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UTECH

Frequency Product Catalog

UTECH Company Profile

UTECH TECHNOLOGY CO.,LTD is a professional solution provider of frequency products, such as crystal resonators and clock oscillators, we offer products with our own brand UTECH and considerate services to customers worldwide.

Focus on researching and manufacturing high precision crystals, they are widely used for communications, IoT, RF remote control, security, smart home, smart meters etc..

Since 2000, we have provided products in metering, smart grid and three-in-one network industries, we have established long term cooperation with 90% of meter manufacturers and solution provider, our products with high stability and great temperature characteristics are served in this industry, and come to millions of families with terminal products.

Since 2010, we stept into European market with the incredible teamwork between German partner and us, have built long term relationship with well-known customers in communication and smart home industries.

In the last decades, with strong technical advantages, our products are served for lots of famous brands, for instance Huawei, LG, Eastsoft, AVM, Devolo, Tado etc..

Our enterprise mission is: “To be the best supplier of our customers”

Our enterprise vision is: “To be the most respectable company in the industry”

1. SHENZHEN UTECH INDUSTRAIL DEVOLOPMENT CO.,LTD ---------(1995) (Marketing of frequency products)
2. SHENZHEN AUDER ELECTRONICS CO.,LTD ----------(1999) (Manufacturing of frequency products)
3. SUZHOU UTECH ELECTRONICS TECHNOLOGY CO.,LTD ---------- (2009) (Marketing of frequency products)
4. HUNAN UTECH TECHNOLOGY CO.,LTD ---------- ---(2011) (Manufacturing of frequency products)

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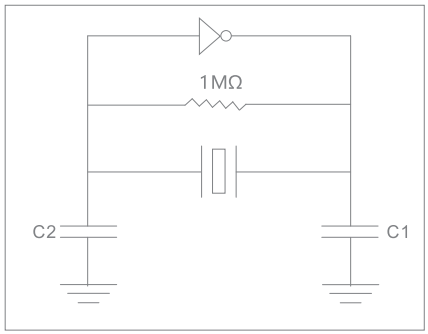
Contents

1. How to choose the right CL of crystals?



1) Recommended CL of crystals by IC

2) Empirical CL Calculation

CL≈C1*C2/(C1+C2)+Cs

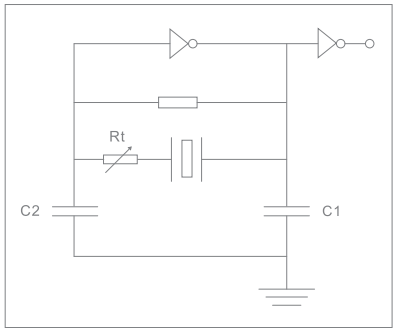
(HC-49S Series: Cs=6pF; SMD Series: Cs=3pF)

C1, C2: Ground Capacitance of Crystal

3) Matching Experiment

Test the output frequency with different CL to find out the optimum CL for the circuit.

2. How to test the Negative Resistance?

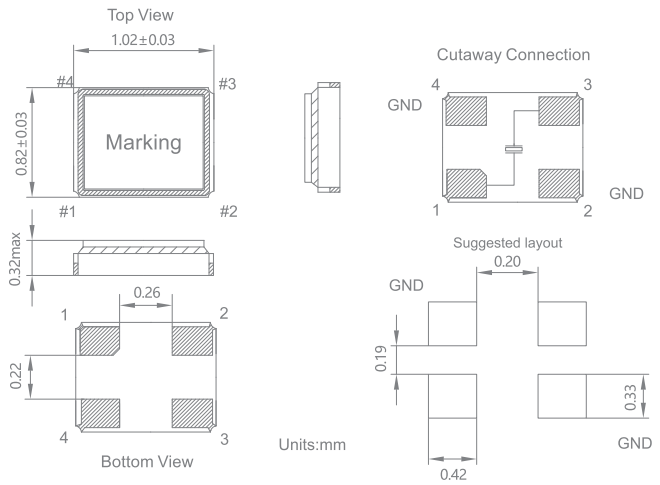


1) Put the adjustable resistance and the crystal in series, increase the resistance (Rt) from 0 to the one lead to the oscillation of the loop get stopped;

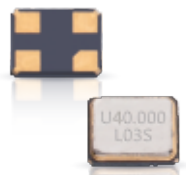
2) Measure the Rt when the oscillation of the loop just get stopped, The negative resistance is: $|-R| = Rt+Rr$.

The recommended negative resistance is: $|-R| > 5*ESR$ (unit: ohm).

Normally, decreasing the ground capacitance of crystal C1 C2 will improve the negative resistance.



Dimensions(mm)



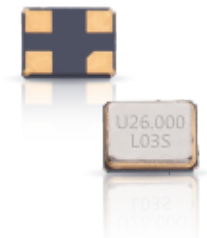
GENERIC SPECIFICATION

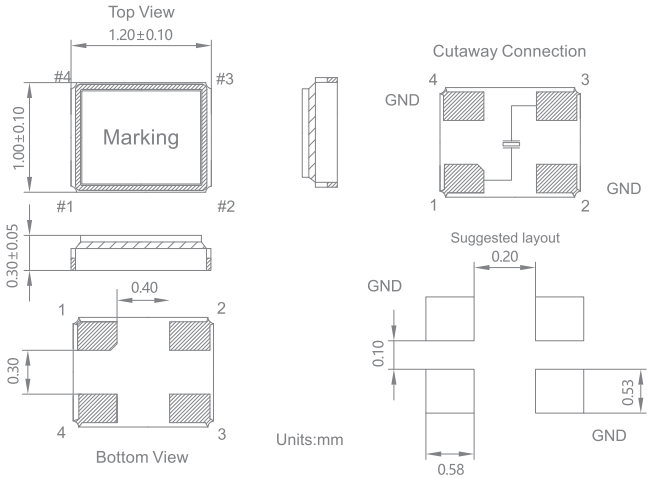
ITEM		QRSC SMD1008-M4	REMARK
Nominal Frequency Range		40MHz to 100MHz	Fund. Mode / AT
Frequency tolerance @25 °C		±10ppm to ±100ppm	Others are offered
Load Capacitance		6pF to ∞pF	Please specify
Frequency temperature characteristics		±10ppm to ±100 ppm	Others are offered
Temperature Range	Storage Temp.	-40°C~ +85°C/-55°C~ +125°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	Others are offered
Drive Level		10uW to 300uW (Typical:10uW)	Please specify
Equivalent Series Resistance		As Per Table	
Shunt Capacitance		5.0pF Max.	
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	40MHz to 100MHz
Mode	Fundamental
R1	60Ω max

Dimensions(mm)



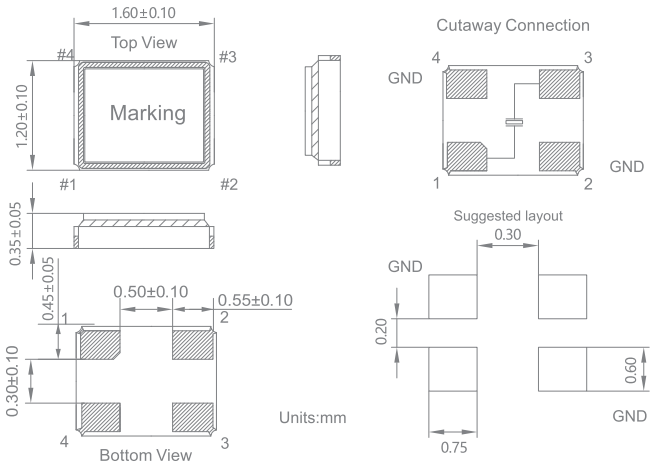


GENERIC SPECIFICATION

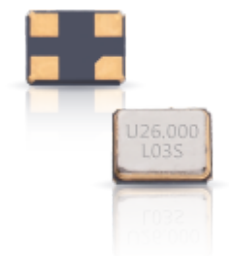
ITEM		QRS0 SMD1210-M4	REMARK
Nominal Frequency Range		24MHz to 100MHz	Fund. Mode / AT
Frequency tolerance @25 °C		±10ppm to ±100ppm	Others are offered
Load Capacitance		6pF to ∞pF	Please specify
Frequency temperature characteristics		±10ppm to ±100 ppm	Others are offered
Temperature Range	Storage Temp.	-40°C~ +85°C/-55°C~ +125°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	Others are offered
Drive Level		10uW to 300uW (Typical:10uW)	Please specify
Equivalent Series Resistance		As Per Table	
Shunt Capacitance		5.0pF Max.	
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	24MHz to 54MHz	54MHz to 100MHz
Mode	Fundamental	Fundamental
R1	150Ω max	100Ω max



Dimensions(mm)



GENERIC SPECIFICATION

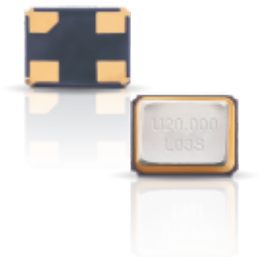
ITEM		QRSA SMD1612-M4	REMARK
Nominal Frequency Range		24MHz to 100MHz	Fund. Mode / AT
Frequency tolerance @25 °C		±10ppm to ±100 ppm	Others are offered
Load Capacitance		6pF to ∞pF	Please specify
Frequency temperature characteristics		±10ppm to ±100 ppm	Others are offered
Temperature Range	Storage Temp.	-40°C~ +85°C/-55°C~ + 125°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	Others are offered
Drive Level		10uW to 300uW (Typical:10uW)	Please specify
Equivalent Series Resistance		As Per Table	
Shunt Capacitance		5.0pF Max.	
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

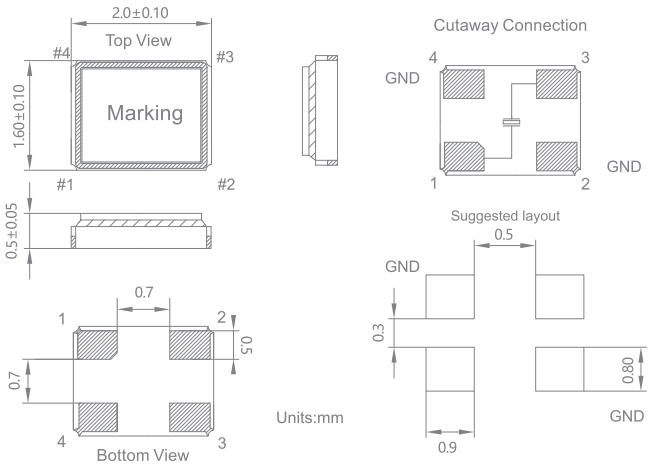
MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	24MHz-30MHz	30MHz-54MHz	54MHz-100MHz
Mode	Fundamental	Fundamental	Fundamental
R1	150Ω max	100Ω max	60Ω max

QRS1 CRYSTAL RESONATOR
SMD2016-M4

Dimensions(mm)



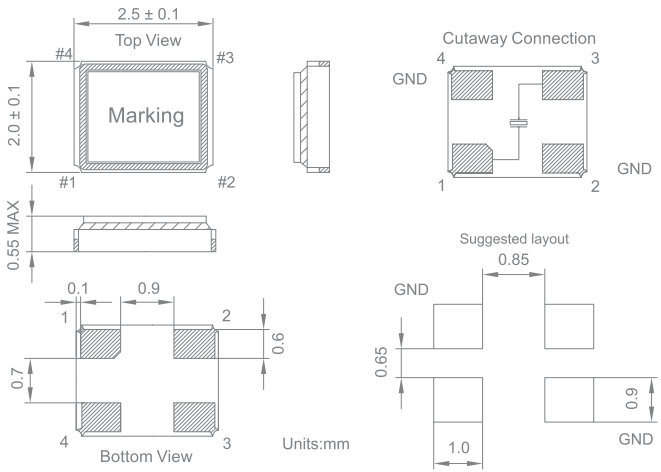


GENERIC SPECIFICATION

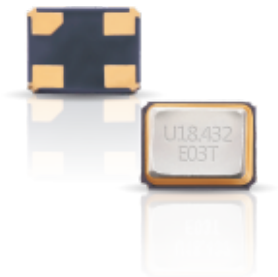
ITEM		QRS1 SMD2016-M4	REMARK
Nominal Frequency Range		16MHz to 100MHz	Fund. Mode / AT
Frequency tolerance @25 °C		±10ppm to ±100 ppm	Others are offered
Load Capacitance		6pF to ∞pF	Please specify
Frequency temperature characteristics		±10ppm to ±100 ppm	Others are offered
Temperature Range	Storage Temp.	-40°C~ +85°C/-55°C~ + 125°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	Others are offered
Drive Level		10uW to 300uW (Typical:10uW)	Please specify
Equivalent Series Resistance		As Per Table	
Shunt Capacitance		5.0pF Max.	
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	16MHz-30MHz	30MHz-54MHz	54MHz-100MHz
Mode	Fundamental	Fundamental	Fundamental
R1	100Ω max	80Ω max	60Ω max



Dimensions(mm)



GENERIC SPECIFICATION

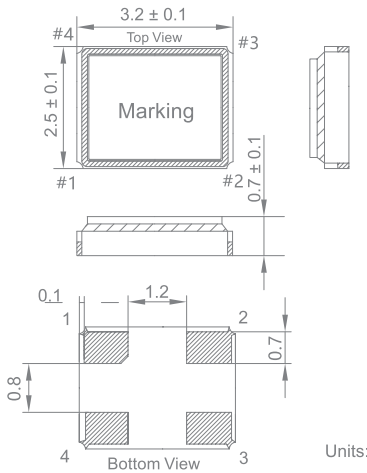
ITEM		QRS2 SMD2520-M4	REMARK
Nominal Frequency Range		12MHz to 100MHz	Fund. Mode / AT
Frequency tolerance @25 °C		±10ppm to ±100 ppm	Others are offered
Load Capacitance		6pF to ∞pF	Please specify
Frequency temperature characteristics		±10ppm to ±100 ppm	Others are offered
Temperature Range	Storage Temp.	-40°C~ +85°C/-55°C~ + 125°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	Others are offered
Drive Level		10uW to 300uW (Typical:10uW)	Please specify
Equivalent Series Resistance		As Per Table	
Shunt Capacitance		5.0pF Max.	
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

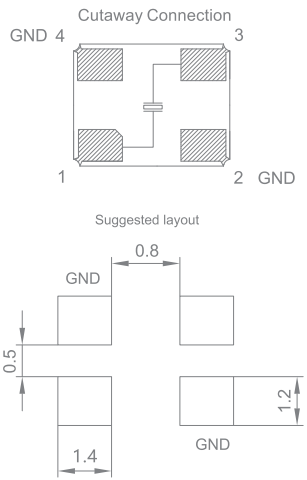
MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	12MHz-20MHz	20MHz-30MHz	30MHz-50MHz	50MHz-100MHz
Mode	Fundamental	Fundamental	Fundamental	Fundamental
R1	100Ω max	80Ω max	60Ω max	40Ω max

QRS3 CRYSTAL RESONATOR
SMD3225-M4

Dimensions(mm)



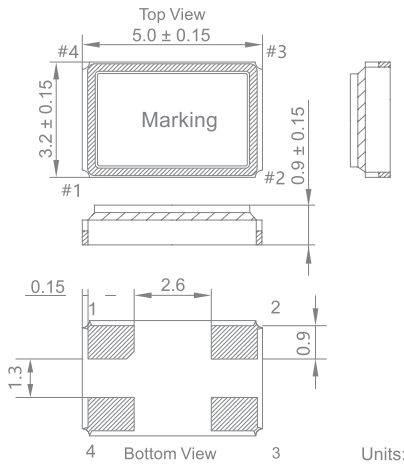


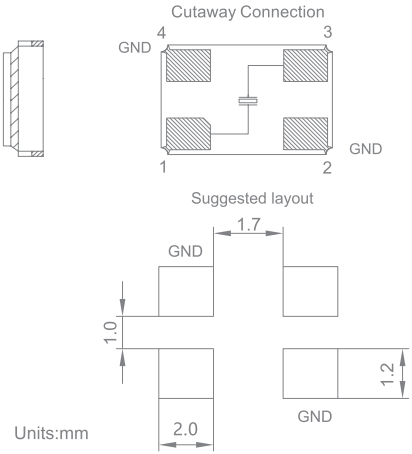
GENERIC SPECIFICATION

ITEM		QRS3 SMD3225-M4	REMARK
Nominal Frequency Range		8MHz to 100MHz	Fund. Mode / AT
Frequency tolerance @25 °C		±10ppm to ±100ppm	Others are offered
Load Capacitance		6pF to ∞pF	Please specify
Frequency temperature characteristics		±10ppm to ±100 ppm	Others are offered
Temperature Range	Storage Temp.	-40°C~ +85°C/-55°C~ +125°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	Others are offered
Drive Level		10uW to 300uW (Typical:10uW)	Please specify
Equivalent Series Resistance		As Per Table	
Shunt Capacitance		5.0pF Max.	
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	8MHz-12MHz	12MHz-16MHz	16MHz-24MHz	24MHz-50MHz	50MHz-100MHz
Mode	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
R1	200Ω max	100Ω max	80Ω max	60Ω max	40Ω max





Units:mm

Dimensions(mm)

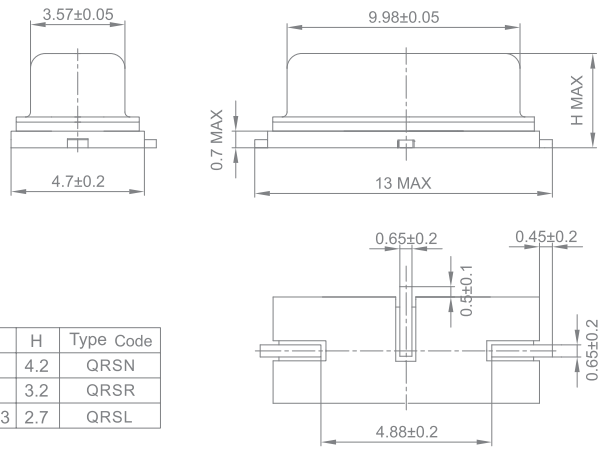
GENERIC SPECIFICATION

ITEM		QRS5 SMD5032-M4	REMARK
Nominal Frequency Range		8MHz to 100MHz	
Frequency tolerance @25 °C		±10ppm to ±100ppm	Others are offered
Load Capacitance		6pF to ∞pF	Please specify
Frequency temperature characteristics		±10ppm to ±100 ppm	Others are offered
Temperature Range	Storage Temp.	-40°C~ +85°C/-55°C~ +125°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	Others are offered
Drive Level		10uW to 300uW (Typical:10uW)	Please specify
Equivalent Series Resistance		As Per Table	
Shunt Capacitance		5.0pF Max.	
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	8MHz-10MHz	10MHz-12MHz	12MHz-16MHz	16MHz-20MHz	20MHz-24MHz	24MHz-100MHz
Mode	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
R1	100Ω max	80Ω max	60Ω max	50Ω max	40Ω max	30Ω max

Dimensions(mm)



Choose	Type	H	Type Code
☐	HC-49SMD3	4.2	QRSN
☐	HC-49SSMD 3	3.2	QRSR
☐	HC-49S3SMD3	2.7	QRSL

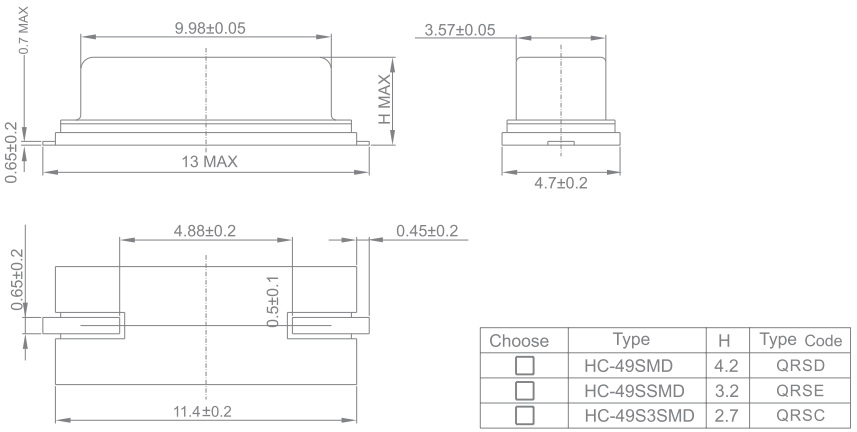
GENERIC SPECIFICATION

ITEM		QRSN HC-49SMD3 / QRSR HC-49SSMD3 / QRSL HC-49S3SMD3	REMARK
Nominal Frequency Range		3.5MHz to 40.0MHz	Fund. Mode/ AT
		24.0MHz to 100.0MHz	Overtone mode
Frequency tolerance @ 25°C		±5ppm to ±100 ppm	Others are offered
Load Capacitance		5pF to ∞pF for Fund. Mode	Need to specify your requirement
Frequency temperature characteristics		±10ppm to ±100 ppm	Others are offered
Temperature Range	Storage Temp.	-40°C~+85°C/-55°C~ +125°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	Others are offered
Drive Level		1 0uW to 500uW(Typical:10uW)	Please specify
Equivalent Series Resistance		As Per Table	
Shunt Capacitance		5.0pF Max.	
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	3.5MHz-6MHz	6MHz-10MHz	10MHz-20MHz	20MHz-40MHz	24MHz-48MHz	48MHz-100MHz
Mode	Fundamental	Fundamental	Fundamental	Fundamental	3rd, Overtone	3rd, Overtone
R1	150Ω max	80Ω max	40Ω max	30Ω max	80Ω max	40Ω max

Dimensions(mm)



Choose	Type	H	Type Code
☐	HC-49SMD	4.2	QRSD
☐	HC-49SSMD	3.2	QRSE
☐	HC-49S3SMD	2.7	QRSC

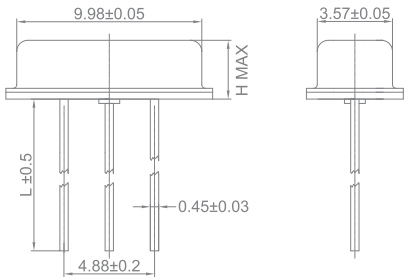
GENERIC SPECIFICATION

ITEM		QRSD HC-49SMD	QRSE HC-49SSMD / QRSC-49S3SMD	REMARK
Nominal Frequency Range		3.5MHz to 40.0MHz	6.0MHz to 40.0MHz	Fund. Mode/AT
		24.0MHzto 100.0MHz	27.0MHz to 100.0MHz	3rd, Overtone
Frequency tolerance @ 25°C		±5ppm to ±100 ppm		Others are offered
Load Capacitance		5 pF to ∞pF for Fund. Mode		Please specify
Frequency temperature characteristics		±10ppm to ±100 ppm		Others are offereda
Temperature Range	Storage Temp.	-40°C- +85°C/-55°C- +125°C		
	Operating Temp.	-10°C- +60°C to -40°C- +85°C		Others are offered
Drive Level		10uW to 500uW(Typical:10uW)		Please specify
Equivalent Series Resistance		As Per Table		
Shunt Capacitance		5.0pF Max.		
Insulation Resistance		More than 50MΩ @ DC 100V		
Aging		First year ±3ppm		

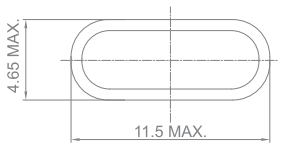
MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	3.5MHz-6MHz	6MHz-10MHz	10MHz-20MHz	20MHz-40MHz	24MHz-48MHz	48MHz-100MHz
Mode	Fundamental	Fundamental	Fundamental	Fundamental	3rd, Overtone	3rd, Overtone
R1	150Ω max	80Ω max	40Ω max	30Ω max	80Ω max	40Ω max

Dimensions(mm)



Choose	Type	H	Type Code
☐	HC-49-3PIN	3.5	QRDB
☐	HC-49SS-3PIN	2.8	QRDC
☐	HC-49S3-3PIN	2.3	QRD I

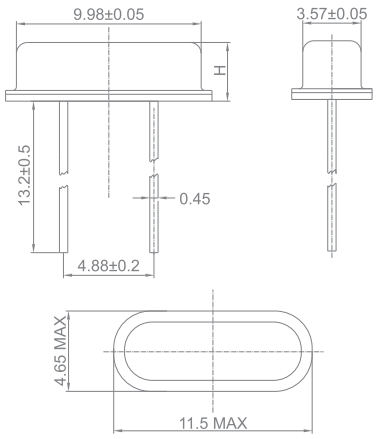


GENERIC SPECIFICATION

ITEM		QRDB HC-49S-3PIN / QRDC HC-49SS-3PIN / QRDI H C-49S3-3PIN	REMARK
Nominal Frequency Range		3.5MHz to 40.0MHz	Fund. Mode/ AT
		24.0MHz to 100.0MHz	Overtone mode
Frequency tolerance @ 25°C		±5ppm to ±100 ppm	Others are offered
Load Capacitance		5 pF to ∞pF for Fund. Mode	Need to specify your requirement
Frequency temperature characteristics		±5ppm to ±100 ppm	Others are offered
Temperature Range	Storage Temp.	-40°C~+85°C/-55°C~ +125°C	
	Operating Temp.	-10°C- +60°C to -40°C- +85°C	Others are offered
Drive Level		10uW to 500uW(Typical:10uW)	Please specify
Equivalent Series Resistance		As Per Table	
Shunt Capacitance		5.0pF Max.	
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	3.5MHz-6MHz	6MHz-10MHz	10MHz-20MHz	20MHz-40MHz	30MHz-48MHz	48MHz-100MHz
Mode	Fundamental	Fundamental	Fundamental	Fundamental	3rd, Overtone	3rd, Overtone
R1	150Ω max	80Ω max	40Ω max	30Ω max	80Ω max	40Ω max



Choose	Type	H	Type Code
☐	HC-49	3.5	QRDS
☐	HC-49SS	2.8	QRDM
☐	HC-49S3	2.3	QRDV

Dimensions(mm)

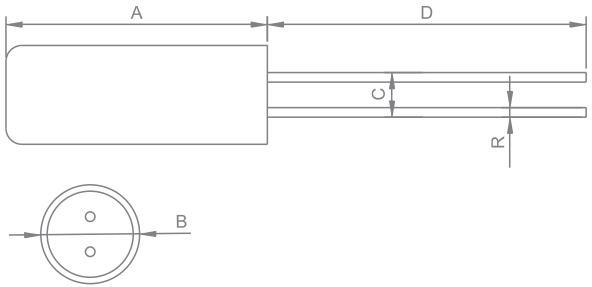
GENERIC SPECIFICATION

ITEM		QRDS HC-49S / QRDM HC-49SS / QRDV HC-49S3	REMARK
Nominal Frequency Range		3.5MHz to 40.0MHz	Fund. Mode/ AT
		24.0MHz to 100.0MHz	Overtone mode
Frequency tolerance @ 25°C		±5ppm to ±100 ppm	Others are offered
Load Capacitance		5 pF to ∞pF for Fund. Mode	Need to specify your requirement
Frequency temperature characteristics		±5ppm to ±100 ppm	Others are offered
Temperature Range	Storage Temp.	-40°C~+85°C/-55°C~ +125°C	
	Operating Temp.	-10°C- +60°C to -40°C- +85°C	Others are offered
Drive Level		10uW to 500uW(Typical:10uW)	Please specify
Equivalent Series Resistance		As Per Table	
Shunt Capacitance		5.0pF Max.	
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	3.5MHz-6MHz	6MHz-10MHz	10MHz-20MHz	20MHz-40MHz	30MHz-48MHz	48MHz-100MHz
Mode	Fundamental	Fundamental	Fundamental	Fundamental	3rd, Overtone	3rd, Overtone
R1	150Ω max	80Ω max	40Ω max	30Ω max	80Ω max	40Ω max

Dimensions(mm)



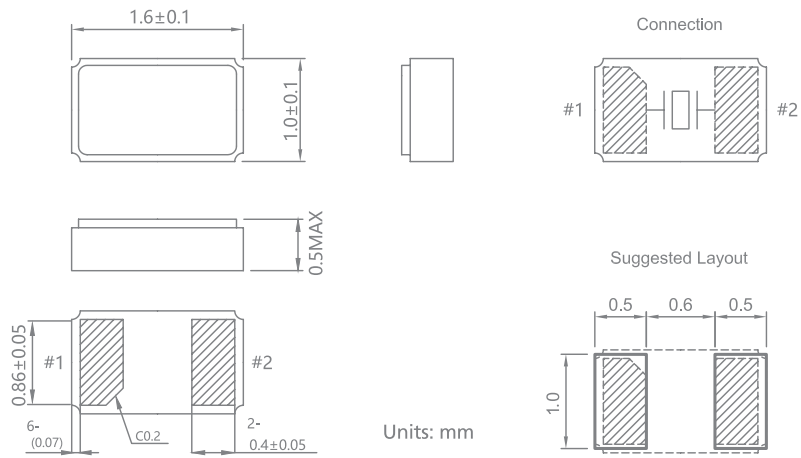
Choose	Type	A	B	C	D	R	Type Code
□	AT308	8.2MAX	Ø3.1MAX	1.1	10.0MAX	Ø 0.3	QRDO
□	AT206	6.2MAX	Ø2.1MAX	0.7	10.0MAX	Ø 0.2	QRDA

GENERIC SPECIFICATION

ITEM		QRDO AT308	QRDA AT206	REMARK
Nominal Frequency Range		4.0MHz to 36.0MHz	12.0MHz to 30.0MHz	Fund. Mode/ AT
		36.0MHz to 70.0MHz		3rd, Overtone
Frequency tolerance @ 25°C		±10, ±20, ±30, ±50, ±100 ppm		Others are offered
Load Capacitance		10 pF to ∞pF for Fund. Mode		Please specify
Frequency temperature characteristics		±10, ±15, ±20, ±30, ±50 ppm		Others are offered
Temperature Range	Storage Temp.	-40°C to +85°C		
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C		Others are offered
Drive Level		10uW to 300uW (Typical:10uW)		Please specify
Equivalent Series Resistance		As Per Table		
Shunt Capacitance		5.0pF Max.		
Insulation Resistance		More than 500MΩ @ DC 1 00V		
Aging		First year ±3ppm		

MOTIONAL (SERIES) RESISTANCE (R1)

Frequency Range	4.0MHz-6MHz	6MHz-10MHz	10MHz-20MHz	20MHz-40MHz	30MHz-48MHz	48MHz-70MHz
Mode	Fundamental	Fundamental	Fundamental	Fundamental	3rd, Overtone	3rd, Overtone
R1	150-80Ω max	60Ω max	40Ω max	30Ω max	100-80Ω max	50Ω max

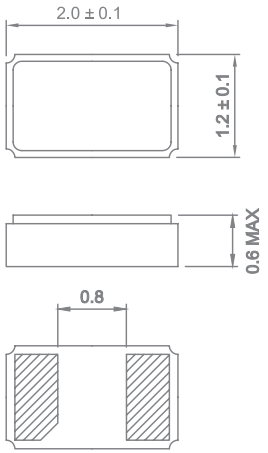


Dimensions(mm)

GENERIC SPECIFICATION

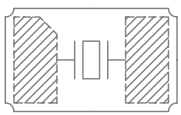
ITEM		QTS1 SMD1610	REMARK
Nominal Frequency Range		32.768KHz	Mode:TF
Frequency tolerance @ 25°C		±5ppm to ±20 ppm	Others are offered
Load Capacitance		6pF~12. 5pF	Please specify
Turn Over Temperature		25°C ± 3°C	
Temperature Coefficient		-0.04 x 10^{-6} / $°C^2$	
Temperature Range	Storage Temp.	-40°C~ +85°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	
Drive Level		0.1μW(Typical) 1.0μW(Max)	
Soldering Condition		Under 230°C ±5°C within 5 sec.	
Equivalent Series Resistance		90KΩ max	
Shunt Capacitance		1.2pF	Typical
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

Dimensions(mm)

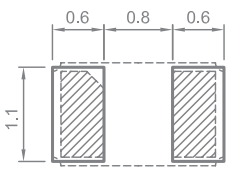


Units: mm

Connection

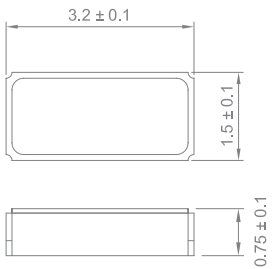


Suggested Layout

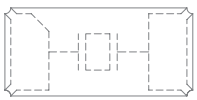


GENERIC SPECIFICATION

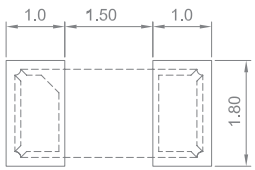
ITEM		QTS2 SMD2012	REMARK
Nominal Frequency Range		32.768KHz	Mode:TF
Frequency tolerance @ 25°C		±5ppm to ±20 ppm	Others are offered
Load Capacitance		6pF~12. 5pF	Please specify
Turn Over Temperature		25°C ± 3°C	
Temperature Coefficient		-0.04 x 10^{-6} / $°C^2$	
Temperature Range	Storage Temp.	-40°C~ +85°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	
Drive Level		0.1μW(Typical) 1.0μW(Max)	
Soldering Condition		Under 230°C ±5°C within 5 sec.	
Equivalent Series Resistance		80KΩ max	
Shunt Capacitance		1.3pF	Typical
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	



Connection



Suggested Layout



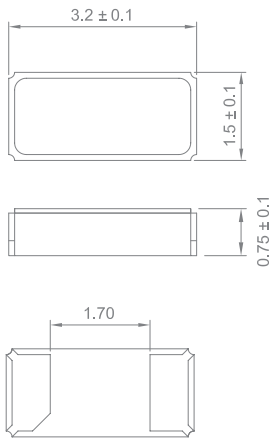
Units: mm

Dimensions(mm)

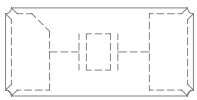
GENERIC SPECIFICATION

ITEM		QTS3 SMD3215	REMARK
Nominal Frequency Range		32.768KHz	Mode:TF
Frequency tolerance @ 25°C		±5ppm to ±20 ppm	Others are offered
Load Capacitance		6pF~12. 5pF	Please specify
Turn Over Temperature		25°C ± 3°C	
Temperature Coefficient		-0.04 x 10^{-6} / $°C^2$	
Temperature Range	Storage Temp.	-40°C~ +85°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	
Drive Level		0.1μW(Typical) 1.0μW(Max)	
Soldering Condition		Under 230°C ±5°C within 5 sec.	
Equivalent Series Resistance		70KΩ max	
Shunt Capacitance		1.2pF	Typical
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

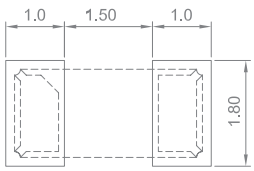
Dimensions(mm)



Connection



Suggested Layout

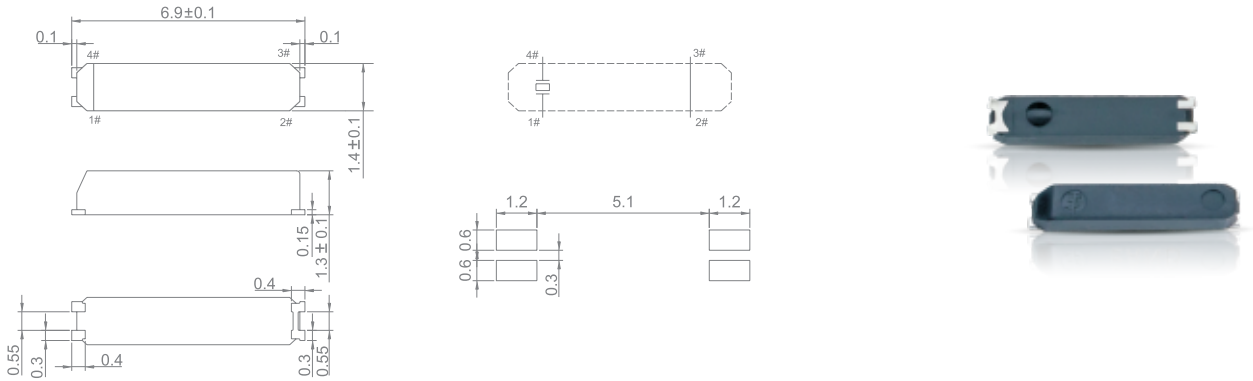


Units: mm

GENERIC SPECIFICATION

ITEM		QTS3 SMD3215 TQ	REMARK
Nominal Frequency Range		32.768KHz	Mode:TF
Frequency tolerance @ 25°C		±5ppm to ±20 ppm	Others are offered
Load Capacitance		6pF~12. 5pF	Please specify
Turn Over Temperature		25°C ±2°C	
Temperature Coefficient		-0.034±0.0015 x 10^{-6}/°C^2	
Consistency of Temp. Characteristic		±2ppm vs -20°C~+60°C / ±5ppm vs -40°C~+85°C	MAX
Temperature Range	Storage Temp.	-55°C~+125°C	
	Operating Temp.	-40°C~ +85°C	
Drive Level		0.1μW (Typical) 1.0μW (Max)	
Soldering Condition		Under 230°C ±5°C within 5 sec.	
Equivalent Series Resistance		70KΩ max	
Shunt Capacitance		1.2pF	Typical
Dynamic Capacitance		4.2pF	Typical
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

Dimensions(mm)



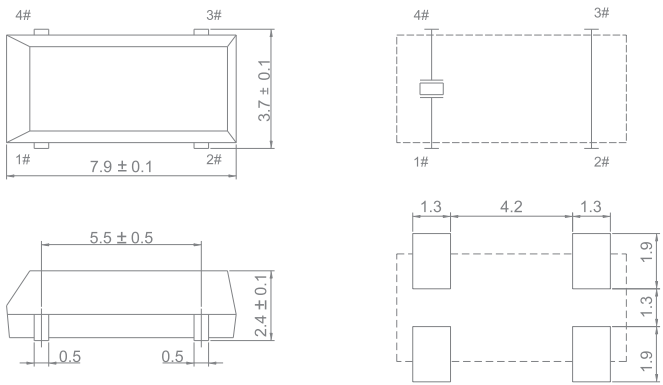
Do not connect to extemal with 2# and 3#

GENERIC SPECIFICATION

ITEM		QTS7 SMD7015	REMARK
Nominal Frequency Range		32.768KHz	Mode:TF
Frequency tolerance @ 25°C		±5ppm to ±20 ppm	Others are offered
Load Capacitance		6pF~12. 5pF	Please specify
Turn Over Temperature		25°C ±5°C	
Temperature Coefficient		-0.04 x 10^{-6} / $°C^2$	
Temperature Range	Storage Temp.	-40°C~ +85°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	
Drive Level		1.0uW	
Soldering Condition		Under 230°C ±5°C within 5 sec.	
Equivalent Series Resistance		65KΩ max	
Shunt Capacitance		1.55 pF	Typical
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

QTS8 CRYSTAL RESONATOR
SMD8038

Dimensions(mm)

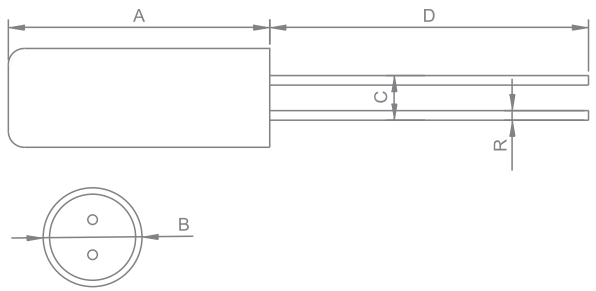


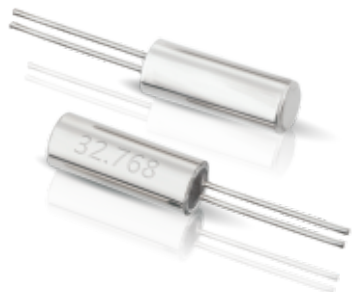
Do not connect to extemal with 2# and 3#

GENERIC SPECIFICATION

ITEM		QTS8 SMD8038	REMARK
Nominal Frequency Range		32.768KHz	Mode:TF
Frequency tolerance @ 25°C		±5ppm to ±20 ppm	Others are offered
Load Capacitance		6pF~12. 5pF	Please specify
Turn Over Temperature		25°C ±5°C	
Temperature Coefficient		-0.04 x 10^{-6} / $°C^2$	
Temperature Range	Storage Temp.	-40°C~ +85°C	
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C	
Drive Level		1.0uW	
Soldering Condition		Under 230°C ±5°C within 5 sec.	
Equivalent Series Resistance		50KΩ max	
Shunt Capacitance		1.55 pF	Typical
Insulation Resistance		More than 500MΩ @ DC 100V	
Aging		First year ±3ppm	

Dimensions(mm)





Choose	Type	A	B	C	D	R	Type Code
□	TF308	8.2MAX	Ø3.1MAX	1.1	10.0MAX	Ø 0.3	QTDO
□	TF206	6.2MAX	Ø2.1MAX	0.7	10.0MAX	Ø 0.2	QTDA

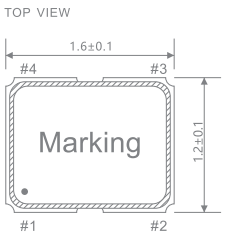
GENERIC SPECIFICATION

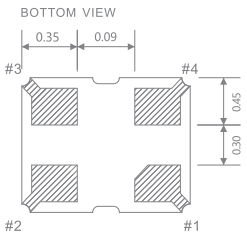
ITEM		QTDO TF308	QTDA TF206	REMARK
Nominal Frequency Range		32.768KHz	32.768KHz	
Frequency tolerance @ 25°C		±5ppm to ±20ppm		
Load Capacitance		6pF~12. 5pF		Please specify
Turn Over Temperature		25°C ± 5°C		
Temperature Coefficient		-0.04 x 10^{-6} / $°C^2$		
Temperature Range	Storage Temp.	-40°C to +85°C		
	Operating Temp.	-10°C~ +60°C to -40°C~ +85°C		
Drive Level		1.0uW		
Soldering Condition		Under 230°C ±5°C within 5 sec.		
Equivalent Series Resistance		As Per Table		
Shunt Capacitance 0.9pF 0.8pF Typical		0.9pF	0.8pF	Typical
Motional Capacitance		2.1fF	2.0fF	Typical
Insulation Resistance		More than 500MΩ @ DC 1 00V		
Aging		First year ±3ppm		

MOTIONAL (SERIES) RESISTANCE (R1)

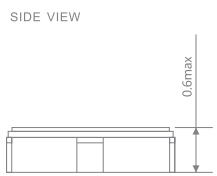
Frequency Range	32.768KHz
R1	35KΩ max

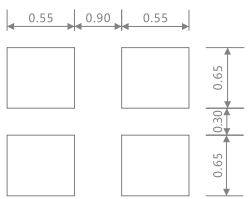
Dimensions(mm)





Pad	Function
#1	ENABLE CONTROL
#2	GND
#3	Output
#4	VDD

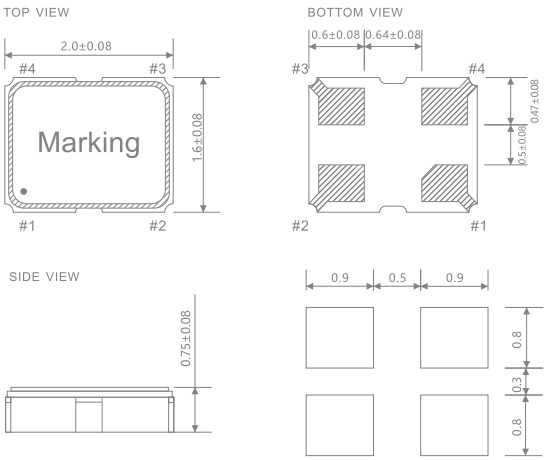




Pad #1	Function
HIGH OPEN	Specified frequency output
LOW	Output is high impedance, Oscillation stops

GENERIC SPECIFICATION

ITEM		3.3V	2.5V	1.8V	REMARK
Frequency Range			32.768KHz to 160.0MHz		
Frequency Stability *			±20, ±30, ±50 ppm		All Condition
Temperature Range	Storage Temp.		-55°C to +125°C		
	Operating Temp.		-20°C to +70°C		-40°C to +85°C option
Power Supply Voltage		3.3V±10%	2.5V ±10%	1.8V ±10%	
Supply Current	1.0MHz≤Freq. < 24MHz	10mAmax.	8mA max	8mAmax.	
	24MHz≤Freq. < 50MHz	15mAmax.	12mA max	10mAmax.	
	50MHz≤Freq.<120MHz	20mAmax.	15mA max	12mAmax.	
	120MHz≤Freq.<160M Hz	25mAmax.	20mA max	——	
	160MHz≤Freq.≤200M Hz	30mAmax.	——		
Output Symmetry (at 1/2Vdd)			40~60%		45~55% option
Rise Time (10%-90%Vdd)			5nS max.		
Fall Time (90%-10%Vdd)			5nS max.		
Output Voltage	VoH		90% Vdd min		
	VoL		10% Vdd max		
Output Load (HCOMS Load)			15pF (Typical)		
Start-up Time			5mS max		
Aging			First year ±3ppm		



Pad	Function
#1	ENABLE CONTROL
#2	GND
#3	Output
#4	VDD

Pad #1	Function
HIGH OPEN	Specified frequency output
LOW	Output is high impedance, Oscillation stops

Dimensions(mm)

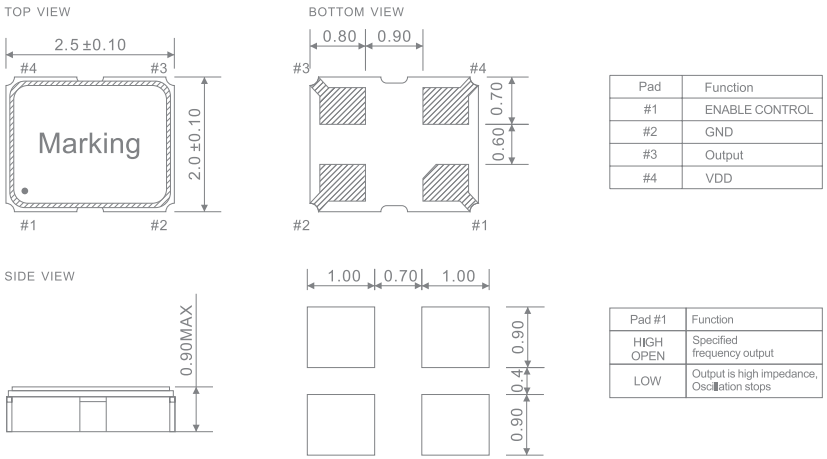
GENERIC SPECIFICATION

ITEM		3.3V	2.5V	1.8V	REMARK
Frequency Range			32.768KHz to 160.0MHz		
Frequency Stability *			±20, ±30, ±50 ppm		All Condition
Temperature Range	Storage Temp.		-55°C to +125°C		
	Operating Temp.		-20°C to +70°C		-40°C to +85°C option
Power Supply Voltage		3.3V±10%	2.5V ±10%	1.8V ±10%	
Supply Current	1.0MHz≤Freq. < 24MHz	10mAmax.	8mA max	8mAmax.	
	24MHz≤Freq. < 50MHz	15mAmax.	12mA max	10mAmax.	
	50MHz≤Freq.<120MHz	20mAmax.	15mA max	12mAmax.	
	120MHz≤Freq.<160M Hz	25mAmax.	20mA max	——	
	160MHz≤Freq.≤200M Hz	30mAmax.	——		
Output Symmetry (at 1/2Vdd)			40~60%		45~55% option
Rise Time (10%-90%Vdd)			5nS max.		
Fall Time (90%-10%Vdd)			5nS max.		
Output Voltage	VoH		90% Vdd min		
	VoL		10% Vdd max		
Output Load (HCOMS Load)			15pF (Typical)		
Start-up Time			5mS max		
Aging			First year ±3ppm		

QOS2 CRYSTAL OSCILLATOR

OSC SMD2520

Dimensions(mm)



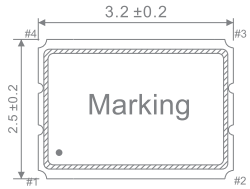
Pad	Function
#1	ENABLE CONTROL
#2	GND
#3	Output
#4	VDD

Pad #1	Function
HIGH OPEN	Specified frequency output
LOW	Output is high impedance, Oscillation stops

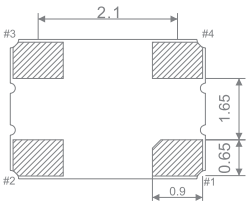
GENERIC SPECIFICATION

ITEM		3.3V	2.5V	1.8V	REMARK
Frequency Range			32.768KHz to 160.0MHz		
Frequency Stability *			±20, ±30, ±50 ppm		All Condition
Temperature Range	Storage Temp.		-55°C to +125°C		
	Operating Temp.		-20°C to +70°C		-40°C to +85°C option
Power Supply Voltage		3.3V±10%	2.5V ±10%	1.8V ±10%	
Supply Current	1.0MHz≤Freq. < 24MHz	10mAmax.	8mA max	8mAmax.	
	24MHz≤Freq. < 50MHz	15mAmax.	12mA max	10mAmax.	
	50MHz≤Freq.<120MHz	20mAmax.	15mA max	12mAmax.	
	120MHz≤Freq.<160M Hz	25mAmax.	20mA max	——	
	160MHz≤Freq.≤200M Hz	30mAmax.	——		
Output Symmetry (at 1/2Vdd)			40~60%		45~55% option
Rise Time (10%-90%Vdd)			5nS max.		
Fall Time (90%-10%Vdd)			5nS max.		
Output Voltage	VoH		90% Vdd min		
	VoL		10% Vdd max		
Output Load (HCOMS Load)			15pF (Typical)		
Start-up Time			5mS max		
Aging			First year ±3ppm		

TOP VIEW



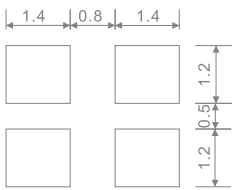
BOTTOM VIEW



Pad	Function
#1	ENABLE CONTROL
#2	GND
#3	Output
#4	VDD

Dimensions(mm)

SIDE VIEW



Pad #1	Function
HIGH OPEN	Specified frequency output
LOW	Output is high impedance, Oscillation stops

GENERIC SPECIFICATION

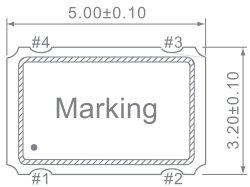
ITEM		3.3V	2.5V	1.8V	REMARK
Frequency Range			32.768KHz to 160.0MHz		
Frequency Stability *			±20, ±30, ±50 ppm		All Condition
Temperature Range	Storage Temp.		-55°C to +125°C		
	Operating Temp.		-20°C to +70°C		-40°C to +85°C option
Power Supply Voltage		3.3V±10%	2.5V ±10%	1.8V ±10%	
Supply Current	1.0MHz≤Freq. < 24MHz	10mAmax.	8mA max	8mAmax.	
	24MHz≤Freq. < 50MHz	15mAmax.	12mA max	10mAmax.	
	50MHz≤Freq.<120MHz	20mAmax.	15mA max	12mAmax.	
	120MHz≤Freq.<160M Hz	25mAmax.	20mA max	——	
	160MHz≤Freq.≤200M Hz	30mAmax.	——		
Output Symmetry (at 1/2Vdd)			40~60%		45~55% option
Rise Time (10%-90%Vdd)			5nS max.		
Fall Time (90%-10%Vdd)			5nS max.		
Output Voltage	VoH		90% Vdd min		
	VoL		10% Vdd max		
Output Load (HCOMS Load)			15pF (Typical)		
Start-up Time			5mS max		
Aging			First year ±3ppm		

QOS5 CRYSTAL OSCILLATOR

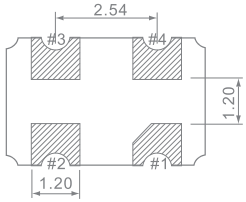
OSC SMD5032

Dimensions(mm)

TOP VIEW

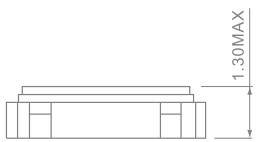


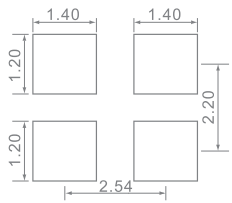
BOTTOM VIEW



Pad	Function
#1	ENABLE CONTROL
#2	GND
#3	Output
#4	VDD

SIDE VIEW

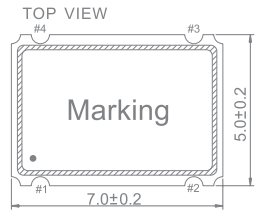


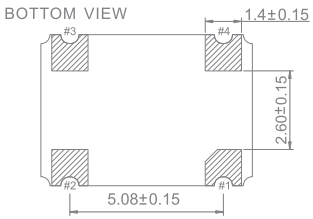


Pad #1	Function
HIGH OPEN	Specified frequency output
LOW	Output is high impedance, Oscillation stops

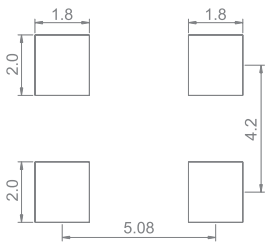
GENERIC SPECIFICATION

ITEM		3.3V	2.5V	1.8V	REMARK
Frequency Range		32.768KHz to 160.0MHz			
Frequency Stability *		±20, ±30, ±50 ppm			All Condition
Temperature Range	Storage Temp.	-55°C to +125°C			
	Operating Temp.	-20°C to +70°C			-40°C to +85°C option
Power Supply Voltage		3.3V ±10%	2.5V ±10%	1.8V±10%	
Supply Current	1.0MHz≤Freq. < 40MHz	15mA max.	12mA max	10mA max.	
	40MHz≤Freq. < 75MHz	20mA max.	18mA max	15mA max.	
	75MHz≤Freq.≤125MHz	35mA max.	30mA max	25mA max.	
Output Symmetry (at 1/2Vdd)		40~60%			45~55% option
Rise Time (10%-90%Vdd)		5nS max.			
Fall Time (90%-10%Vdd)		5nS max.			
Output Voltage	VoH	90% Vdd min			
	VoL	10% Vdd max			
Output Load (HCOMS Load)		15pF (Typical)			
Start-up Time		5mS max			
Aging		First year ±3ppm			





Pad	Function
#1	ENABLE CONTROL
#2	GND
#3	Output
#4	VDD



Pad #1	Function
HIGH OPEN	Specified frequency output
LOW	Output is high impedance, Oscillation stops

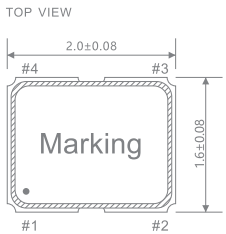
Dimensions(mm)

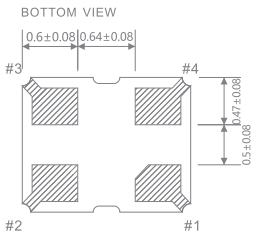
GENERIC SPECIFICATION

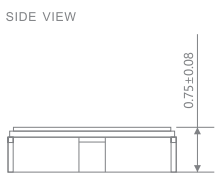
ITEM		3.3V	2.5V	1.8V	REMARK
Frequency Range		32.768KHz to 160.0MHz			
Frequency Stability *		±20, ±30, ±50 ppm			All Condition
Temperature Range	Storage Temp.	-55°C to +125°C			
	Operating Temp.	-20°C to +70°C			-40°C to +85°C option
Power Supply Voltage		3.3V ± 10%	2.5V ±10%	1.8V ± 10%	
Supply Current	1.0MHz≤Freq. < 36MHz	15mA max.	10mA max	10mA max.	
	36MHz≤Freq. < 75MHz	20mA max.	20mA max	15mA max.	
	75MHz≤Freq.<125MHz	35mA max.	30mA max	25mA max.	
	125MHz≤Freq.≤200M Hz	45mA max.	40mA max	––	
Output Symmetry (at 1/2Vdd)		40~60%			45~55% option
Rise Time (10%-90%Vdd)		5nS max.			
Fall Time (90%-10%Vdd)		5nS max.			
Output Voltage	VoH	90% Vdd min			
	VoL	10% Vdd max			
Output Load (HCOMS Load)		15pF (Typical)			
Start-up Time		5mS max			
Aging		First year ±3ppm			

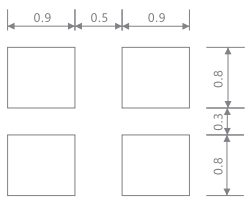
Dimensions(mm)

Pad	Function
#1	VCON : VCTCXO GND/NC : TCXO
#2	GND
#3	Output
#4	VDD



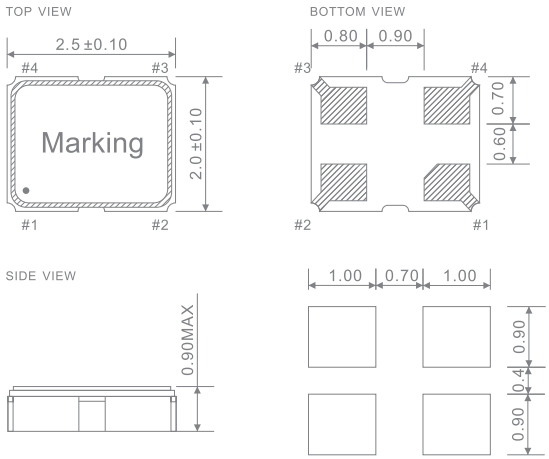






GENERIC SPECIFICATION

IEFM		3.0V		2.5V		1.8V		UNIT
		Min	Max	Min	Max	Min	Max	
Frequency Range		10.0MHz to 52.0MHz						
Frequency Tolerance		±2.0						PPM
Temperature Range	Storage Temp.	-55 to +125						°C
	Operating Temp.	-20 to +70 / -40 to +85						
Frequency Stability	Vs Operating Temperature Range	±0.5/ ±1.0/±2.0						PPM
	Vs Voltage(±5%) change (Clipped sine wave)	±0.2Max						
	Vs Load(±10%) change	±0.2Max						
	Vs Aging (at1st Year)	±1.0Max						
Supply Current	10MHz≤Fo<26MHz	---	2.0	---	2.0	---	2.0	mA
	26MHz≤Fo≤52MHz	---	2.5	---	2.5	---	2.5	
Output Load	Clipped sine wave	0.8	---	0.8	---	0.8	---	Vp-p
	Clipped sine wave	10KΩ /10PF						
Control Voltage Range(VCTCXO)		0.5	2.5	0.4	2.4	0.3	1.5	V
Pulling Range(VCTCXO)		±5.0	---	±5.0	---	±5.0	---	PPM
VC Input Impedance(VCTCXO)		500	---	500	---	500	---	KΩ
Start Time		---	2	---	2		2	mSec.
Phase Noise	100Hz	---	-115	---	-115		-115	dBc/Hz
	1000Hz	---	-135	---	-135		-135	
	10KHz	----	-148	---	-148		-148	



Pad	Function
#1	VCON : VCTCXO GND/NC : TCXO
#2	GND
#3	Output
#4	VDD

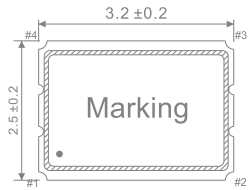
Dimensions(mm)

GENERIC SPECIFICATION

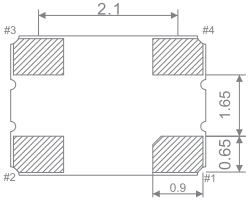
RAMETER		2.8V		2.5V		1.8V		UNIT
		Min	Max	Min	Max	Min	Max	
Frequency Range		10.0MHz to 52.0MHz						
Frequency Tolerance		±2.0						PPM
Temperature Range	Storage Temp.	-55 to +125						°C
	Operating Temp.	-20 to +70 / -40 to +85						
Frequency Stability	Vs Operating Temperature Range	±0.5/ ±1.0/±2.0						PPM
	Vs Voltage(±5%) change (Clipped sine wave)	±0.2Max						
	Vs Load(±10%) change	±0.2Max						
	Vs Aging (at1st Year)	±1.0Max						
Supply Current	10MHz≤Fo<26MHz	---	2.0	---	2.0	---	2.0	mA
	26MHz≤Fo≤52MHz	---	2.5	---	2.5	---	2.5	
Output Load	Clipped sine wave	0.8	---	0.8	---	0.8	---	Vp-p
	Clipped sine wave	10KΩ /10PF						
Control Voltage Range(VCTCXO)		0.4	2.5	0.4	2.4	0.3	1.5	V
Pulling Range(VCTCXO)		±5.0	---	±5.0	---	±5.0	---	PPM
VC Input Impedance(VCTCXO)		500	---	500	---	500	---	KΩ
Start Time		---	2	---	2		2	mSec.
Phase Noise	100Hz	---	-115	---	-115		-115	
	1000Hz	---	-135	---	-135		-135	dBc/Hz
	10KHz	----	-148	---	-148		-148	

Dimensions(mm)

TOP VIEW

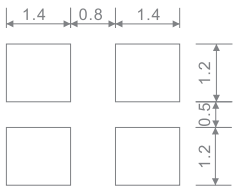


BOTTOM VIEW



Pad	Function
#1	VCON : VCTCXO GND/NC : TCXO
#2	GND
#3	Output
#4	VDD

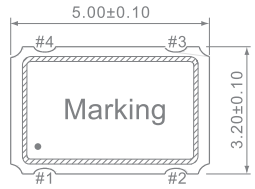
SIDE VIEW



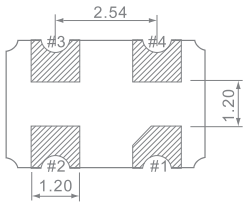
GENERIC SPECIFICATION

RAMETER		3.0V		2.5V		1.8V		UNIT
		Min	Max	Min	Max	Min	Max	
Frequency Range		10.0MHz to 52.0MHz						
Frequency Tolerance		±2.0						PPM
Temperature Range	Storage Temp.	-55 to +125						°C
	Operating Temp.	-20 to +70 / -40 to +85						
Frequency Stability	Vs Operating Temperature Range	±0.5/ ±1.0/±2.0						PPM
	Vs Voltage(±5%) change (Clipped sine wave)	±0.2Max						
	Vs Load(±10%) change	±0.2Max						
	Vs Aging (at1st Year)	±1.0Max						
Supply Current	10MHz≤Fo<26MHz	---	2.0	---	2.0	---	2.0	mA
	26MHz≤Fo≤52MHz	---	2.5	---	2.5	---	2.5	
Output Load	Clipped sine wave	0.8	---	0.8	---	0.8	---	Vp-p
	Clipped sine wave	10KΩ /10PF						
Control Voltage Range(VCTCXO)		0.5	2.5	0.4	2.4	0.3	1.5	V
Pulling Range(VCTCXO)		±5.0	---	±5.0	---	±5.0	---	PPM
VC Input Impedance(VCTCXO)		500	---	500	---	500	---	KΩ
Start Time		---	2	---	2		2	mSec.
Phase Noise	100Hz	---	-115	---	-115		-115	
	1000Hz	---	-135	---	-135		-135	dBc/Hz
	10KHz	----	-148	---	-148		-148	

TOP VIEW

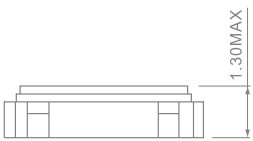


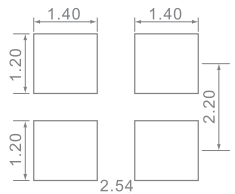
BOTTOM VIEW



Dimensions(mm)

SIDE VIEW





Pad	Function
#1	VCON : VCTCXO GND/NC : TCXO
#2	GND
#3	Output
#4	VDD

GENERIC SPECIFICATION

PARAMETER		5.0V		3.3V		UNIT
		Min	Max	Min	Max	
Frequency Range		10.0MHz to 52.0MHz				
Frequency Tolerance		±2.0				PPM
Temperature Range	Storage Temp.	-55 to +125				°C
	Operating Temp.	-20 to +70 / -40 to +85				
Frequency Stability	Vs Operating Temperature Range	±0.5/ ±1.0/±2.0				PPM
	Vs Supply Voltage (±5%) change (CMOS)	-	±0.2	-	±0.2	
	Vs Load (±10%) change	-	±0.2	-	±0.2	
	Vs Aging (after 1 year)	-	±1.0	-	±1.0	
Supply Current (CMOS output)		-	6	-	6	mA
Supply Current (Clipped sine wave)		-	3.5	-	3.5	
Output Level (CMOS)	Output High (Logic"1")	90%VDD	-	90%VDD	-	V
	Output Low (Logic"0")	-	-10%VDD	-	-10%VDD	
	Duty	45	55	45	55	%
Output Level (Clipped sine wave)		0.8	-	0.8	-	Vp-p
Load (CMOS		15pF		15pF		
Load (Clipped sine wave		10KΩ//10pF		10KΩ//10pF		
Control Voltage Range (VCTCXO)		0.5	2.5	0.5	2.5	V
Pulling Range (VCTCXO)		±5.0	±10.0	±5.0	±10.0	PPM
Vc Input Impedance (VCTCXO)		100	-	100	-	KΩ
Start Time		-	2	-	2	mSec
Phase Noise	100 Hz	-125		-125		dBc/Hz
	1 KHz	-145		-145		
	10 KHz	-150		-150		

- ≫ Radar System
- ≫ LiDAR System
- ≫ Camera System
- ≫ Automotive Computer
- ≫ Surround Camera System
- ≫ Gateway (In-Vehicle Network)

Product Type	Holder	Frequency Range	Typical Frequency	Output Wave	Temp. Range	Certificate
Tuning Fork	SMD2012-M2	32.768KHz	32.768KHz		-40 to +105°C -40 to +125°C -40 to +150°C	IATF16949 AEC-Q200
Tuning Fork	SMD3215-M2	32.768KHz	32.768KHz			
Crystal	SMD2016-M4	16MHz ~ 100MHz	16, 25, 40, 50, 80MHz			
Crystal	SMD3225-M4	8MHz ~ 100MHz	12, 27, 50, 60, 80MHz			
Oscillator	SMD2016-M4	32.768KHz ~ 100MHz	24, 25, 27, 50, 100MHz	CMOS		
Oscillator	SMD2520-M4	32.768KHz ~ 100MHz	24, 25, 27, 50, 100MHz	CMOS		
Oscillator	SMD3225-M4	32.768KHz ~ 100MHz	24, 25, 27, 50, 100MHz	CMOS		
TCXO	SMD2016-M4	10MHz ~ 100MHz	25, 27, 50, 100MHz	Clipped Sine		
TCXO	SMD2520-M4	10MHz ~ 100MHz	25, 27, 50, 100MHz	Clipped Sine		
TCXO	SMD3225-M4	10MHz ~ 100MHz	25, 27, 50, 100MHz	Clipped Sine		

- ≫ C-V2X
- ≫ Telematics
- ≫ Car Audio, Navigation
- ≫ In-Vehicle Infotainment (IVI)

Product Type	Holder	Frequency Range	Typical Frequency	Output Wave	Temp. Range	Certificate
Tuning Fork	SMD2012-M2	32.768KHz	32.768KHz		-40 to +105°C -40 to +125°C -40 to +150°C	IATF16949 AEC-Q200
Tuning Fork	SMD3215-M2	32.768KHz	32.768KHz			
Crystal	SMD2016-M4	16MHz ~ 100MHz	25, 27, 50, 52.08333MHz			
Crystal	SMD3225-M4	8MHz ~ 100MHz	12, 16, 20, 24, 25, 40MHz			
Oscillator	SMD2016-M4	32.768KHz ~ 100MHz	12.288, 25, 27, 50, 100MHz	CMOS		
Oscillator	SMD2520-M4	32.768KHz ~ 100MHz	12.288, 25, 27, 50, 100MHz	CMOS		
Oscillator	SMD3225-M4	32.768KHz ~ 100MHz	12.288, 25, 27, 50, 100MHz	CMOS		
TCXO	SMD2016-M4	10MHz ~ 100MHz	25, 27, 50MHz	Clipped Sine		
TCXO	SMD2520-M4	10MHz ~ 100MHz	25, 27, 50MHz	Clipped Sine		
TCXO	SMD3225-M4	10MHz ~ 100MHz	25, 27, 50MHz	Clipped Sine		

- ≫ Air Conditioner
- ≫ Front Lighting System
- ≫ Remote Keyless Entry (RKE)
- ≫ Digital Mirror (Viewing System)
- ≫ Tire Pressure Monitoring System (TPMS)

Product Type	Holder	Frequency Range	Typical Frequency	Output Wave	Temp. Range	Certificate
Tuning Fork	SMD2012-M2	32.768KHz	32.768KHz		-40 to +105°C -40 to +125°C -40 to +150°C	IATF16949 AEC-Q200
Tuning Fork	SMD3215-M2	32.768KHz	32.768KHz			
Crystal	SMD1612-M4	24MHz ~ 100MHz	24, 32, 37.4, 38.4, 48MHz			
Crystal	SMD2016-M4	16MHz ~ 100MHz	16, 18.08, 24, 37.4, 48MHz			
Crystal	SMD3225-M4	8MHz ~ 100MHz	16, 18.08, 24, 26, 27.12MHz			
Oscillator	SMD2016-M4	32.768KHz ~ 100MHz	24, 25, 33.3333, 50, 100MHz	CMOS		
Oscillator	SMD2520-M4	32.768KHz ~ 100MHz	25, 33.3333, 50, 100MHz	CMOS		
Oscillator	SMD3225-M4	32.768KHz ~ 100MHz	24, 25, 27, 50, 100MHz	CMOS		
TCXO	SMD2016-M4	10MHz ~ 100MHz	25, 27, 38.4, 50, 55.2MHz	Clipped Sine		
TCXO	SMD2520-M4	10MHz ~ 100MHz	25, 27, 38.4, 50MHz	Clipped Sine		

- Converter
- Motor (Traction Inverter)
- Charger (from electrical grid)
- Battery Management System (BMS)

Product Type	Holder	Frequency Range	Typical Frequency	Output Wave	Temp. Range	Certificate
Tuning Fork	SMD2012-M2	32.768KHz	32.768KHz		-40 to +105°C -40 to +125°C -40 to +150°C	IATF16949 AEC-Q200
Tuning Fork	SMD3215-M2	32.768KHz	32.768KHz			
Crystal	SMD1612-M4	24MHz ~ 100MHz	24, 32, 37.4, 48MHz			
Crystal	SMD2016-M4	16MHz ~ 100MHz	16, 24, 32, 37.4, 48MHz			
Crystal	SMD3225-M4	8MHz ~ 100MHz	12, 16, 20, 24, 40MHz			

Chassis / Safety

- Airbag
- Antilock Brake System (ABS)
- Electric Stability Control (ESC)

Product Type	Holder	Frequency Range	Typical Frequency	Output Wave	Temp. Range	Certificate
Crystal	SMD2016-M4	16MHz ~ 100MHz	16, 20, 24, 40MHz		-40 to +150°C	IATF16949 AEC-Q200
Crystal	SMD3225-M4	8MHz ~ 100MHz	12, 16, 20, 24, 40MHz			

Powertrain

- Transmission
- Engine Control
- Electric Power Steering

Product Type	Holder	Frequency Range	Typical Frequency	Output Wave	Temp. Range	Certificate
Crystal	SMD2016-M4	16MHz ~ 100MHz	16, 20, 24, 40MHz		-40 to +150°C	IATF16949 AEC-Q200
Crystal	SMD3225-M4	8MHz ~ 100MHz	12, 16, 20, 24, 40MHz			

- ≫ DMS
- ≫ Head Up Display (HUD)
- ≫ Dashboard Camera (Dashcam)
- ≫ Driver Monitoring System (DMS)
- ≫ Child Presence Detection (CPD)

Product Type	Holder	Frequency Range	Typical Frequency	Output Wave	Temp. Range	Certificate
Tuning Fork	SMD2012-M2	32.768KHz	32.768KHz		-40 to +105°C -40 to +125°C -40 to +150°C	IATF16949 AEC-Q200
Tuning Fork	SMD3215-M2	32.768KHz	32.768KHz			
Crystal	SMD2016-M4	16MHz ~ 100MHz	16, 20, 24, 30, 40MHz			
Crystal	SMD3225-M4	8MHz ~ 100MHz	12, 16, 20, 24, 40MHz			
Oscillator	SMD2016-M4	32.768KHz ~ 100MHz	24, 25, 27, 50, 100MHz	CMOS		
Oscillator	SMD2520-M4	32.768KHz ~ 100MHz	25, 27, 50, 100MHz	CMOS		
Oscillator	SMD3225-M4	32.768KHz ~ 100MHz	24, 25, 27, 50, 100MHz	CMOS		
TCXO	SMD2016-M4	10MHz ~ 100MHz	25, 27, 50, 100MHz	Clipped Sine		
TCXO	SMD2520-M4	10MHz ~ 100MHz	25, 27, 50, 100MHz	Clipped Sine		
TCXO	SMD3225-M4	10MHz ~ 100MHz	25, 27, 50, 100MHz	Clipped Sine		

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