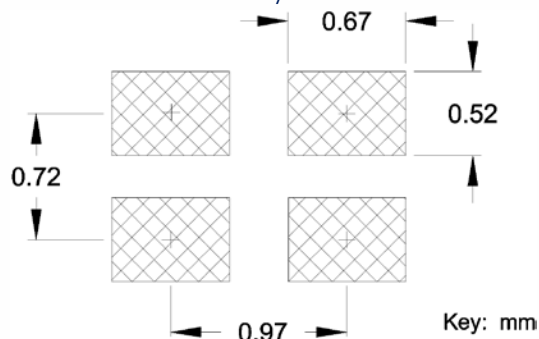
Notes

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.

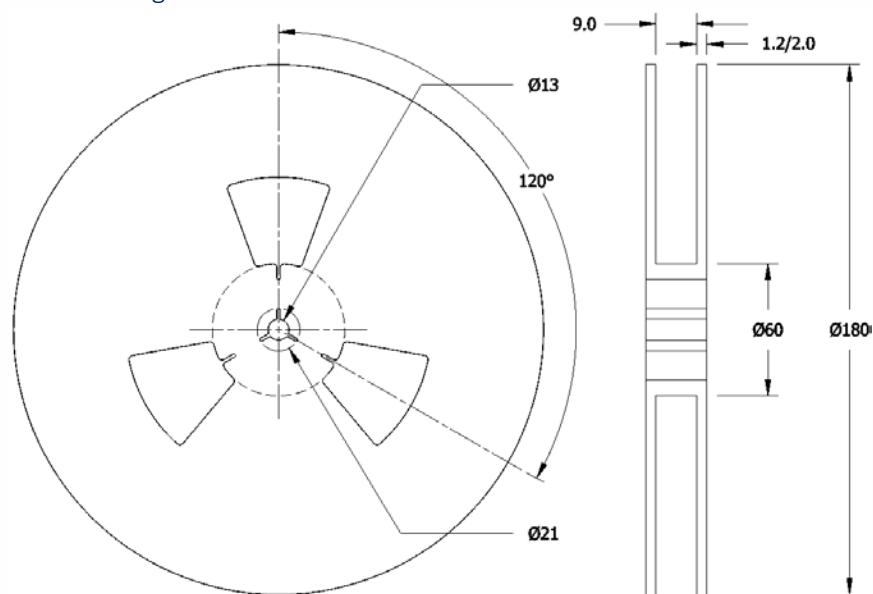### Table I – Date Code, Beginning year 2021

MONTH / YEAR					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
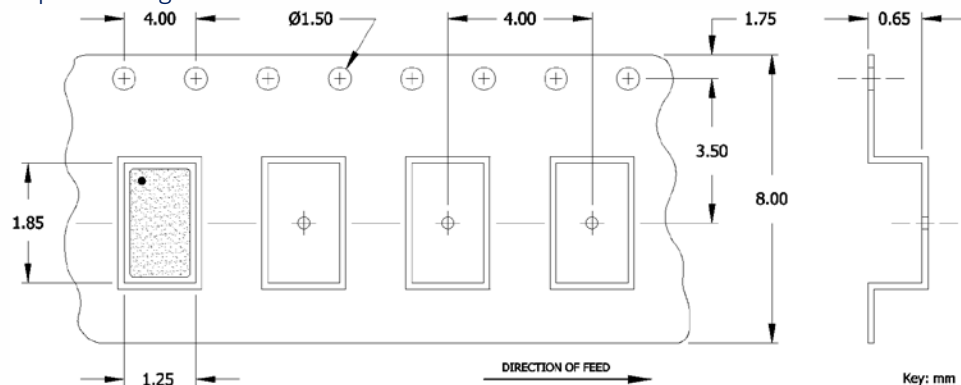
Reel Drawing

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				

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[CTS](#):

416F40022IKT   416F36022CKT   416F48022IKT   416F52022CKT   416F52022IKT   416F30022CKT   416F44022CKT
416F27022CKT   416F32022IKT   416F24022IKT   416F40022CKT   416F32022CKT   416F48022CKT   416F26022IKT
416F26022CKT   416F36022IKT   416F24012IST   416F26025CLT   416F440X3CST   416F440XXCLT   416F440XXAST
416F260XXCKT   416F440X3IST   416F440XXCKT   416F48011ADT   416F44013IST   416F4401XAST   416F4401XCLT
416F44013CST   416F44022CLT   416F44022CST   416F44022IAT   416F44035AST   416F44012IST   416F44013ADT
416F44013CDT   416F44033AKT   416F44035AKT   416F440X2AKT   416F440X2CST   416F44025AAT   416F44022IDT
416F44025CKT   416F44025IAT   416F440X3ALT   416F44023CST   416F44033ITT   416F440X2AST   416F44035ALT
416F440X2AAT   416F44025CDT   416F44025IDT   416F44033IAT   416F44033IDT   416F440X3AKT   416F440X3CDT
416F440X3ITT   416F44022AKT   416F44011CTT   416F44023CLT   416F44023IST   416F44011ALT   416F406X3CST
416F406X3ITT   416F44012ALT   416F44012AST   416F406XXALT   416F40635IST   416F406X2ILT   416F406X3AKT
416F4401XCST   416F4401XCTT   416F406X3AAT   416F44013ILT   416F44013CLT   416F44013CAT   416F40633ADT
416F40622IKT   416F44013AAT   416F44013AST   416F440XXAKT   416F40623CKT   416F40625ALT   416F44035ILT
416F440X2IST   416F440X3CLT   416F440X3IDT   416F406X2ALT   416F3201XCST   416F40625IST   416F32013ITT
416F3201XCAT   416F32022AKT   416F32013IDT   416F32013IST   416F406X3ILT   416F40633ALT   416F40623AAT
416F32025CAT   416F32025IAT