AK2F3 series

ClearClock™ Oscillator Family | Clock Oscillator| 2.5x2.0mm XO

Description

Abracon's AK2F3 offers the latest high frequency crystal technology, with exceptional low jitter performance. The Abracon AK2F3 is available with a compact 2.5 x 2.0 x 0.9mm package with an all-inclusive frequency stability of ±20ppm over an operating temperature range of -40℃ to 105℃. This series offers a supply voltage of 2.5V or 3.3V with a LVPECL or LVDS (Standard and High Swing) output logic type.

Features

- Output Frequency 312.5MHz
- Voltage supply options (2.5V and 3.3V)
- Standby (Power Down) function
- Output - LVDS (Standard and High Swing) and LVPECL
- Frequency stability of ±20ppm, ±25 ppm and ±50 ppm
- Hermetically seam-sealed ceramic package
- REACH/RoHS II Compliant | MSL Level 1

Typical Applications

- Optical Transceivers and Modules
- Data Centers, Storage, and Servers
- Networking switches and gateways
- 100G/200G/400G/800G Ethernet
- Fibre Channel/SONET/SDH/PCIe
- Industrial and FPGA applications
- Test & measurement

Electrical Specifications

Parameters		Min.	Typ.	Max.	Unit	Notes
Frequency Range			312.5		MHz	
Supply Voltage (V_{DD})		3.135	3.3	3.465	V	Option "A"
		2.375	2.5	2.625		Option "B"
Supply Current (I_{DD})	LVPECL			65	mA	Option "P"
	LVDS			40		Option "D & E"
Operating Temperature Range		-40		85	°C	Option "R, F & Q"
		-40		105		Option "S, N & T"
Storage Temperature		-40		105	°C	
First Year Aging [Note 2]		-3		+3	ppm	At 25°C
Frequency Stability [Note 1]		-50		50	ppm	Option "R" (-40°C to +85°C)
		-50		50		Option "S" (-40°C to +105°C)
		-25		25		Option "F" (-40°C to +85°C)
		-25		25		Option "N" (-40°C to +105°C)
		-20		20		Option "Q" (-40°C to +85°C)
		-20		20		Option "T" (-40°C to +105°C)

Note 1: Includes post reflow frequency tolerance, temperature stability, load pulling, power supply variation and first year aging.
Note 2: Relative to initial measured frequency @ +25°C.

Electrical Specifications *continued*

Parameters			Min.	Typ.	Max.	Unit	Notes	
Rise (Tr) / Fall (Tf) Time[Note 3]	LVPECL				0.35	ns	R_L=50Ω to V_{dd}–2.0V on each output	
	LVDS				0.35		R_L= 100Ω (Between Outputs)	
Duty Cycle			45		55	%		
Start-up Time					500	ns		
Output High Voltage (VOH) Output Low Voltage (VOL)	LVPECL	V_{OH}	V_{DD}-1.10			V	R_L=50Ω into V_{dd}–2.0V on each output	
		V_{OL}			V_{DD}-1.50			
Output Voltage	LVDS	V_{OD}	250		450	mV	R_L= 100Ω (Between Outputs)	Option “D”
			400		800	mV		Option “E”
		ΔV_{OD}			50	mV		Option “D & E”
Offset Voltage		V_{OS}	1.15		1.35	V		
		ΔV_{OS}			50	mV		
Differential Output Voltage Swing (Vopp)	LVPECL		800			mV	OUT-OUTN	Option “P”
	LVDS		500		900			Option “D”
			800		1600			Option “E”
Tri-state Function		V_{IH}	“1” (V_{IH}≥0.8*Vdd) or Open: Oscillation; “0” (V_{IL}<0.2*Vdd): No Oscillation/Hi Z			V		
		V_{IL}						
Output Enable Time					500	ns		
Output Disable Time					100	ns		
Output Disable Current Consumption					60	µA	OE (pad 1) ≤ 0.2*(V_{dd})	
RMS Phase Jitter (12kHz to 20MHz from Carrier)			See Table 1 below				Vdd, output logic type and Carrier frequency dependent	

Note 3: Measured over 20% to 80% of waveform.

Phase Noise Specifications

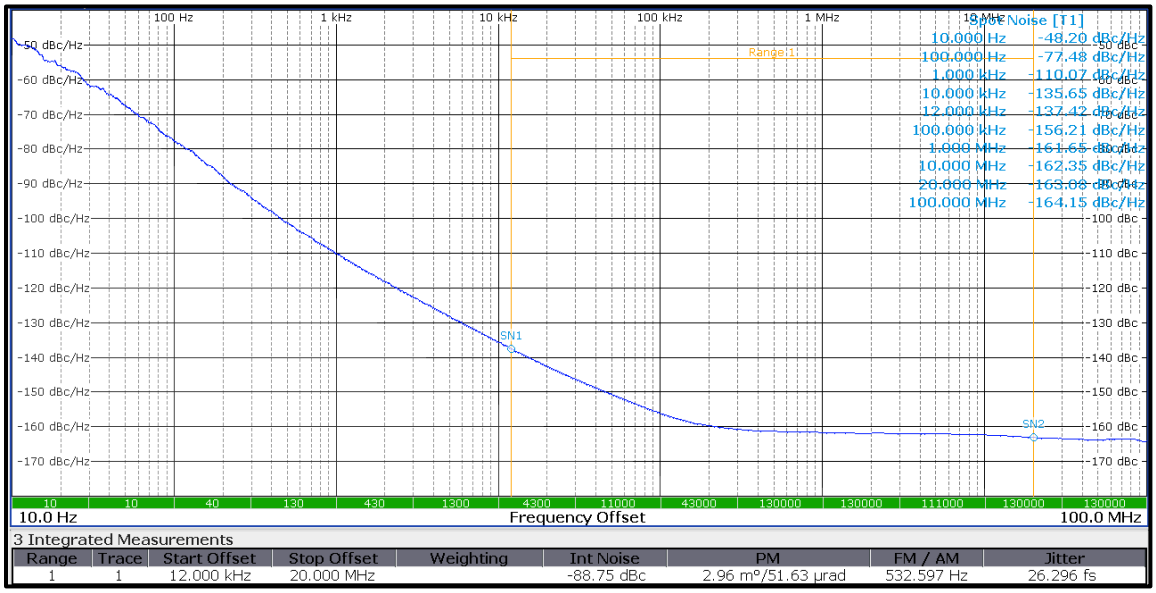
Table 1
RMS Phase Jitter 12kHz – 20MHz BW[Note 4,5]

Carrier Frequency	Output Logic	Supply Voltage (2.5V)		Supply Voltage (3.3V)	
		RMS Jitter		RMS Jitter	
		Typ. (fs)	Max (fs)	Typ. (fs)	Max (fs)
312.5	LVDS	26.3	60	26.3	60
	LVPECL	33.2	60	33.2	60

Note 4: Guaranteed by characterization; RMS Phase Jitter specifications are inclusive of any spurs
Note 5: Phase jitter measured with Rohde & Schwarz FSWP8

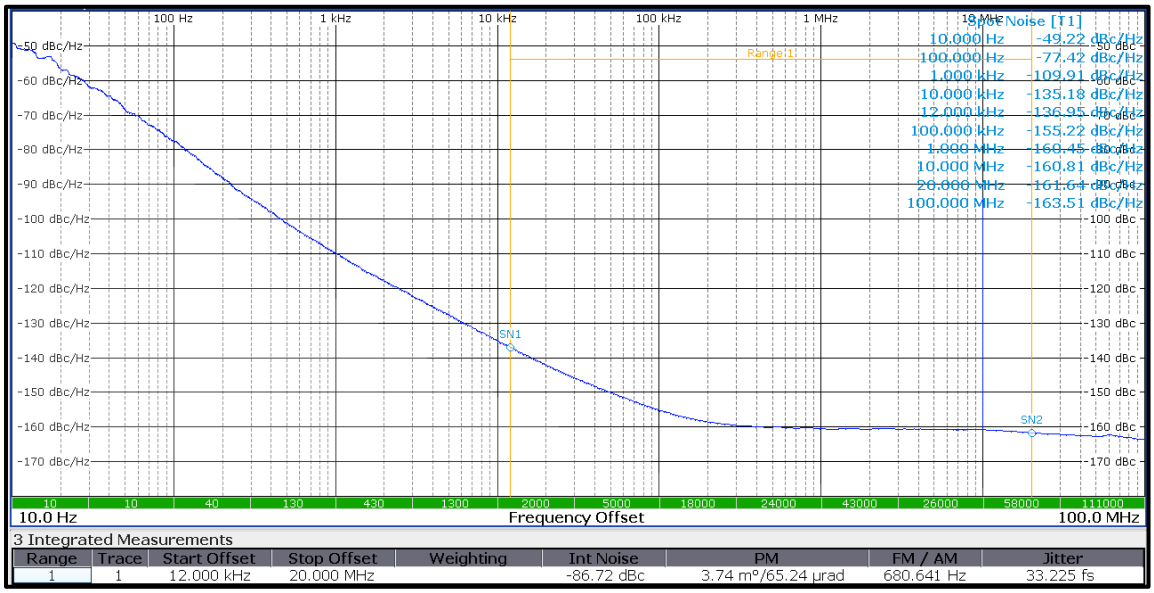
Phase Noise Plots [Note 5]

Plot #1: LVDS, 3.3V, 312.5 MHz



Phase Noise Plots Cont. [Note 5]

Plot #2: LVPECL, 3.3V, 312.5 MHz



Part Identification (Left Blank If Standard)

AK2F3 ☐ ☐ ☐ ☐ - ☐ ☐

(1): Output
P: LVPECL
D: LVDS (V_{OD}=250mV-450mV)
E: LVDS (V_{OD}=400mV-800mV)

(3): Vdd
A: 3.3V
B: 2.5V

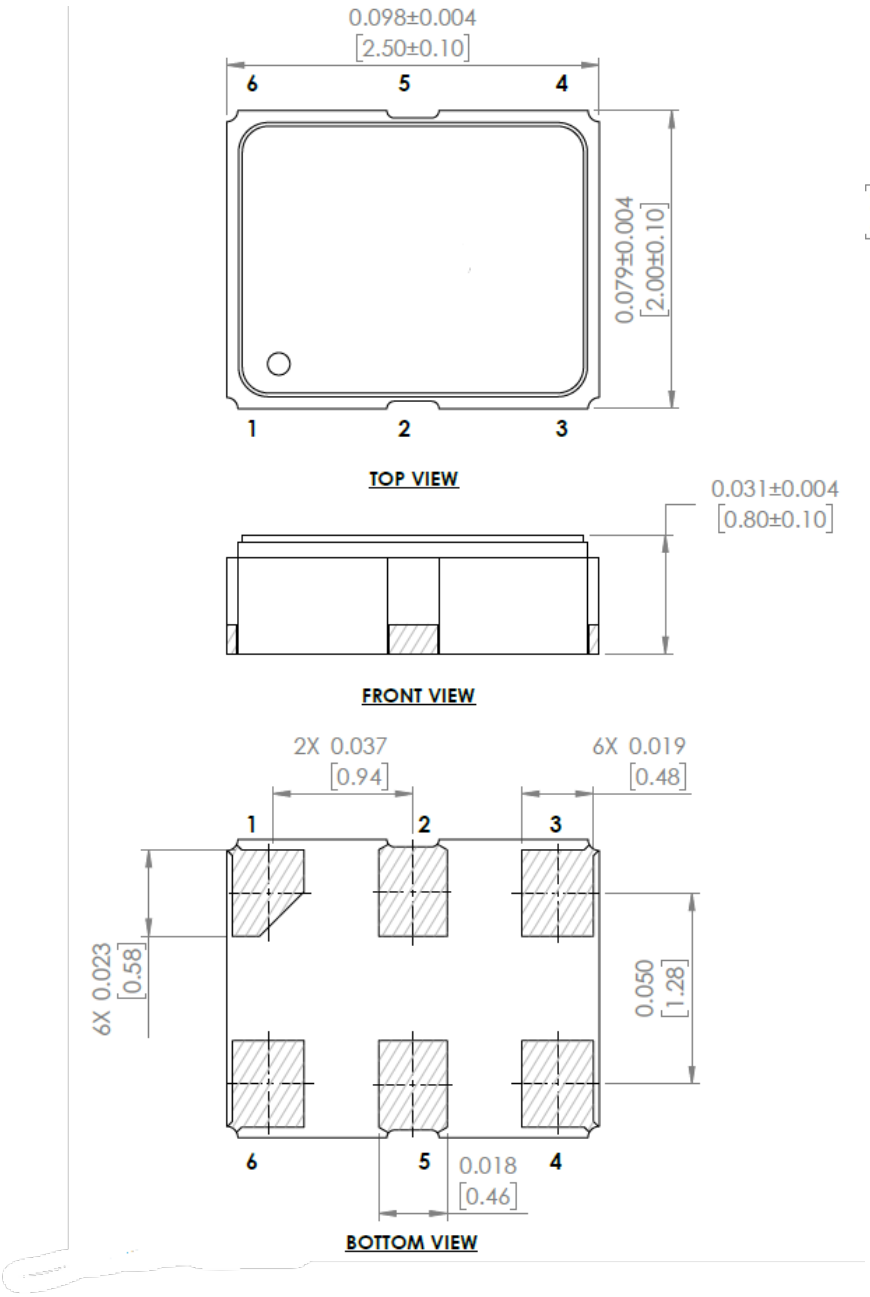
(4): Frequency Stability
R: ±50 ppm over -40°C to +85°C
S: ±50 ppm over -40°C to +105°C
F: ±25 ppm over -40°C to +85°C
N: ±25 ppm over -40°C to +105°C
Q: ±20 ppm over -40°C to +85°C
T: ±20 ppm over -40°C to +105°C

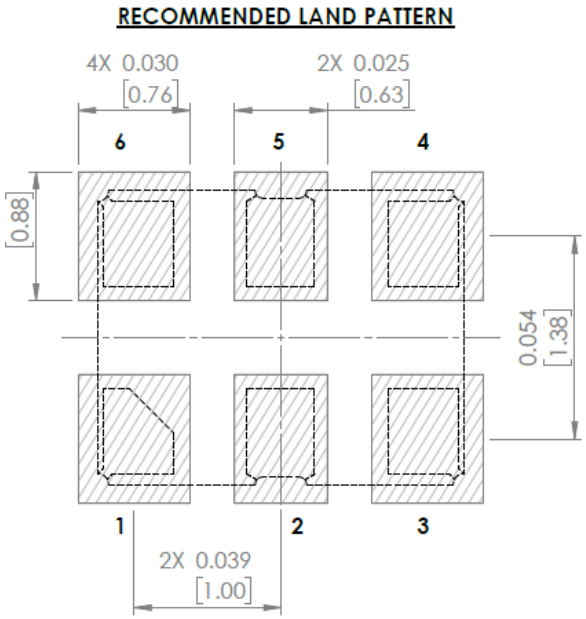
(5): OE Function
1: OE Pin 1; Active High

(6): Output Frequency
Please specify the Frequency in units of MHz out to 4-**digit** accuracy after the decimal. *Example:* Output frequency of 312.5MHz = '312.5000'

(7): Packaging
Blank: Bulk
T: 1k pcs / reel
T3: 3k pcs / reel

Mechanical Dimensions





Pin #	Function
1	Tri-State
2	Do Not Connect
3	GND
4	Output
5	Complimentary Output
6	V_{DD}

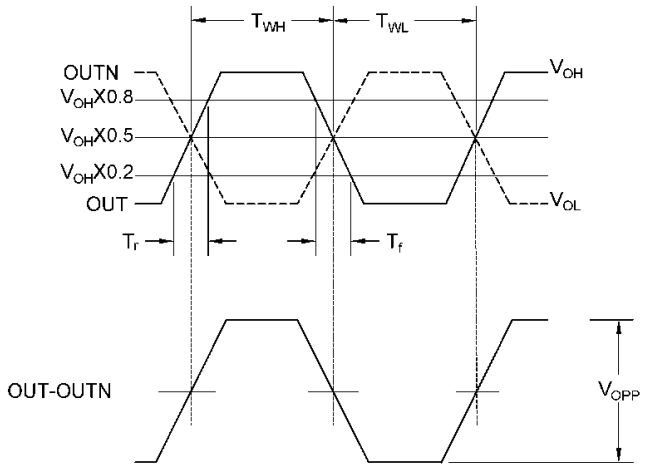
Note: Recommended to use approximately 0.01µF bypass capacitor between PIN 3 and PIN 6

$\overline{INH}$ Function	
PAD #1	PAD #4 & 5 (Outputs)
Open	Active
"H" Level	Active
"L" Level	High Z (No Oscillation)

Dimensions: inches (mm)

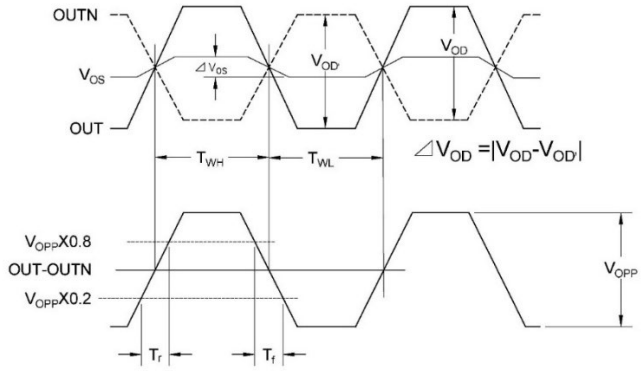
Output Waveform Diagram

LVPECL: Output Wave Form (Duty, Tr, Tf, V_{OH}, V_{OL}, Vopp)



$$\text{Duty Cycle} = \frac{T_{WH}}{T_{WH}+T_{WL}} \text{ X } 100\%$$

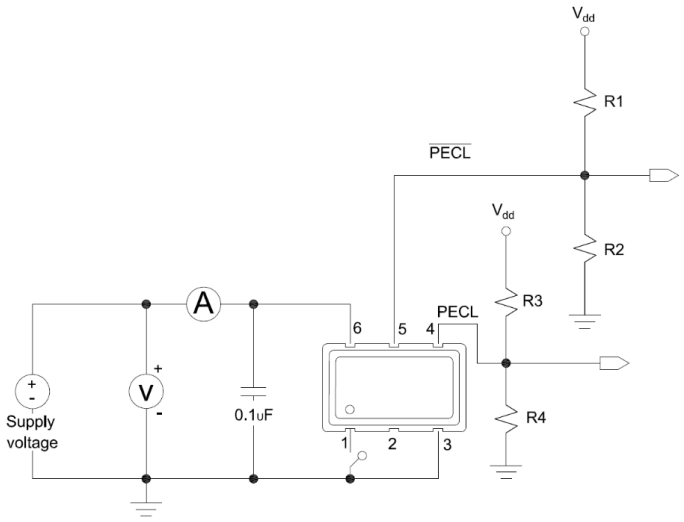
LVDS: Output Wave Form (Duty, Tr, Tf, V_{OD}, ΔV_{OD}, V_{OS}, ΔV_{OS}, Vopp)



$$\text{Duty} = \frac{T_{WH}}{T_{WH}+T_{WL}} \text{ X } 100\%$$

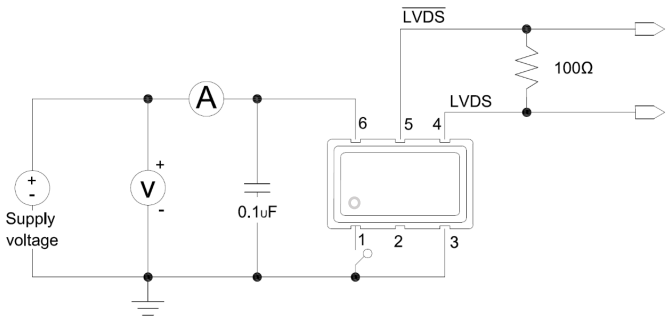
Recommended Test Circuit

LVPECL



Vdd=3.3V: R1=R3=127Ω; R2=R4=82.5 Ω
Vdd=2.5V: R1=R3=250Ω; R2=R4=62.5 Ω

LVDS



Absolute Maximum Ratings [Note 6]

Parameters	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	-0.3		4.5	V	
Input Voltage	-0.3		V_{DD}+0.3	V	
Output Voltage	-0.3		V_{DD}+0.3	V	
Maximum Junction Operating Temperature			150	ºC	
Ambient Operating Temperature Range	-40		85	ºC	Industrial
Ambient Operating Temperature Range	-40		105	ºC	Extended Industrial
Reflow Temperature			260	°C	See Reflow Profile
ESD Protection	3kV HBM, 1kV CDM				
MSL Rating	1				

Note 6: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability. The data sheet limits are not guaranteed if the device is operated beyond the recommended operating conditions.

Reflow Profile [JEDEC J-STD-020]

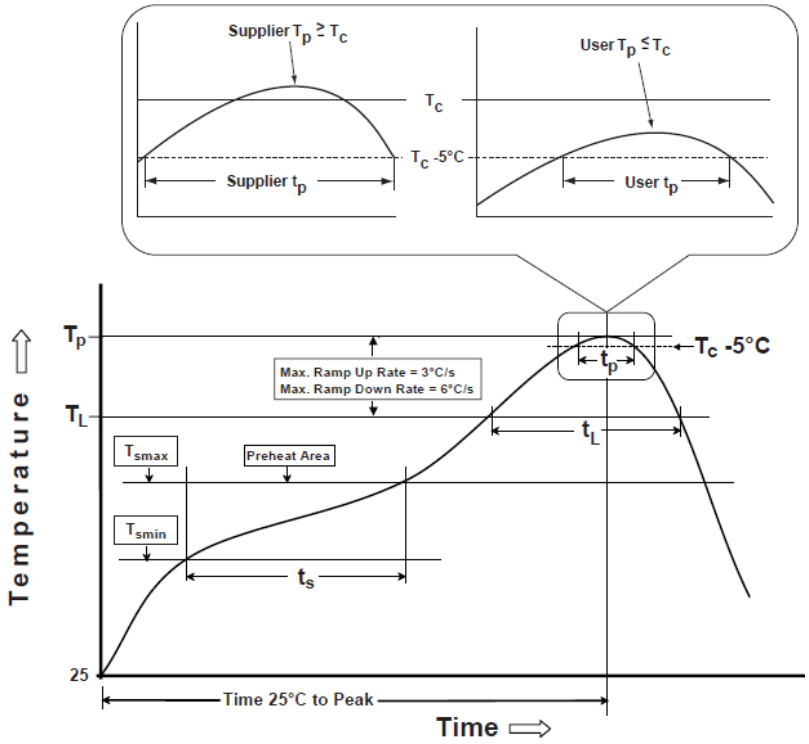


Table 1

SnPb Eutectic Process Classification Temperatures (T_c)		
Package Thickness	**Volume mm³ <350**	**Volume mm³ ≥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 mm³ <350**	**Volume mm³ 350-2000**	**Volume mm³ >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

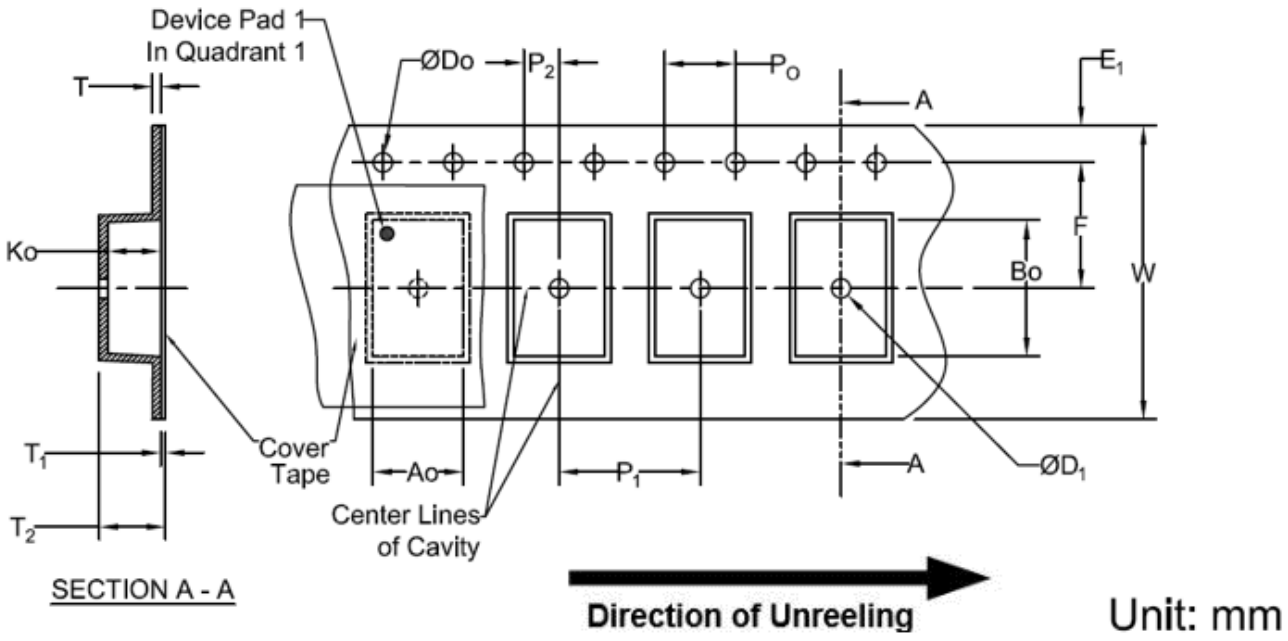
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat / soak		
Temperature minimum (T_{smin})	100°C	150°C
Temperature maximum (T_{smax})	150°C	200°C
Time (T_{smin} to T_{smax}) (t_s)	60 - 120 sec.	60 - 120 sec.
Average ramp-up rate (T_{smax} to T_P)	3°C/sec. max	3°C/sec. max
Liquidous temperature (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 supplier minimum and a user maximum.

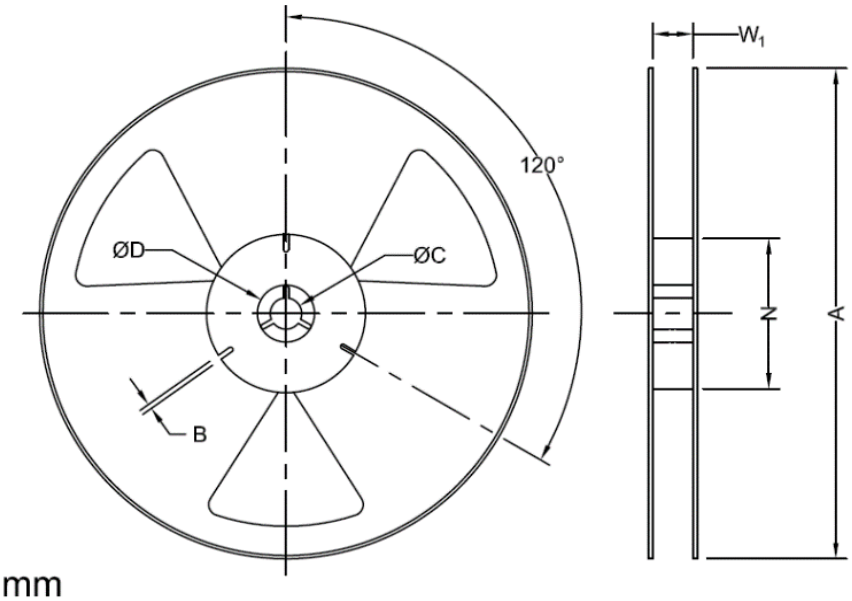
Packaging

T: 1,000pcs/reel
T3: 3,000pcs/reel



Tape Specifications (mm)							
Width	Ao	Bo	Do	D_1 (Min)	E_1	F	Ko
8mm	2.3±0.1	2.8±0.1	1.5+0.1/-0.0	1.0	1.75±0.1	3.5±0.05	1.15±0.1
Width	P_1	P_2	P_0	T	T_1 (Max)	T_2 (Max)	W (Max)
8mm	4.0±0.1	2.0±0.05	4.0±0.1	0.3±0.05	0.1	2.5	8.0±0.2

***Note: Compliant to EIA-481**



Unit: mm

Reel Specifications (mm)							
Width	Qty/Reel	A	B	C	D (Min)	N	*W_1
8mm	1000	180+0/-3	4.0±0.2	13.0±0.5	20.2	60+1/-0	9.0±0.3
	3000	180+0/-3	4.0±0.2	13.0±0.5	20.2	60+1/-0	9.0±0.3

***Note: Measured at Hub**