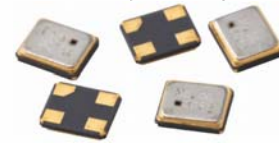


# Model 416

## 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 – 80MHz
- Frequency Tolerance, ±20ppm Standard
- Frequency Stability, ±20ppm Standard
- Operating Temperature Range to -40°C to +85°C
- Tape and Reel Packaging, EIA-418

### Applications

- Wearable and Handheld Electronics
- Wireless Communications
- FPGA/Microcontrollers
- Computer Peripherals
- USB Interfaces
- Measuring Equipment
- Consumer Electronics
- High Density Board Layouts

### 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	5	C	D	R
	Code   Mode		Code   Tolerance		Code   Temp. Range		Code   Packing
	F   Fundamental		1   ±10ppm X   ±15ppm 2   ±20ppm Y   ±25ppm 3   ±30ppm		A   -10°C to +60°C C   -20°C to +70°C D   -30°C to +85°C I   -40°C to +85°C		R   3k pcs./reel
		Code   Frequency		Code   Stability		Code   Capacitance   Code   Capacitance	
		Product Frequency Code <sup>1</sup>		1   ±10ppm <sup>2</sup> X   ±15ppm 2   ±20ppm Y   ±25ppm 3   ±30ppm 5   ±50ppm		W   5pF   L   12pF T   6pF   C   16pF V   7pF   D   18pF K   8pF   E   20pF J   9pF   S   Series A   10pF	

Notes:

- 1] Refer to document 016-1454-0, Frequency Code Tables. 3-digits for frequencies <100MHz.
- 2] Check factory availability when combined with -40°C to +85°C temperature range.

**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 <sub>A</sub>	-	-10		+60	°C
			-20	+25	+70	
			-30		+85	
			-40		+85	
Storage Temperature	T <sub>STG</sub>	-	-40	-	+90	°C

### Frequency Stability

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Frequency Range	f <sub>0</sub>	-		24 - 80		MHz
Frequency Tolerance	Δf/f <sub>0</sub>	@ +25°C		10, 15, 20, 25 or 30		±ppm
Frequency Stability	Δf/f <sub>25</sub>	Referenced to +25°C reading		10, 15, 20, 25, 30 or 50		±ppm
Aging	Δf/f <sub>0</sub>	Typical per year @ +25°C	-	±3	-	ppm

### Crystal Parameters

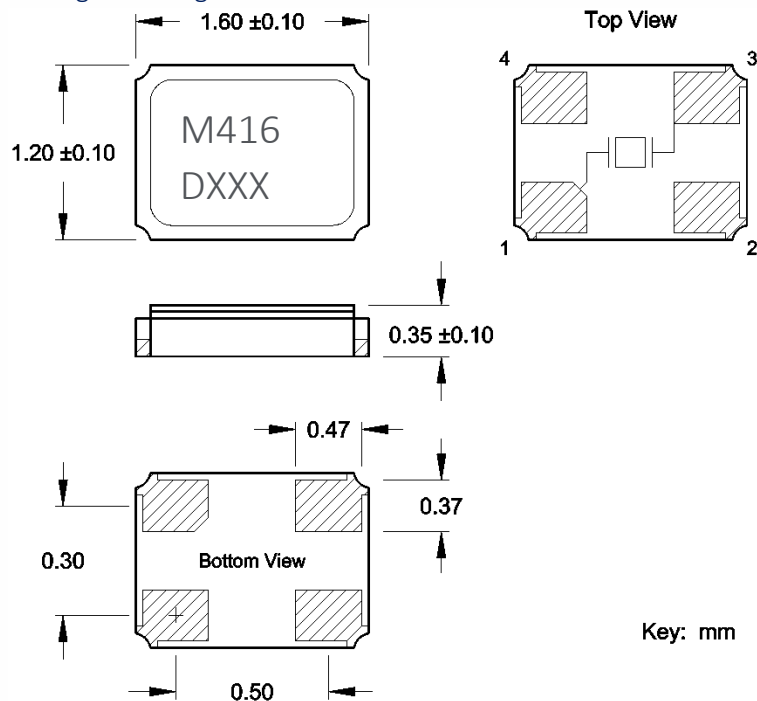
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Mode	-	-		Fundamental		-
Crystal Cut	-	-		AT-Cut Strip		-
Load Capacitance	C <sub>L</sub>	-		See Ordering Information		pF
Shunt Capacitance	C <sub>0</sub>	-	-	3.0	5.0	pF
<b>Series Resistance</b>						
Fundamental	R <sub>1</sub>	24MHz - <30MHz	-	-	120	Ω
		30MHz - <37MHz	-	-	80	
		37MHz - <80MHz	-	-	60	
Drive Level	DL	-	-	10	200	μW
Insulation Resistance	R <sub>i</sub>	+100Vdc ±15Vdc	500	-	-	MΩ

Δf/f<sub>0</sub> - Frequency deviation referenced to nominal frequency.

Δf/f<sub>25</sub> - Frequency deviation referenced to +25°C frequency.

## Mechanical Specifications

### Package Drawing



Key: mm

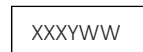
### Marking Information

#### Format A – 2 Lines [Preferred]



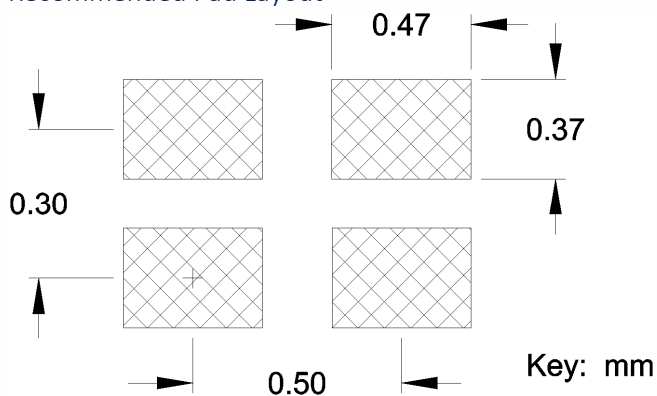
1. M416 – CTS Model series.
2. D – Date code. See Table I for codes.
3. XXX – Frequency code, 3-digits frequencies below 100MHz.  
[See document 016-1454-0, Frequency Code Tables].

#### Format B – 1 Line [Acceptable]



1. XXX – 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



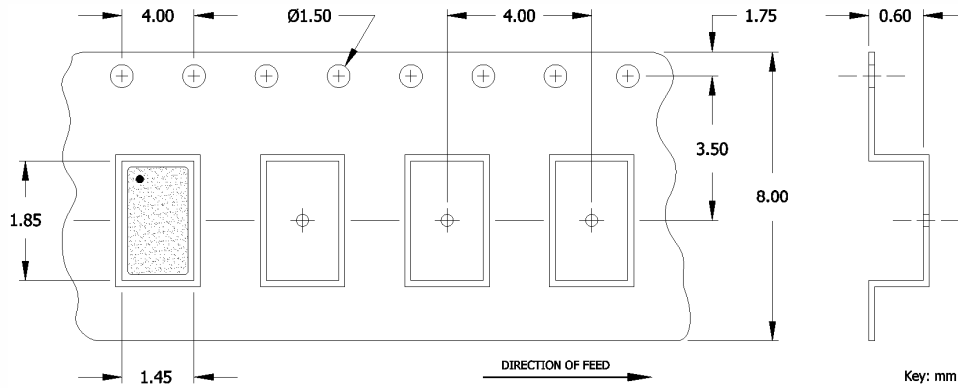
Key: mm

### Notes

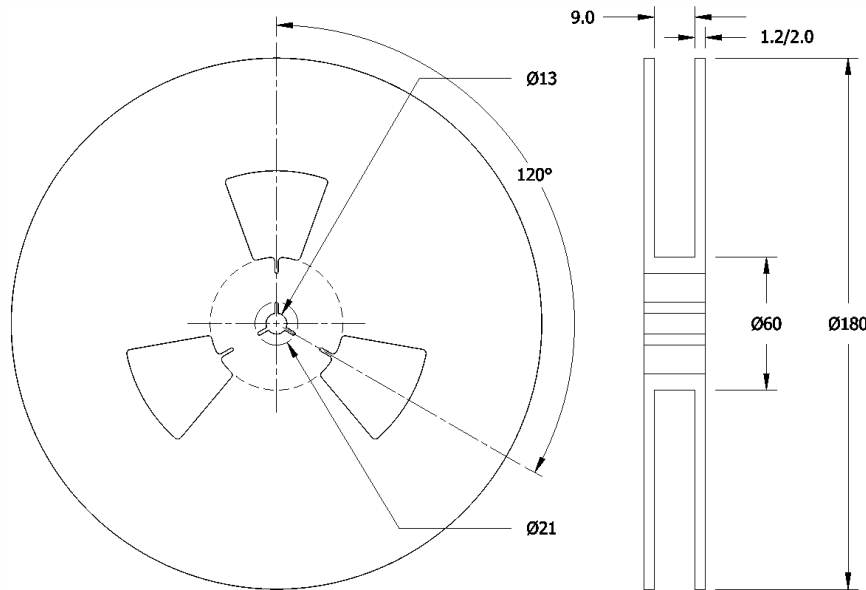
1. Terminations #2, #4 and metal lid are connected internally. End user may connect these pins to circuit ground for EMI suppression.
2. JEDEC termination code (e4). Barrier-plating is nickel [Ni] with gold [Au] flash plate.
2. Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
3. MSL = 1.

### Packaging - Tape and Reel

#### Tape Drawing



#### Reel Drawing



#### Notes

1. Device quantity is 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.