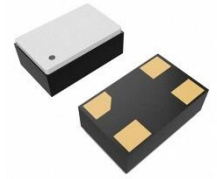


Low Power 32.768 kHz Crystal Oscillator

Description

Abrakon's ASH5KW series is a low power 32.768 kHz crystal oscillator with a miniature 1.6 mm x 1.0 mm x 0.6 mm package. This series offers a variable supply voltage, capable of operating with 1.6V to 5.5V. The ASH5KW delivers a CMOS output with a ± 20 ppm frequency tolerance. This series has an output enable/disable feature, with a low 0.45 μ A typical disable current.



Features

- Wide supply voltage range: 1.6V ~ 5.5V
- Miniature package: 1.6 mm x 1.0 mm x 0.6 mm
- Low current consumption
- CMOS output with Tri-state function
- Hermetically sealed ceramic package with metal lid
- Suitable for RoHS compliant reflow process

Typical Applications

- Internet of Things (IoT)
- Computers and peripherals
- Portable and wearable electronics
- Consumer electronics
- Industrial control and automation
- Mobile communication

Electrical Specifications [Note 1]

Parameters	Min.	Typ.	Max.	Units	Notes
Frequency		32.768		kHz	
Operating Temperature	-40		+85	°C	
Storage Temperature	-55		+125	°C	
Turnover Temperature	20	25	30	°C	
Frequency Tolerance	-20		+20	ppm	@25°C
Temperature Coefficient	-0.035 $\pm$ 10%			ppm/C ²	Relative to frequency at turnover temperature
Frequency vs Supply Voltage	-3		+3	ppm/V	
Supply Voltage (V _{DD})	1.6		5.5	V	
Supply Current (I _{DD})			2.15	μ A	V _{DD} = 3.0 V, 15 pF, @25°C
Disable Current (I _{DD}) [Note 2]		0.45	0.65	μ A	V _{DD} = 3.0V @25°C
		0.68	0.90	μ A	V _{DD} = 5.0V @25°C
			1.30	μ A	V _{DD} = 3.0V, -40°C~+85°C
			1.80	μ A	V _{DD} = 5.0V, -40°C~+85°C
Output Load (CL)			15	pF	CMOS
Output Voltage Low (VOL)			0.1*V _{DD}	V	I _{OL} = +400 μ A
Output Voltage High (VOH)	0.9*V _{DD}			V	I _{OH} = -400 μ A
Input Voltage Low (VIL)			0.3*V _{DD}	V	Output disabled, High Z
Input Voltage High (VIH)	0.7*V _{DD}			V	Output enabled
Output enable time			0.5	μ s	
Output disable time			0.1	μ s	
Aging	-3		+3	ppm	@25°C first year
Symmetry (DC)	40		60	%	@1/2V _{DD}
Start-up Time		250	500	ms	
Rise Time (Tr)		30	70	ns	10% to 90% V _{DD}
Fall Time (Tf)		30	70	ns	90% to 10% V _{DD}

Note 1: All measurements guaranteed at V_{DD} = 3.0V, +25°C unless otherwise specified.

Note 2: When output is enabled, the total supply current can be calculated as:

Total Supply Current = (Output load [F] x Supply Voltage [V] x 32,768 [Hz]) + Disable Current [A]

Example: I_{DD} = (15 x 10⁻¹² [F] x 3.0 [V] x 32,768 [Hz]) + 0.65 x 10⁻⁶ [A]
 = 1.5 μ A + 0.65 μ A
 = 2.15 μ A

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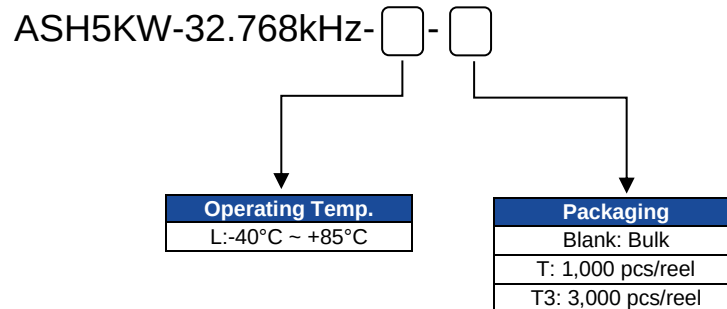
Environmental Parameters

Parameters	Description
MSL	1
REACH/RoHS II	Compliant, No Exemptions
Shock resistance	5000 g, 0.3 ms, ½ sine (±5 ppm)
Vibration resistance	20 g / 10-2,000 Hz (±5 ppm)
Termination Finish	Gold (0.5 µm) over Nickel (5 µm)

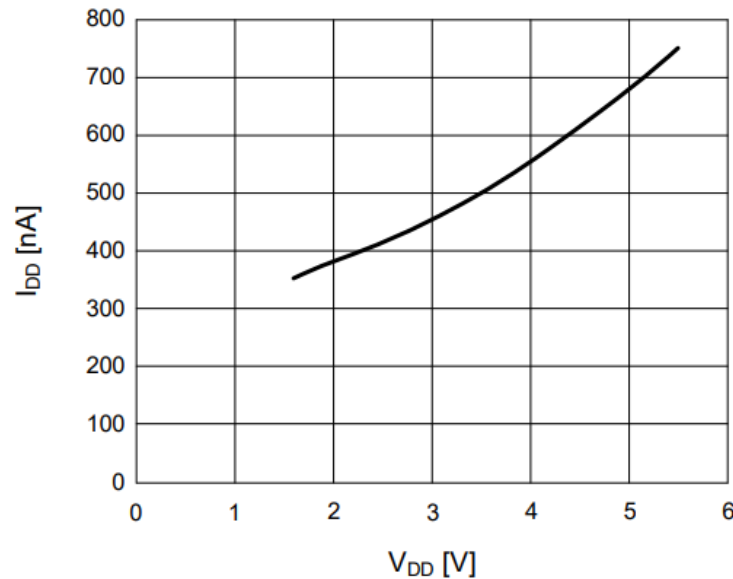
Absolute Maximum Ratings

Parameters	Conditions	Min	Max	Unit
Supply Voltage		-0.5	+6.0	V
Input Voltage		-0.5	+6.0	V
Output Voltage		-0.5	+6.0	V
Electrostatic Discharge Voltage	Human Body Model (EIAJ ED-4701)	-1000	+1000	V
	Charged Device Model (EIAJ ED-4701)	-1000	+1000	V
	Machine Model (EIAJ ED-4701)	-200	+200	V

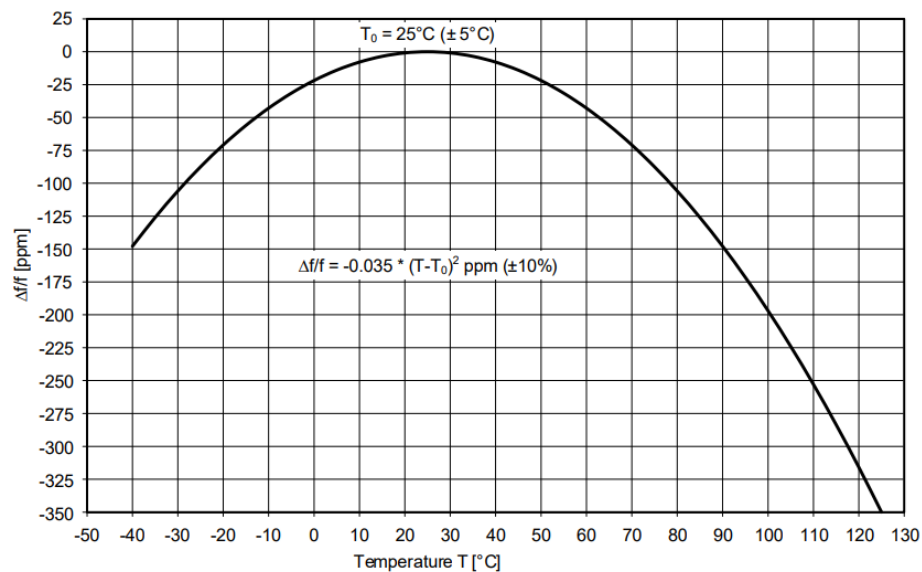
Part Identification



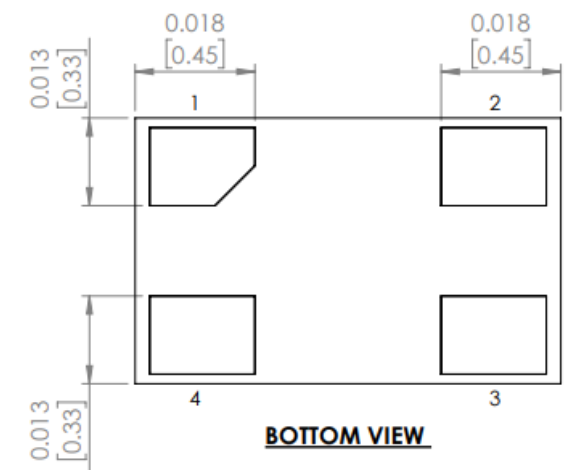
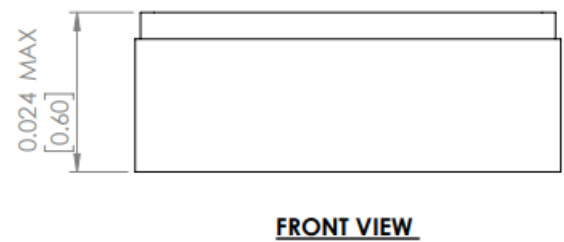
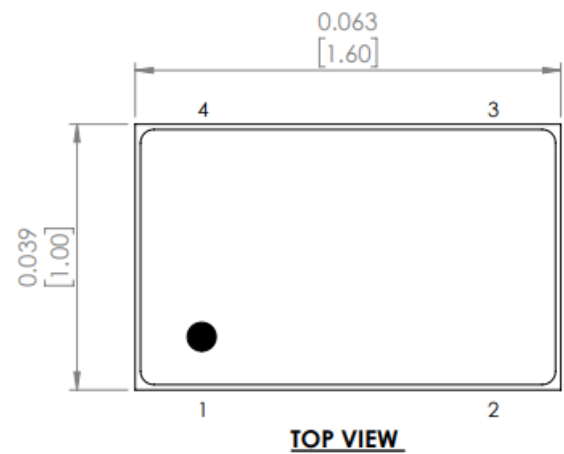
Disable Current vs Supply Voltage (@25°C)



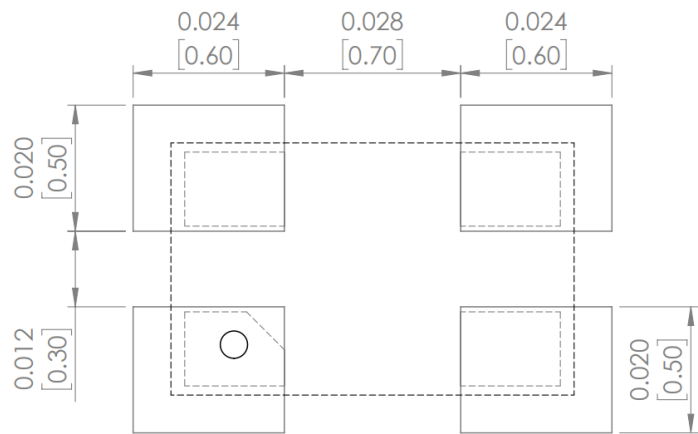
Frequency vs Temperature Characteristics (Normalized to Frequency Tolerance @25°C)



Mechanical Dimensions



RECOMMENDED LAND PATTERN

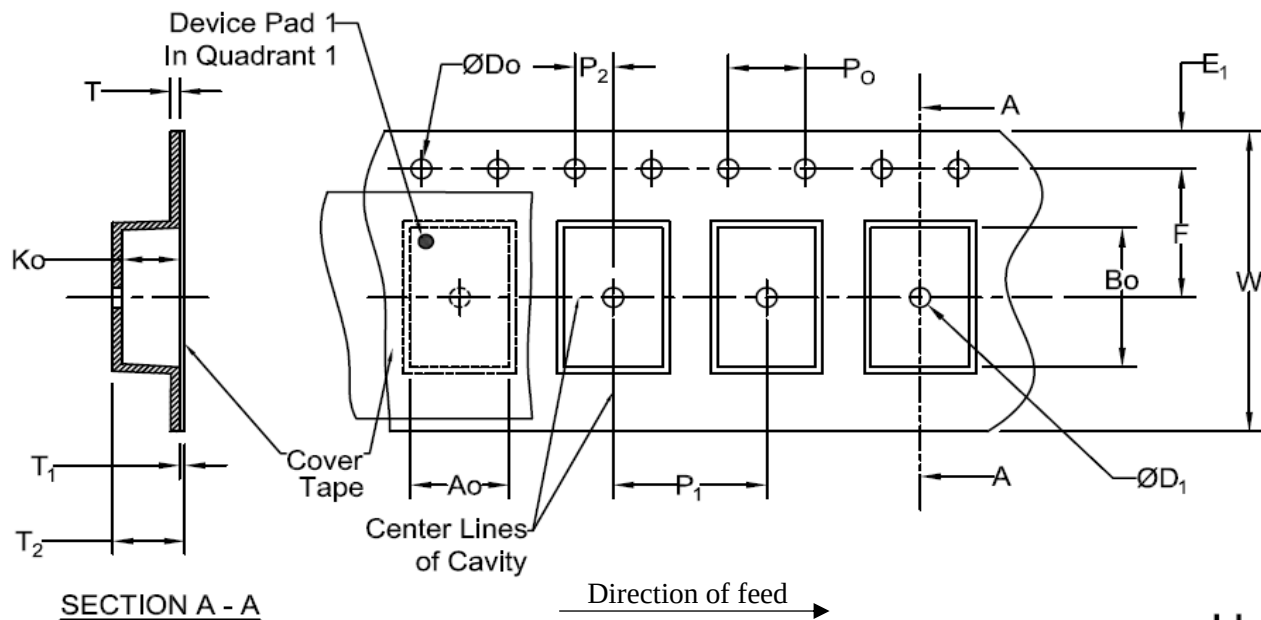


Pin #	Function
1	Output
2	Ground
3	Enable/Disable
4	Supply Voltage

Dimensions: Inches [mm]

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Tape



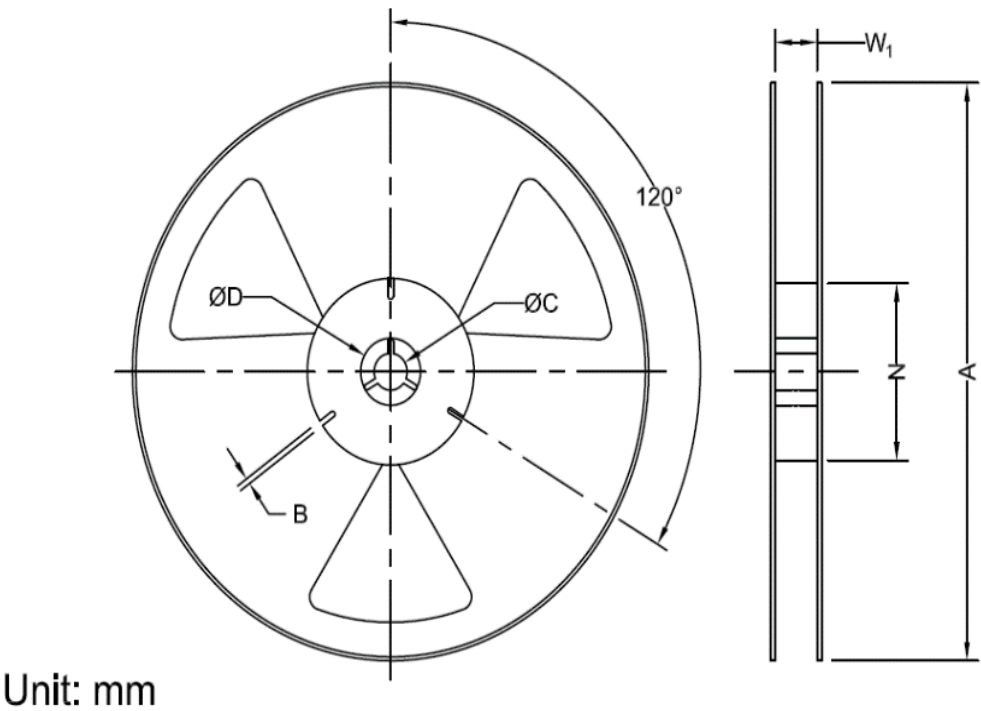
Unit: mm

Tape Specifications (mm)							
Width	Ao	Bo	Do	D1	E1	F	Ko
8mm	1.35±0.05	1.75±0.05	1.5+0.1/-0.0	0.6±0.05	1.75±0.1	3.5±0.05	0.63±0.05

Tape Specifications (mm)							
Width	P1	P2	P0	T	T1 (Max)	T2 (Max)	W (Max)
8mm	4.0±0.1	2.0±0.05	4.0±0.1	0.25±0.02	0.1 (0.06 Typ)	0.94±0.05	8.0+0.3/-0.1

(*Note: Compliant to EIA-481)

Reel



Tape Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Typ)	*W ₁
8mm	1000	178	1.5 (1.8 Typ)	13.0+0.5/-0.2	20.2	61.5	8.4+1.5/-0.0
	3000	178	1.5 (1.8 Typ)	13.0+0.5/-0.2	20.2	61.5	8.4+1.5/-0.0

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Reflow

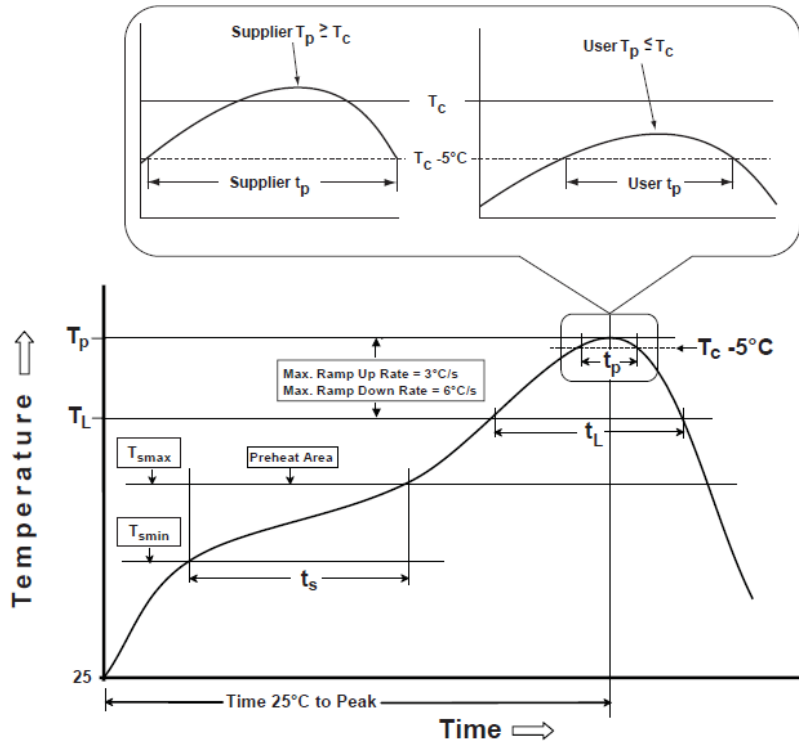


Table 1

SnPb Eutectic Process
Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ ≥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 ³ <350	Volume mm ³ 350-2000	Volume mm ³ >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 - 180 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.	20 - 40 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 supplier minimum and a user maximum.