

# 32.768KHZ IoT OPTIMIZED SMD CRYSTAL



ABS07W

3.2 x 1.5 x 0.9 mm

RoHS/RoHS II Compliant

MSL = N/A: NOT APPLICABLE

**Due to capacity constraints, this product is temporarily unavailable.**  
**Recommended alternative part number: ABS04W or ABS05W**  
**Contact Abracon for technical assistance: tech-support@abracon.com**

## FEATURES

- Exceptionally low plating load of 3.0pF, ideal for wearables, wireless, and IoT applications
- Simultaneously optimized for ESR over extended operating temperature range
- Miniature 3.2x1.5x0.9 mm SMD package, ideally suited for space constrained designs
- Available with  $\pm 10$  ppm set tolerance
- Seam sealed package for long term reliability

## APPLICATIONS

- Wearables
- Wireless Modules
- Internet of Things (IoT)
- Bluetooth/Bluetooth Low Energy (BLE)
- Machine-to-Machine (M2M) Connectivity
- Ultra Low Power MCU
- Near Field Communication (NFC)
- ISM Band Applications
- Ultra low power, energy saving MCU

## STANDARD SPECIFICATIONS

PARAMETERS	MINIMUM	TYPICAL	MAXIMUM	UNITS	NOTES
Frequency	32.768			kHz	
Operation Mode	Flexural Mode (Tuning Fork)				
Operating Temperature	-40		+125	°C	See options
Storage Temperature	-55		+125	°C	
Frequency Tolerance @ +25°C	-10		+10	ppm	Refer to Note #1, $\pm 20$ ppm is also available
Shift through standard RoHS Reflow, (2) reflow cycles maximum	-2.00		+2.00	ppm	260°C peak maximum reflow temperature, relative to stand-alone set-tolerance frequency
Temperature Coefficient	-0.040	-0.036		ppm/T <sup>2</sup>	
Turn-over temperature	+20	+25	+30	°C	
Frequency Stability Over Operating Temperature, relative to in-circuit measured frequency post reflow	-200		-100	ppm	Over -40°C to +85°C
	-275		-100	ppm	Over -40°C to +105°C
	-450		-100	ppm	Over -40°C to +125°C
Load capacitance (CL)	3			pF	Refer to Note #2
Equivalent Series Resistance (ESR)	< 40		45	k $\Omega$	@ +25 $\pm$ 3°C
	< 45		55	k $\Omega$	Over -40°C to +85°C
	< 50		60	k $\Omega$	Over -40°C to +105°C
	< 60		70	k $\Omega$	Over -40°C to +125°C
Shunt capacitance (C0)		1.15	1.30	pF	Combined Electrode & Package Capacitance
Motional Capacitance (C1)		4.68		fF	C1 also referred as Cm
Motional Inductance (L1)		5,048,571		mH	L1 also referred as Lm
Drive Level		0.1	0.5	$\mu$ W	
Crystal sensitivity to closed-loop oscillator loading (Ts)	125		140	ppm/pF	Refer to Note #3
Q value	13000				Quality Factor
Aging @ +25°C $\pm$ 3°C [First Year]	-3		+3	ppm	Relative to post reflow measured frequency
Aging @ +25°C $\pm$ 3°C [Over 10-years]	-10		+10	ppm	Relative to post reflow measured frequency
Insulation Resistance	500			M $\Omega$	@ 100Vdc

Note #1: With an effective loop capacitance of 3.0pF, the oscillator circuit will be within set-tolerance specification; less any frequency shift due to the reflow process.

Note #2: The oscillator loop needs to present an effective loop capacitance of 3.0 pF to track the stand-alone crystal frequency. This loop capacitance is essential to ensure highest possible Closed-Loop Safety Factor for the entire population of crystals.

Note #3:  $T_s = - (C1) / [ 2*(C0 + CL)^2 ]$  ..... Where CL = 3pF



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REVISED: 05.26.2021

ABRACON IS  
 ISO9001-2015  
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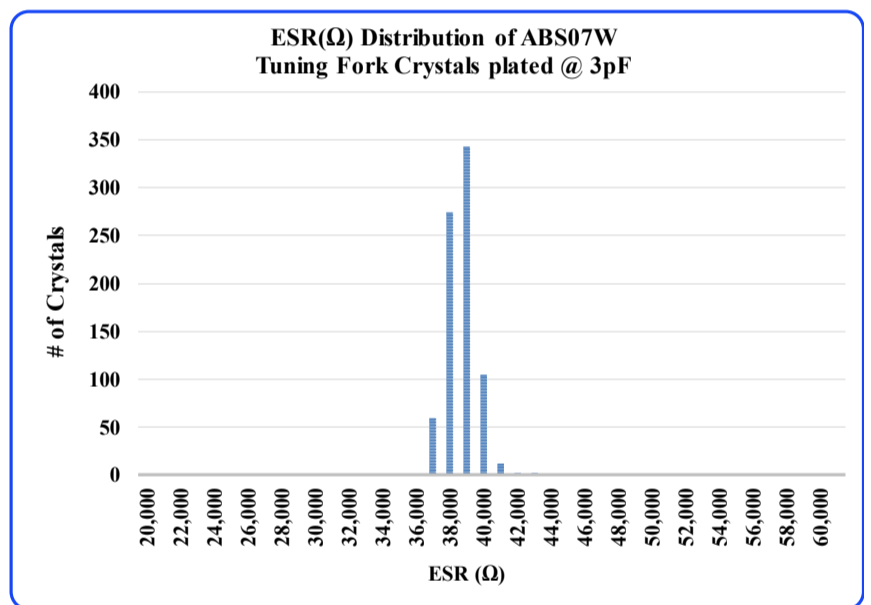
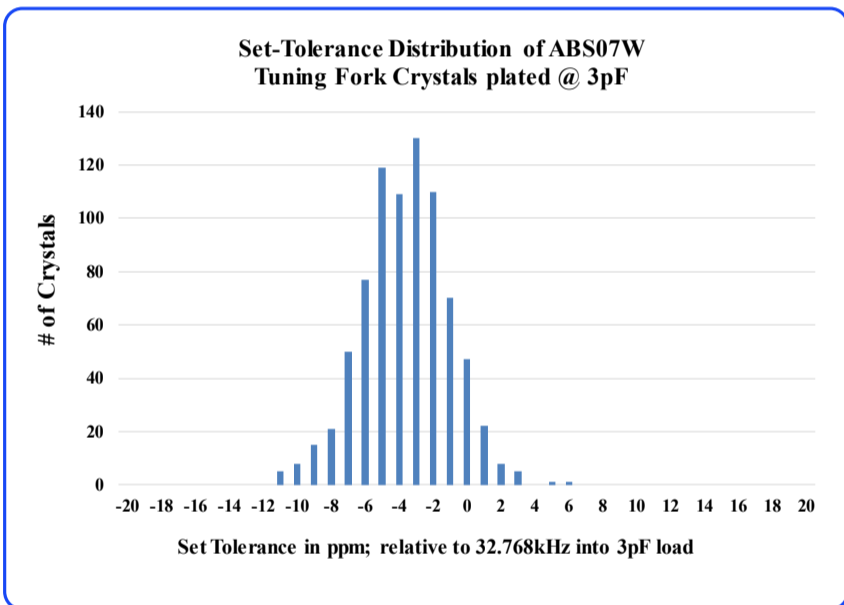
## OPTIONS AND PART IDENTIFICATION

ABS07W - 32.768kHz - ○ - ○ - ○

OPERATING TEMP RANGE	FREQ. TOLERANCE	PACKAGING
D: -40°C ~ +85°C	1: ±10 ppm	Blank: Bulk
J: -40°C ~ +105°C	2: ±20 ppm	T: Tape & Reel (3,000pcs/reel)
K: -40°C ~ +125°C		T9: Tape & Reel (9,000pcs/reel)

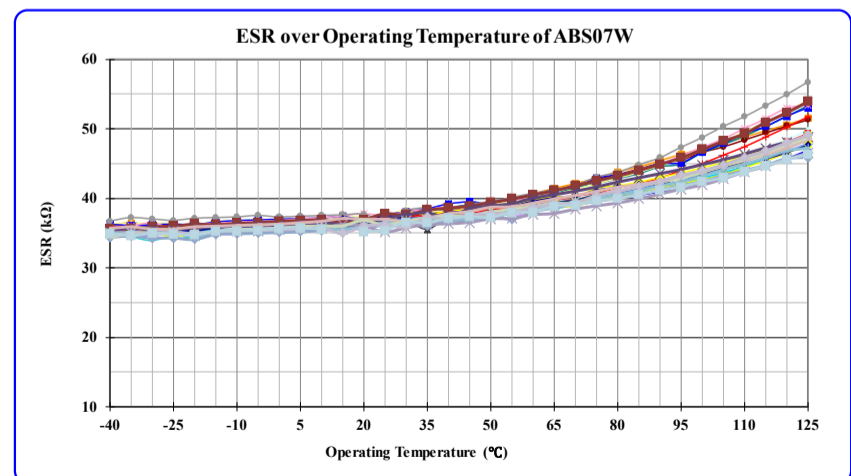
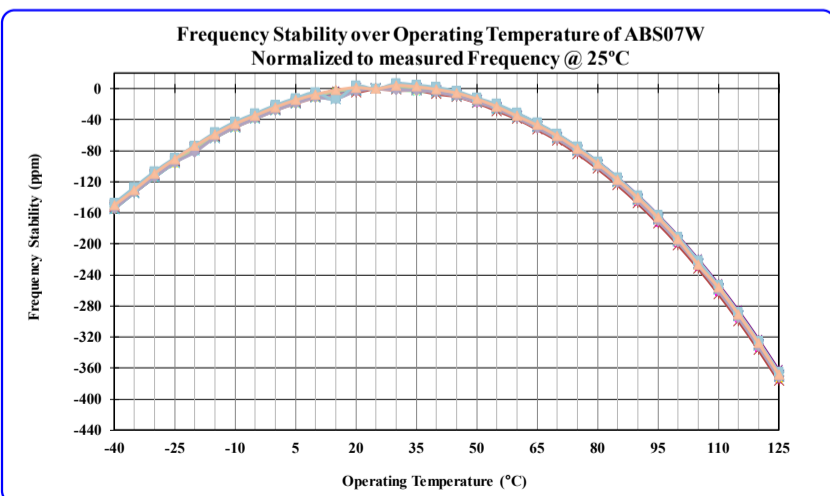
## TYPICAL FREQUENCY TOLERANCE DISTRIBUTION (AT 25°C ± 3°C)

## TYPICAL ESR DISTRIBUTION (AT 25°C ± 3°C)



## TYPICAL FREQUENCY Vs. TEMPERATURE CHARACTERISTICS

## TYPICAL ESR (EQUIVALENT SERIES RESISTANCE) Vs. OPERATING TEMPERATURE



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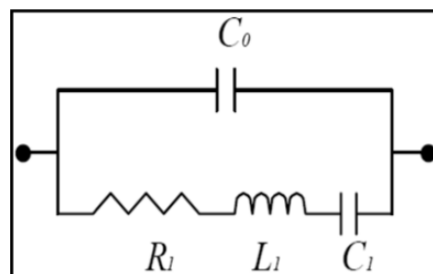
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SPICE MODEL (BASED ON TYPICAL VALUES AT 25°C ± 3°C):

## Quartz Crystal Equivalent Circuit

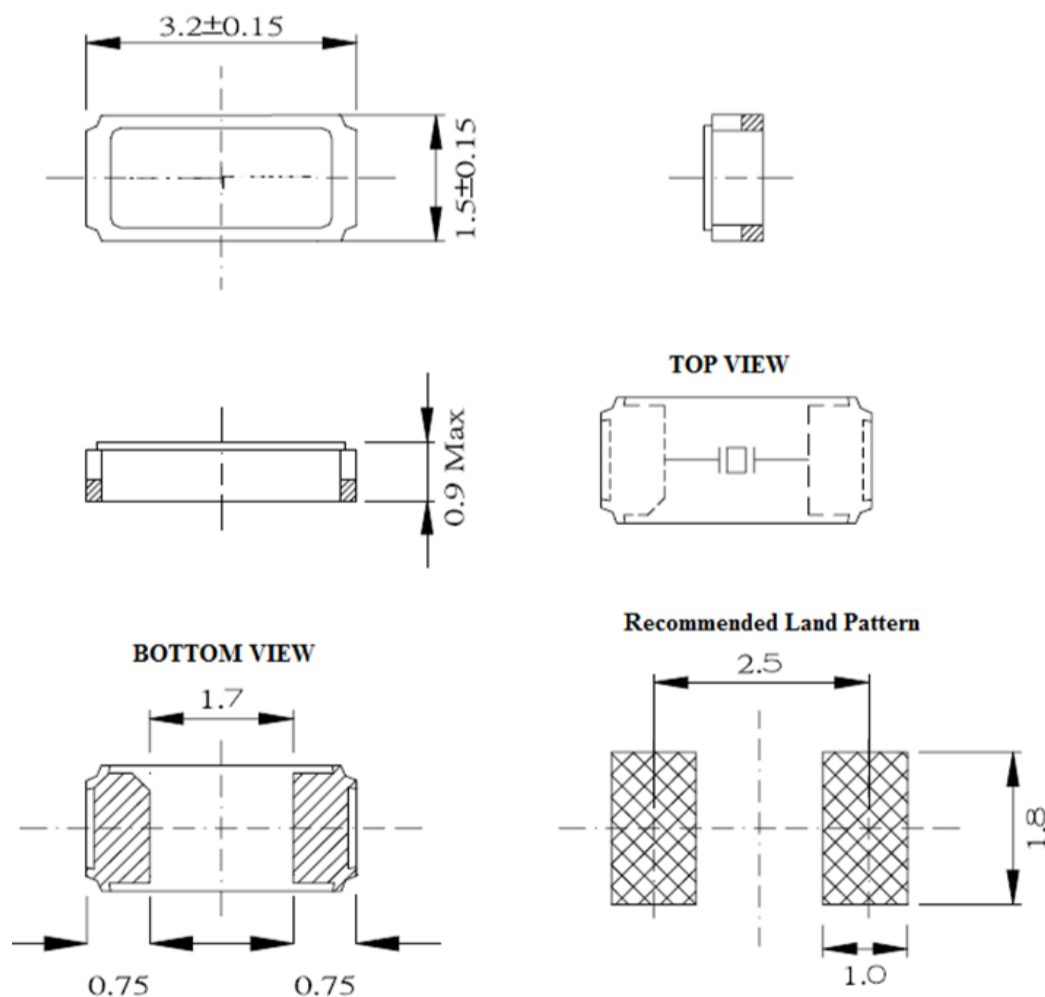


Frequency: 32.78kHz

Plating Load (CL) = 3pF

C0 = 1.15 pF  
R1 = 38,194 Ω  
L1 = 5,048,571 mH  
C1 = 4.68 fF

## MECHANICAL DIMENSIONS



DIMENSIONS: mm

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## REFLOW PROFILE [JEDEC J-STD-020]

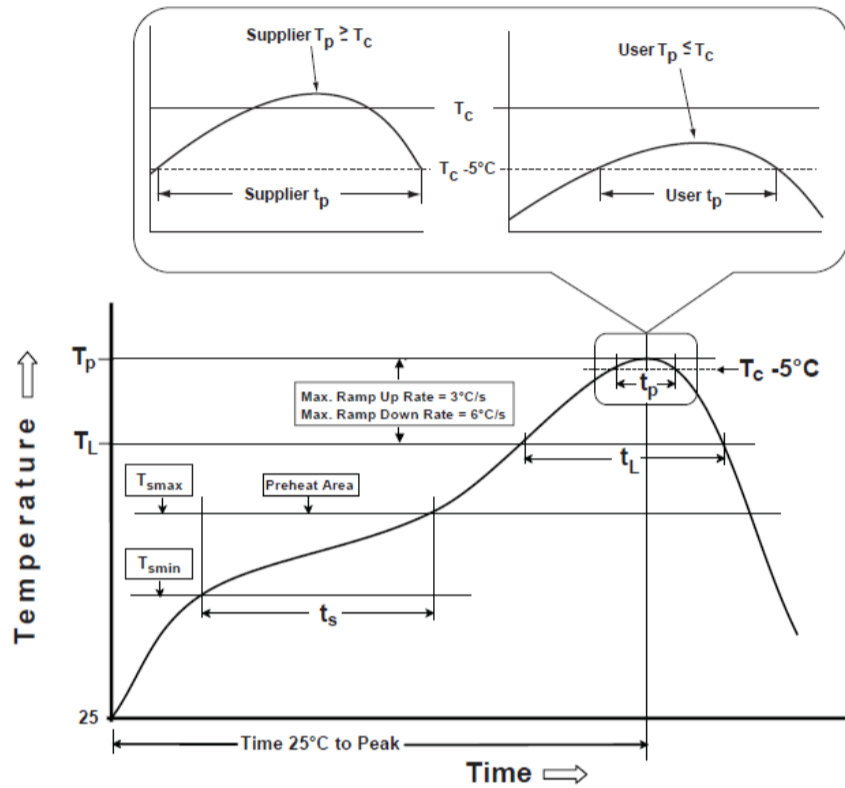


Table 1

SnPb Eutectic Process Classification Temperatures ( $T_c$ )		
Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> >350
<2.5 mm	235 °C	220 °C
>2.5 mm	220 °C	220 °C

Table 2

Pb-Free Process Classification Temperatures ( $T_c$ )			
Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat / soak		
Temperature minimum ( $T_{smin}$ )	100°C	150°C
Temperature maximum ( $T_{smax}$ )	150°C	200°C
Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )	60 - 120 sec.	60 - 120 sec.
Average ramp-up rate ( $T_{smax}$ to $T_p$ )	3°C/sec. max	3°C/sec. max
Liquidous temperature ( $T_L$ )	183°C	217°C
Time at liquidous ( $t_L$ )	60 - 150 sec.	60 - 150 sec.
Peak package body temperature ( $T_p$ )*	see Table 1	see Table 2
Time ( $t_p$ )** within 5°C of the specified classification temperature ( $T_c$ )	20 sec.	30 sec.
Ramp-down rate ( $T_p$ to $T_{smax}$ )	6°C/sec. max	6°C/sec. max
Time 25°C to peak temperature	6 min. max	8 min. max
Reflow cycles	2 max	2 max

\*Tolerance for peak profile temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.

\*\*Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum.

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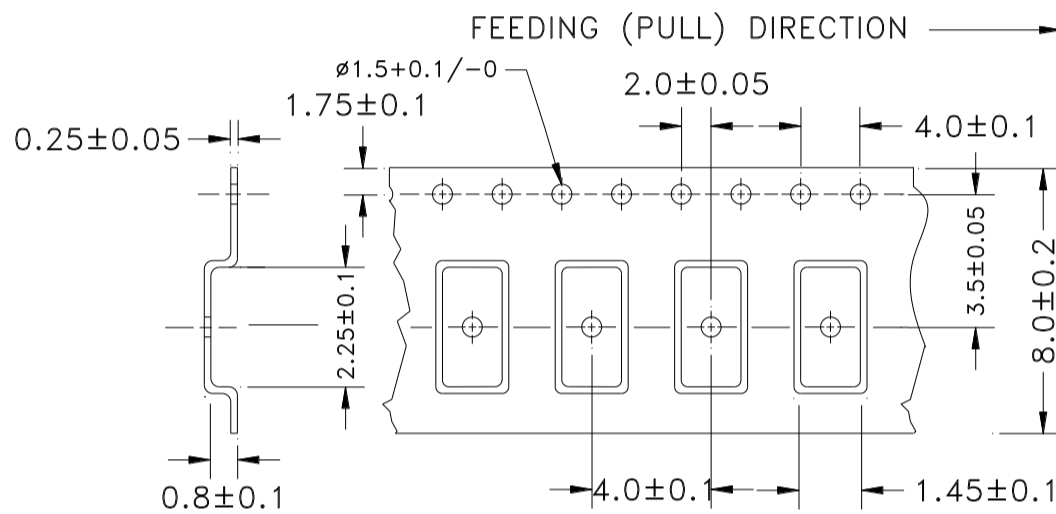
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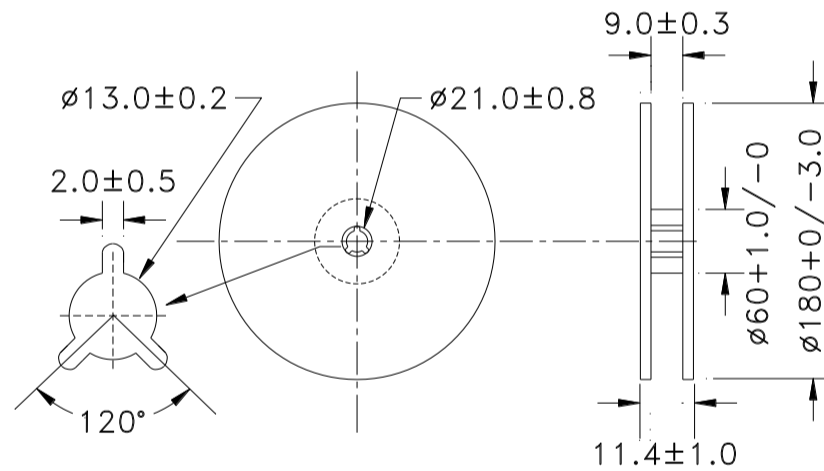
## PACKAGING

T= Tape and reel (3,000pcs/reel)

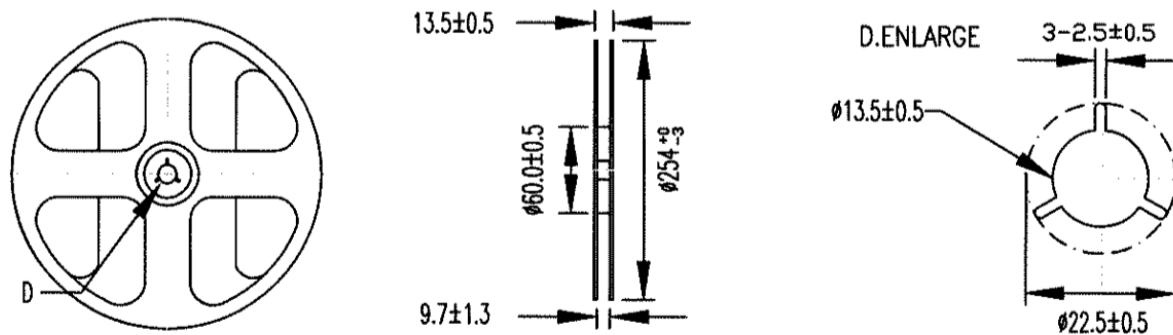
T9= Tape and reel (9,000pcs/reel)



Reel=3,000pcs



Reel=9,000pcs



Dimensions: mm



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