1. Device Name Crystal Resonator (with dedicated temperature sensor)
2. Model Name DSR211STH
3. Nominal Frequency 38.400 MHz
4. Device Summary
   4.1 Mass 0.015g max.
   4.2 RoHS Confirmation Yes
   4.3 Pb-free Yes

5. Absolute Maximum Ratings

	Item	Rating	unit
1	Storage Temperature Range	-40~+105	°C

6. Recommended Operating Conditions

	Item	min.	typ.	max.	unit
1	Operating Temperature Range	-30	-	+105	°C

7. Electrical Characteristics

7.1 Crystal Resonator

	Item	Limits			unit	Conditions	Notes
		min.	typ.	max.			
1	Mode of Vibration	-	AT-cut fundamental	-			
2	Initial Frequency Tolerance	-	-	±10	ppm	T_A=+25°C	
3	Tolerance Over Temperature	-	-	±12	ppm	T_A=-30~+85°C	
4	Aging	-	-	±0.7	ppm/year		
		-	-	±5	ppm/7years		
5	Frequency Drift After Reflow	-	-	±2	ppm	After two reflows	
6	Equivalent Series Resistance	-	-	80	Ω		*8
7	Quality Factor	75000	-	-			
8	Spurious Mode Series Resistance	1100	-	-	Ω	±1MHz	
9	Pullability	10	-	-	ppm/pF		
10	Load Capacitance	-	7	-	pF		
11	Inflection Point	27.5	29	30.5	°C	T=T0-C2/3C3	
12	First-order Curve Fitting Parameter/ C1	-0.40		-0.10	ppm/°C	Between +25 and +35°C	*1
13	Second-order Curve Fitting Parameter/ C2	-4.5	0	+4.5	$x10^{-4}$ ppm/°C		*1
14	Third-order Curve Fitting Parameter/ C3	+8.5	+10	+11.5	$x10^{-5}$ ppm/°C		*1
15	Residual Frequency Stability Slope	-	-	±50	ppb/°C		*2, *3
16	5°C Small Orbit Hysteresis1	-	-	±50	ppb/°C	T_A=-30~+85°C	*2,3,4
17	5°C Small Orbit Hysteresis2	-	-	100 (magnitude)	ppb pk-pk	T_A=-30~+85°C	*5,6
18	Drive Level	10	-	100	uW		
19	Drive Level Dependency						
	1. Frequency (Max.–Min.)	-	-	3	ppm		*7
	2. Frequency (Repeatability)	-	-	0.7	ppm		*7
	3. ESR (Max.–Min.)	-	-	20	%		*7
	4. ESR(Repeatability)	-	-	10	%		*7
20	Insulation Resistance	500	-	-	MΩ		

Notes

*1. The FT curve of an AT-cut crystal can be modeled as a third-order polynomial.
C0, C1, C2, and C3 are coefficients that need to be defined are calculated in the order specified by Qualcomm's 80-V9690-23 Rev D

$$f(t) = c_3(\theta)(t-t_0)^3 + c_2(\theta)(t-t_0)^2 + c_1(\theta)(t-t_0) + c_0$$

C0, C1, C2, and C3 are coefficients that need to be defined.
C1: First-order Curve Fitting Parameter/ C2: Second-order Curve Fitting Parameter/
C3: Third-order Curve Fitting Parameter/ T0=+29°C

*2. Measure FT point every 1℃, heating up from -30 to +85°C, subtract off a 5th order polynomial best fit and calculate the slope of the residual.

*3. Continuous temperature rate change of ~1.0°C/min

*4. Measure FT points every 0.5°C while cycling temperature over a 5°C small temperature orbit, an example 5°C small orbit temperature cycle is +30 to +35 to +30°C.
Subtract the 5th order polynomial best fit from *2(discard the first point of each heating and cooling cycle), and calculate the slope of the residual for each of these heating and cooling 10 points curves.

*5. Continuous temperature rate change of 1.0°C/min

*6. Measure FT points every 0.5°C while cycling temperature over a 5°C small temperature orbit, an example 5°C small orbit temperature cycle is +30 to +35 to +30°C.
Calculate the average difference between each pair of 9 same temperature cooling – heating frequency measurement (discard the first and last point of each heating and cooling cycle).

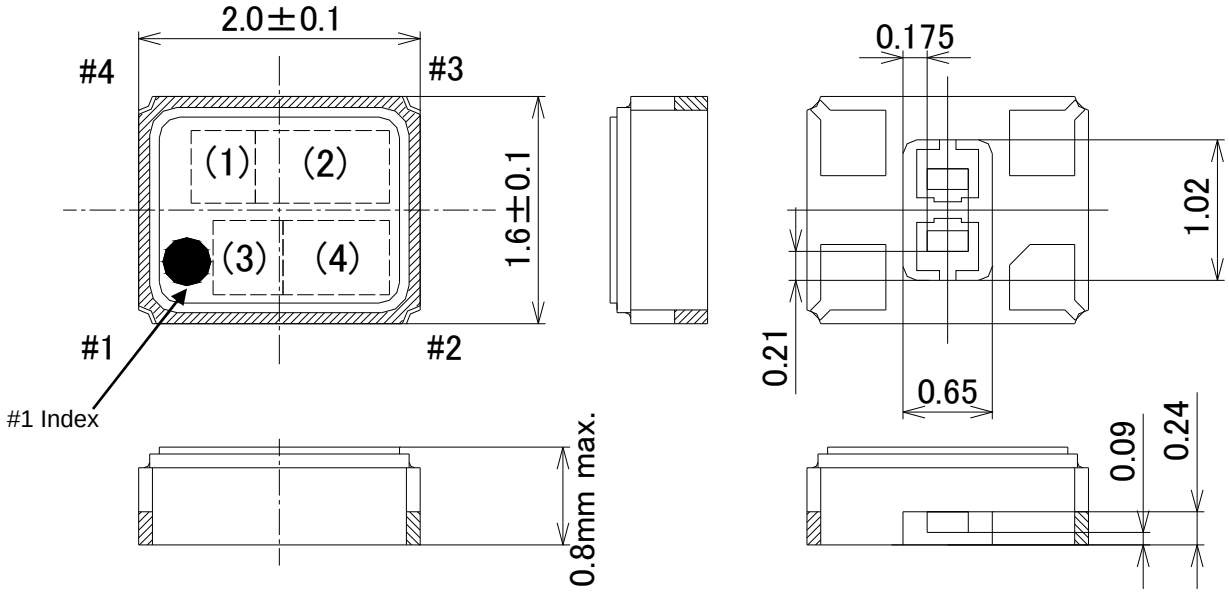
*7. 0.01uW to 100uW to 0.01uW (Measurement point: Total 30 points) *8. KDS internal inspection spec is 60ohms max.

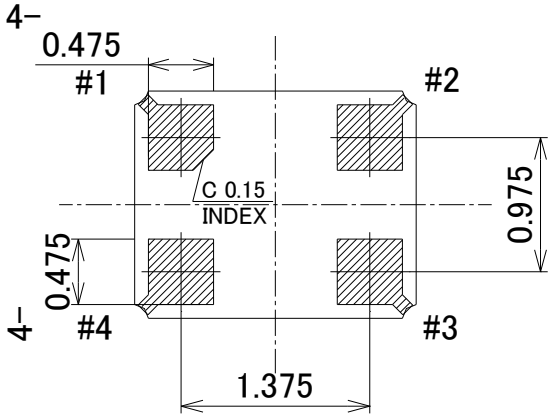
7.2 Thermistor

	Item	Limits			unit	Notes
		min.	typ.	max.		
1	Resistance	-	100	-	kΩ	Ta=+25°C
2	B-constant	-	4250	-	K	+25°C - +50°C
3	Tolerance	-	-	1	%	

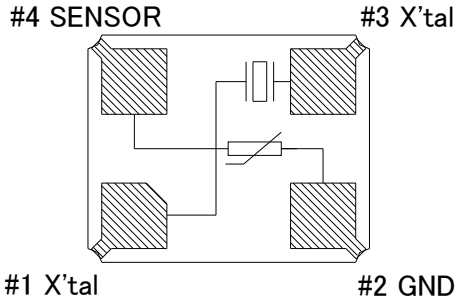
8. Outline, Pin Connections

Outline





Connection (Top View)



Marking

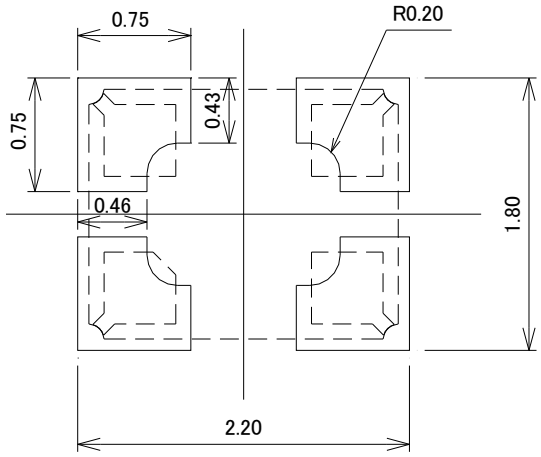
(1) Model code	TH
(2) Frequency	38.4 (MHz, 3digits)
(3) Logo	D
(4) Date code	Year (1digit) +Week (2digits) e.g.2016/1/1 → 601

unit: mm
Dimensional Tolerance: ±0.1
(Unless otherwise noted)

TITLE	Remark		
DSR211STH TYPE SPECIFICATION	T16-0492		
Date	Spec. No.	Rev.	Page
2016/09/12	1RAZ38400CAA	-	3/4

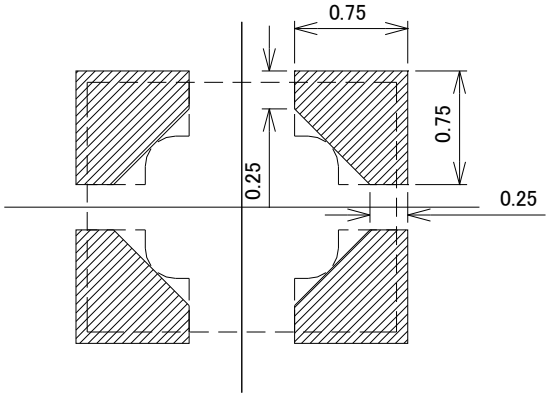
9. Land Pattern Layout

Land Pattern Layout



Component Pad

Metal Mask Hole



Solder Paste

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