

# 32.768KHZ IoT OPTIMIZED SMD CRYSTAL



ABS06W

2.0 x 1.2 x 0.6 mm



RoHS/RoHS II Compliant

MSL = N/A: NOT APPLICABLE

## 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 2.0x1.2x0.6 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:	-0.04	-0.03	-0.02	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)	<55		65	k $\Omega$	@ +25 $\pm$ 3°C
	<75		95	k $\Omega$	Over -40°C to +85°C
	<90		110	k $\Omega$	Over -40°C to +105°C
	<100		120	k $\Omega$	Over -40°C to +125°C
Shunt capacitance (C0)		1.0	2.0	pF	Combined Electrode & Package Capacitance
Motional Capacitance (C1)		5.0		fF	C1 also referred as Cm
Motional Inductance (L1)		5,549,000		mH	L1 also referred as Lm
Drive Level		0.1	0.5	$\mu$ W	
Crystal sensitivity to closed-loop oscillator loading (Ts)	125	140	165	ppm/pF	Refer to Note #3
Q value	10000				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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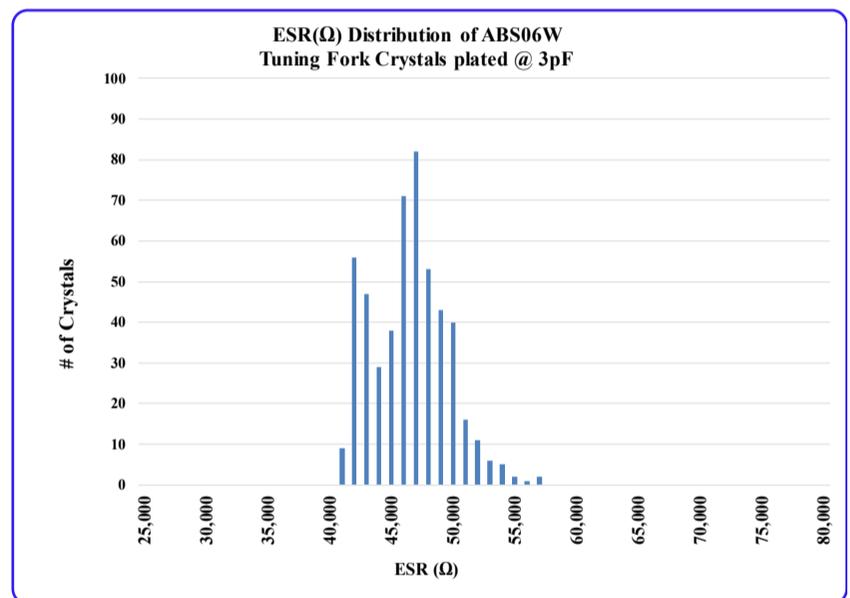
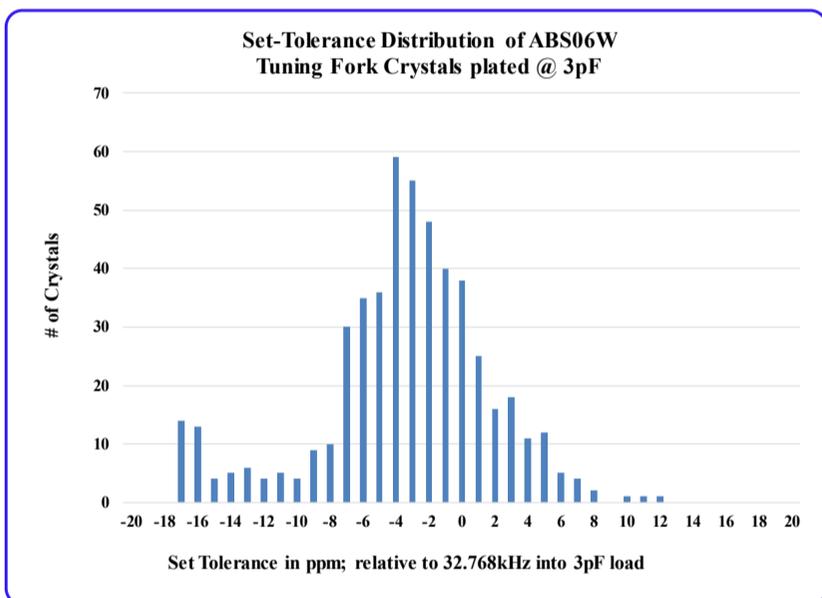
## OPTIONS AND PART IDENTIFICATION

ABS06W - 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		

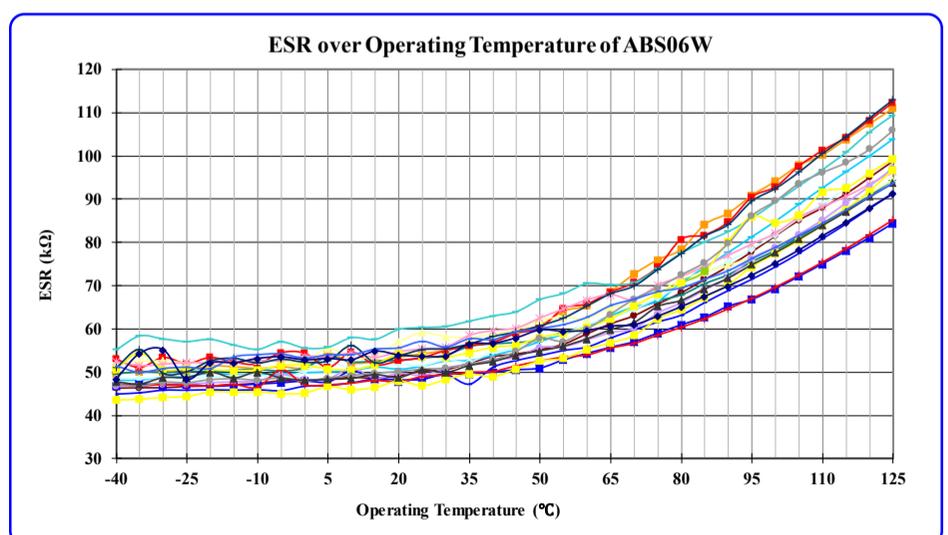
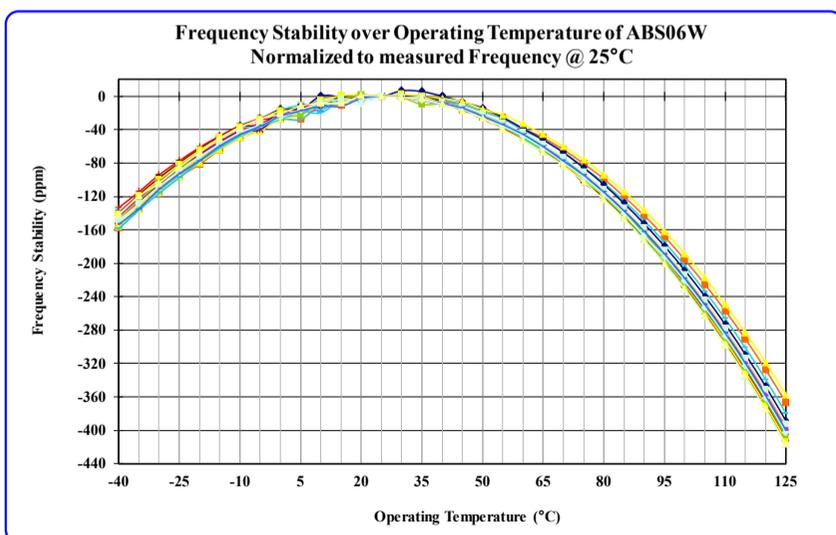
## TYPICAL FREQUENCY TOLERANCE DISTRIBUTION (AT 25°C ± 3°C)

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



## TYPICAL FREQUENCY Vs. TEMPERATURE CHARACTERISTICS

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



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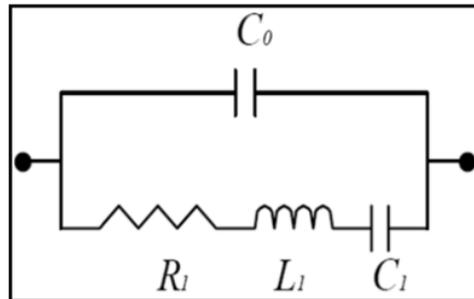


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SPICE MODEL (BASED ON TYPICAL VALUES AT 25°C ± 3°C):

## Quartz Crystal Equivalent Circuit



Frequency: 32.78kHz

Plating Load (CL) = 3pF

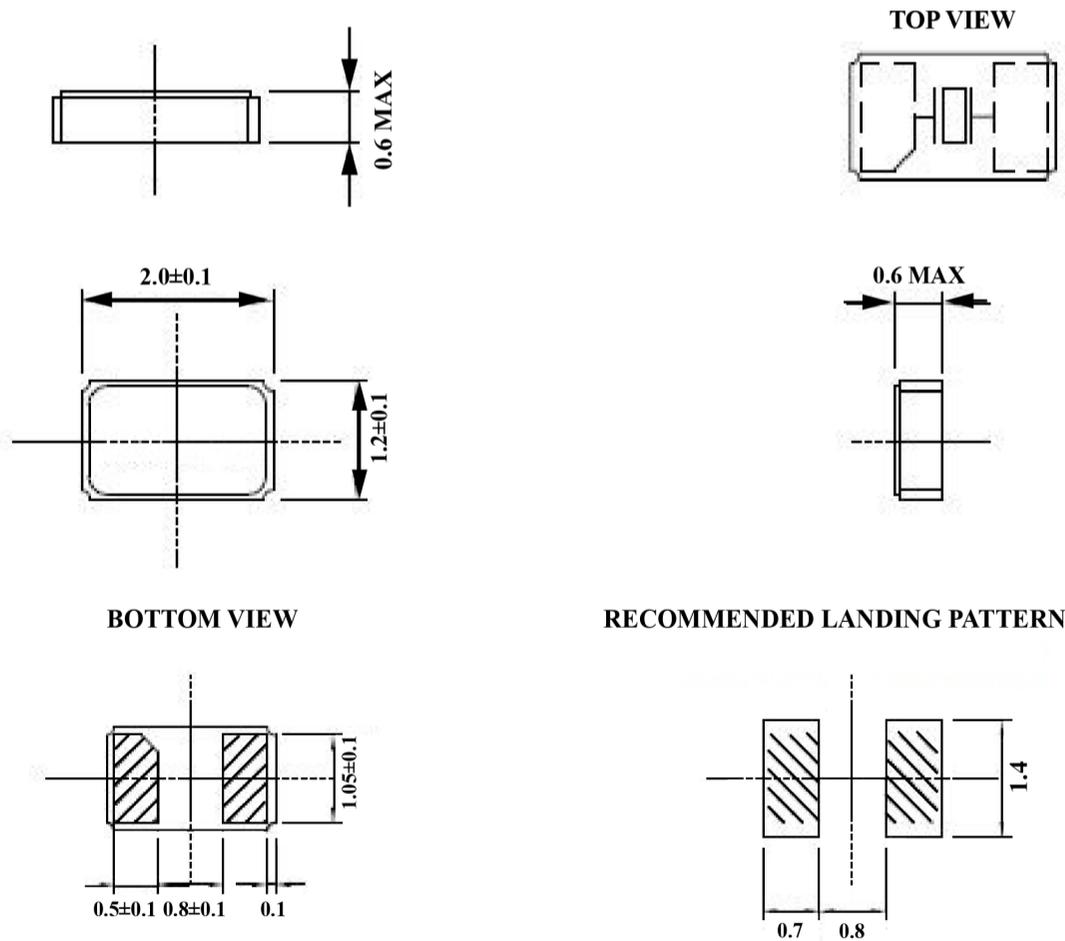
C0 = 0.90 pF

R1 = 47,594 Ω

L1 = 5,549,000 mH

C1 = 4.26 fF

## MECHANICAL DIMENSIONS



DIMENSIONS: mm

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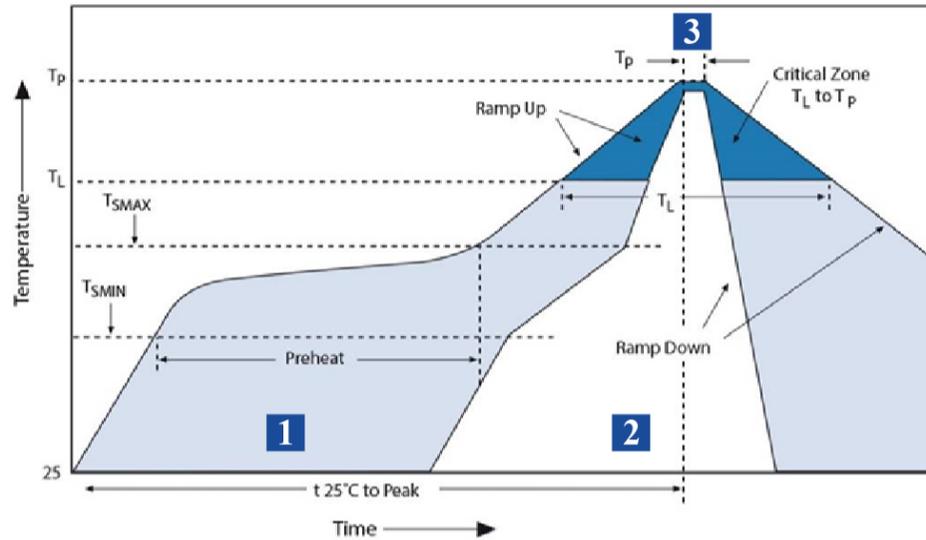
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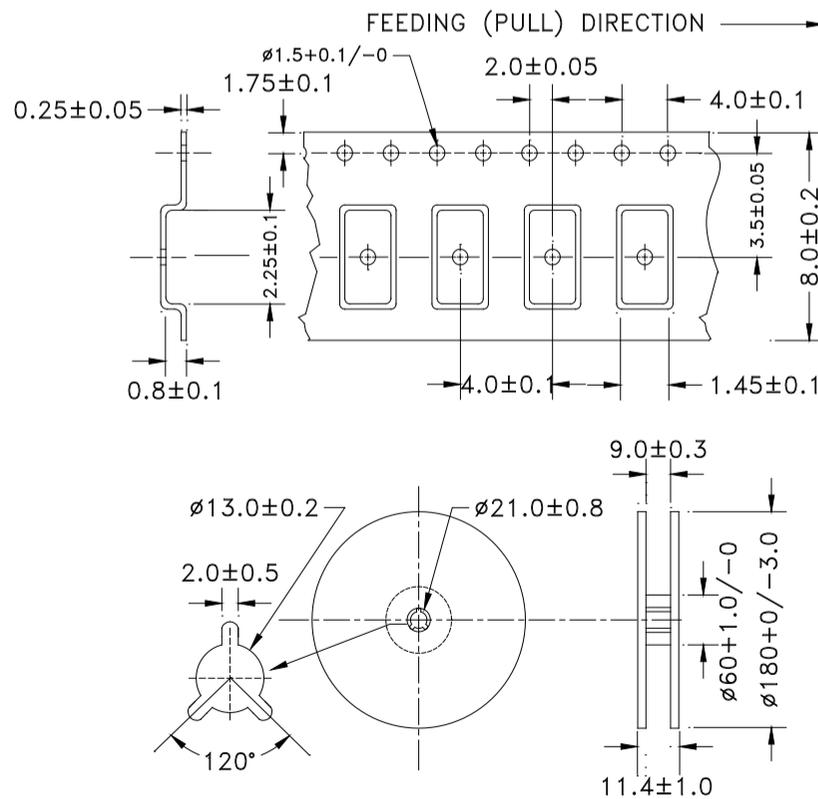
## RECOMMENDED REFLOW PROFILE



Zone	Description	Temperature	Time
1	Preheat	$T_{SMIN} \sim T_{SMAX}$ 150°C ~ 200°C	60 ~ 120 sec.
2	Reflow	$T_L$ 217°C	60 ~ 150 sec.
3	Peak Heat	$T_p$ 260 ±5°C	10 ±5 sec. MAX

## PACKAGING

### TAPE AND REEL (3,000PCS/REEL)



DIMENSIONS: mm