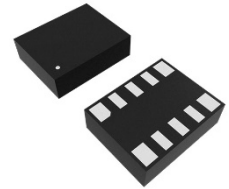


### Description

Abrakon's AB-RTC-XB-32.768kHz-2 Real-Time Clock (RTC) uses I2C communication interface to configure numerous features. These include a digital offset function, an alarm function capability, a leap year autocorrection function, timer function, and automatic backup battery function. The RTC has a broad operating power supply range of 1.6V to 5.5V with low power consumption. The RTC's integrated 32.768kHz crystal provides precise timing accuracy in a compact plastic SMD 3.2 x 2.5 mm package.



### Features

- Build-in frequency adjusted 32.768kHz crystal unit
- Low current consumption: 0.9uA (Typ. @VDD = 3.0VDC)
- High stability: 5±23ppm @ +25°C
- Communication interface: I2C bus
- Timer output function with adjustable period
- Leap years autocorrection
- Automated backup battery function
- Digital offset function
- [REACH/RoHS II Compliant | MSL Level 3](#)

### Typical Applications

- IoT, Wireless communication
- Medical instrumentation
- Utility meters
- Data loggers and Appliances
- Consumer electronics

### Absolute Maximum Ratings

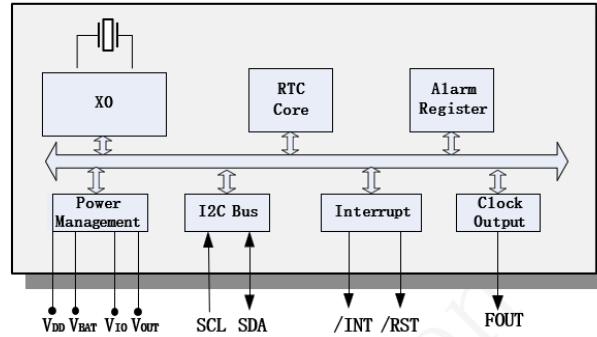
Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Supply Voltage	V <sub>DD</sub>	-0.3		6.5	V	
Internal voltage	V <sub>OUT</sub>	-0.3		6.5	V	
Input Voltage	V <sub>IN</sub>	GND-0.3		6.5	V	SCL,SDA input
Clock output Voltage	V <sub>Out1</sub>	GND-0.3		V <sub>DD</sub> +0.3	V	FOUT output
Output Voltage	V <sub>Out2</sub>	GND-0.3		6.5	V	SDA,/INT output
Backup battery voltage	V <sub>BAT</sub>	-0.3		6.5	V	
Interface Voltage	V <sub>IO</sub>	-0.3		6.5	V	
Operating Ambient Temperature Range	T <sub>OPR</sub>	-40		85	°C	
Storage Temperature Range	T <sub>STO</sub>	-55		125	°C	
Reflow Temperature				+260	°C	See Reflow Profile
ESD Protection	V <sub>ESD</sub>	4kV HBM,400V MM,2kV CDM,(1),2)				

1) HBM: Human Body Model, according to JESD22-A114.

2) MM: Machine Model, according to JESD22-A115.

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.

**Block Diagram**



**Frequency Characteristics** (Unless otherwise specified, GND=0V, Ta=-40°C~+85°C)

Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Frequency tolerance	$\Delta f_1/f$	5±23			ppm	VDD=3.0V;@25°C
Frequency stability	$\Delta f_2/f$	-120		+10	ppm	VDD=3.0V, -20°C to +70°C,Reference Frequency at 25°C
Oscillation start time	t <sub>STA</sub>			1	s	VDD=2.5V-5.5V
Year Aging	fa			±5	ppm	
F <sub>OUT</sub> duty cycle	t <sub>w/t</sub>	40	50	60	%	

**DC Characteristics** (Unless otherwise specified, GND=0V, VBAT=VDD=1.2~5.5V, VIO=1.6V ~5.5V, Ta=-40°C~+85°C)

Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Power Supply (pad 8) <sup>[Note 1,2]</sup>	V <sub>DD</sub>	1.2	3.0	5.5	V	
Interface voltage (pad 1)	V <sub>IO</sub>	1.6	3.0	5.5	V	If INIEN = 1, VDD<VDET1, the interface is disable.
Backup Battery (pad 10)	V <sub>BAT</sub>	1.2	3.0	5.5	V	
VDD Detect Voltage	-V <sub>DET2</sub>	1.2	1.44	1.68	V	Exchange voltage : VDD to VBAT
Operating Temperature	T <sub>OPR</sub>	-40	25	85	°C	
Current consumption	I <sub>DD1</sub>		0.9	5.6	uA	SCL=SDA = 'High', FOUT=OFF, INT=OFF, VDD=VIO=3.0V,CHGEN=0b or VBAT≥VDET3, -40°C~85°C

	I <sub>DD2</sub>		3.4	7.8	uA	SCL=SDA = 'H', FOUT=32.768kHz (FOUT pin CL=15pF), INT=OFF, VDD=VIO=3.0V, CHGEN=0b or VBAT≥VDET3, -40°C~85°C
	I <sub>DD3</sub>		1.0	5.0	uA	SCL, SDA = 'L', VBAT=3.0V, VDD=VIO=0V, - 40°C~+85°C
I <sup>2</sup> C clock signal (pad 2)	SCL					
Input voltage high-level	V <sub>IH</sub>	0.8*V <sub>IO</sub>		5.5	V	
Input voltage low-level	V <sub>IL</sub>	GND-0.3		0.2*V <sub>IO</sub>	V	
I <sup>2</sup> C data signal (pad 3)	SDA					
Input voltage high-level	V <sub>IH</sub>	0.8*V <sub>IO</sub>		5.5	V	
Input voltage low-level	V <sub>IL</sub>	GND-0.3		0.2*V <sub>IO</sub>	V	
Output voltage Low-level	V <sub>OL</sub>	GND		GND+0.4	V	
Frequency Output (pad 4)	FOUT					
Output voltage high-level	V <sub>OH</sub>	VIO-0.5		VIO	V	I <sub>OH</sub> =-1mA
Output voltage low-level	V <sub>OL</sub>	GND		GND+0.5	V	I <sub>OL</sub> =1mA
Reset signal output (pad 5)	RST					
Output voltage low-level	V <sub>OL</sub>	GND		GND+0.25	V	V <sub>IO</sub> =5.0V, I <sub>OL</sub> =1mA
Interrupt output (pad 6)	INT					
Output voltage low-level	V <sub>OL</sub>	GND		GND+0.4	V	V <sub>IO</sub> =3.0V, I <sub>OL</sub> =1mA
Internal voltage output (pad 9)	V <sub>OUT</sub>					
V <sub>OUT</sub> output voltage1	V <sub>OUT1</sub>		V <sub>DD</sub> -0.06V		V	V <sub>DD</sub> =3.0V, I <sub>OUT</sub> =1mA
V <sub>OUT</sub> output voltage2	V <sub>OUT2</sub>		V <sub>BAT</sub> -0.02V		V	V <sub>BAT</sub> =3.0V, I <sub>OUT</sub> =0.1mA

Note 1: To apply Min. value of VDD, VDD needs to be supplied with more than 2.5V at least for the oscillation to stabilize (oscillation start time tSTA). Please ensure that force the power to VDD rather than VBAT when first power on.

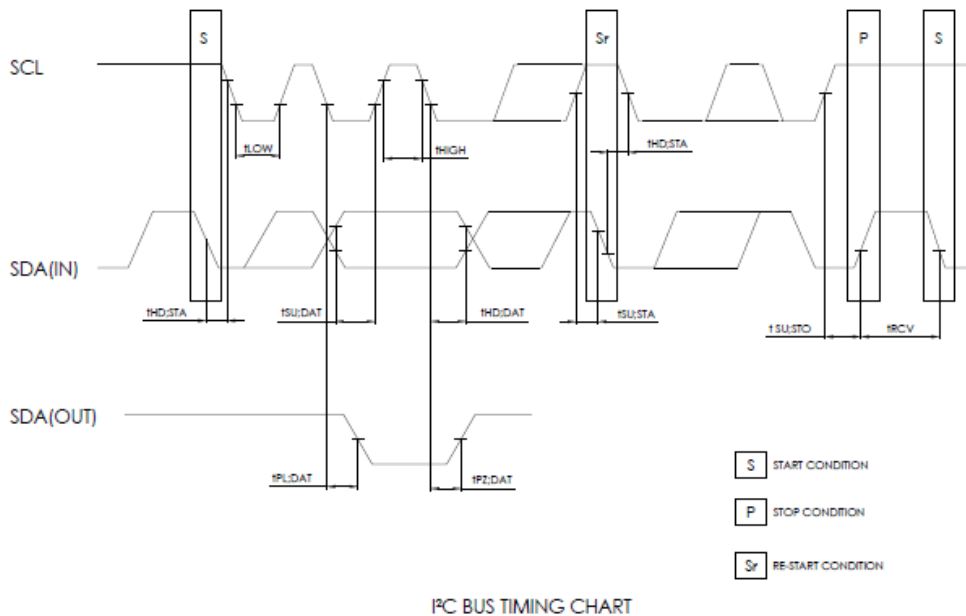
Note 2: Ensure that the power on time from 0 to VDD is less than 100ms

**AC Characteristics** (Unless otherwise specified, GND =0V, VIO =1.6V ~ 5.5V; Ta=-40°C ~ +85°C)

Parameters	Symbol	Min.	Typ.	Max.	Units	Notes
Start condition setup time <sup>[Note 1]</sup>	t <sub>HD;STA</sub>	0.6			us	
Start condition hold time <sup>[Note 1]</sup>	t <sub>SU;STA</sub>	0.6			us	
Stop condition setup time	t <sub>SU;STO</sub>	0.6			us	
Bus idle time between start condition and stop condition	t <sub>RCV</sub>	1.3			us	
Data setup time	t <sub>SU;DAT</sub>	100			ns	
Data hold time	t <sub>HD;DAT</sub>	0			ns	
I <sup>2</sup> C clock signal (pad 2)	SCL					
SCL clock frequency	f <sub>SCL</sub>			400	kHz	

SCL low level time	t <sub>LOW</sub>	1.3			us	
SCL high level time	t <sub>HIGH</sub>	0.6			us	
SCL rising time	t <sub>r</sub>			0.3	us	
SCL falling time	t <sub>f</sub>			0.3	us	
I <sup>2</sup> C data signal (pad 3)	SDA					
SDA rising time	t <sub>r</sub>			0.3	us	
SDA falling time	t <sub>f</sub>			0.3	us	

**I2C BUS Timing Characteristics**

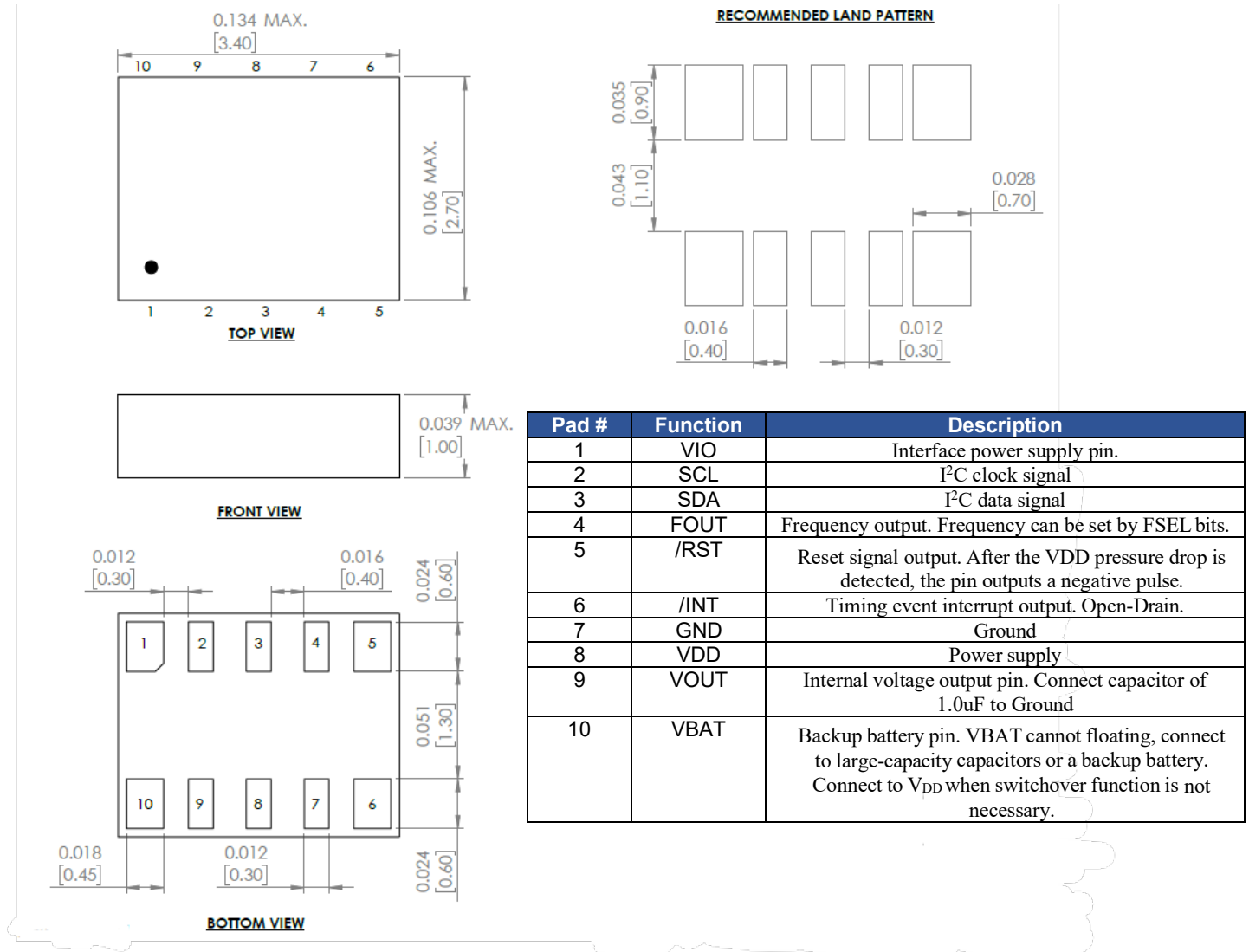


**Part Identification**

AB - RTC - XB - 32.768kHz - 2 -

Packaging
Blank: Bulk
T3: 3000pcs / reel

**Mechanical Dimensions**



Pad #	Function	Description
1	VIO	Interface power supply pin.
2	SCL	I <sup>2</sup> C clock signal
3	SDA	I <sup>2</sup> C data signal
4	FOUT	Frequency output. Frequency can be set by FSEL bits.
5	/RST	Reset signal output. After the VDD pressure drop is detected, the pin outputs a negative pulse.
6	/INT	Timing event interrupt output. Open-Drain.
7	GND	Ground
8	VDD	Power supply
9	VOUT	Internal voltage output pin. Connect capacitor of 1.0uF to Ground
10	VBAT	Backup battery pin. VBAT cannot floating, connect to large-capacity capacitors or a backup battery. Connect to V <sub>DD</sub> when switchover function is not necessary.

Note: VBAT cannot floating, connect to large-capacity capacitors or a backup battery. Connect to VDD when switchover function is not necessary.

Note: A 0.1µF bypass capacitor is needed at least between power supply pins and GND pin.

Note: Input pins regardless of VIO applied voltage. It is able to input up to 5.5V.

Note: Open drain pins regardless of VIO applied voltage. It is able to Pull-up to 5.5V

Note: When not in use, take the FOUT, /RST, /INT terminals as OPEN.

**Dimensions: inches[mm]**

Reflow Profile [JEDEC J-STD-020]

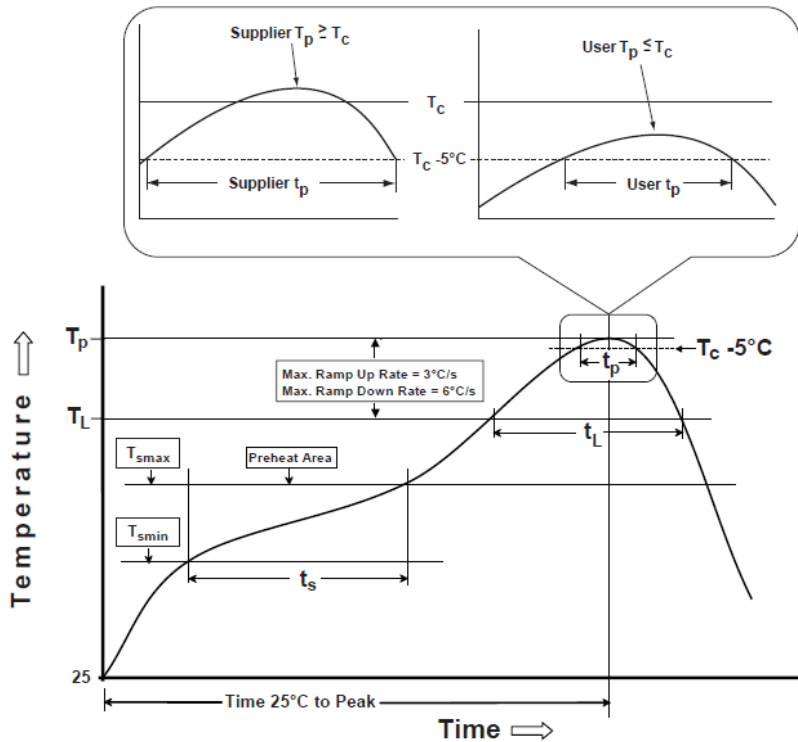


Table 1

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

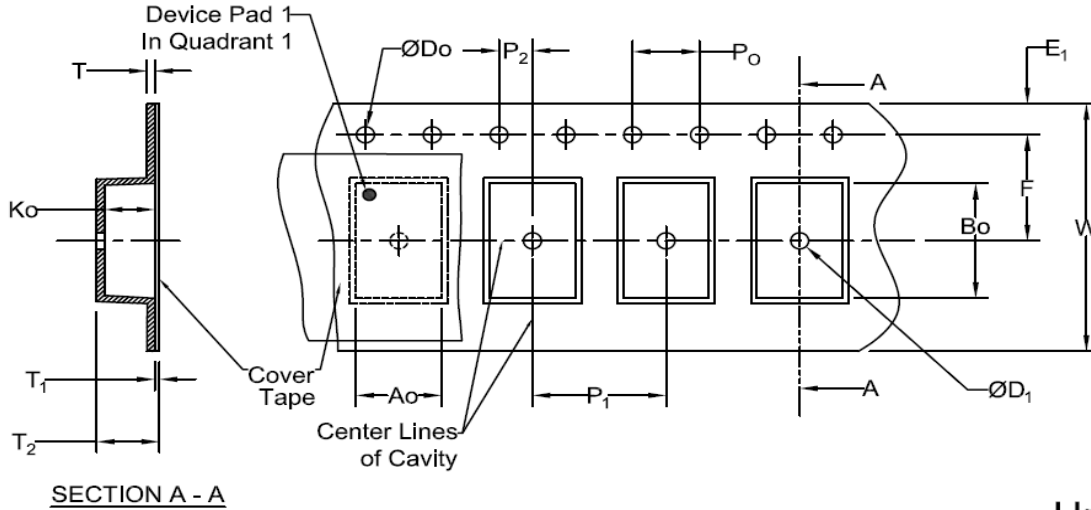
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat / soak		
Temperature minimum ( $T_{smin}$ )	100°C	150°C
Temperature maximum ( $T_{smax}$ )	150°C	200°C
Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )	60 - 120 sec.	60 - 120 sec.
Average ramp-up rate ( $T_{smax}$ to $T_p$ )	3°C/sec. max	3°C/sec.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

**Packaging**

T3: 3,000pcs/reel



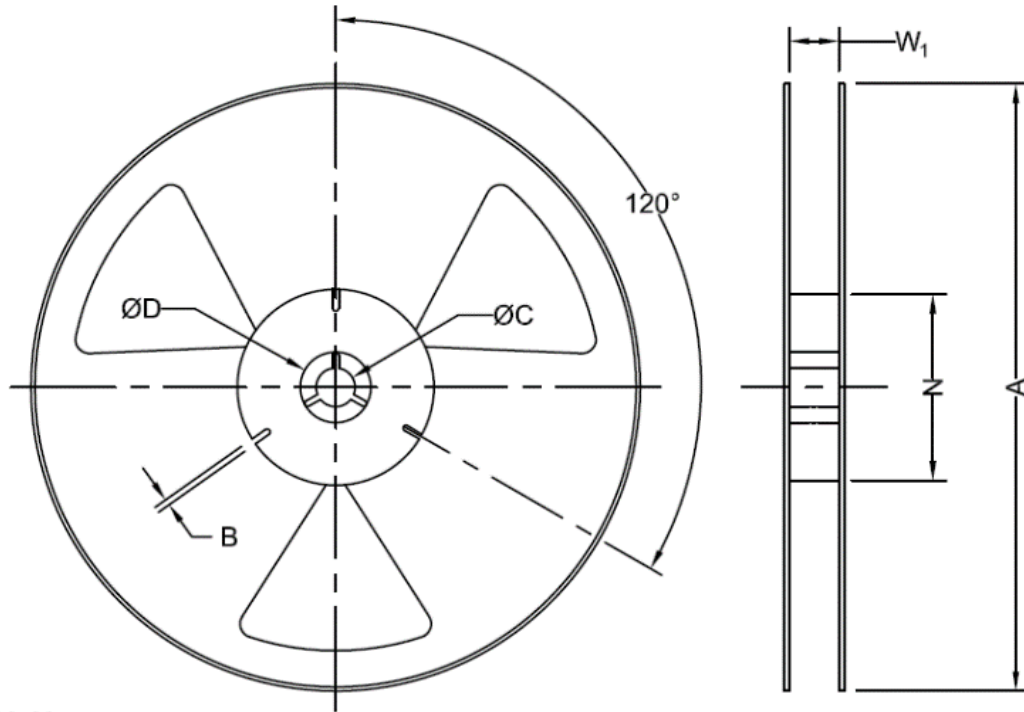
Unit: mm

Tape Specifications (mm)							
Width	Ao	Bo	Do	D <sub>1</sub> (Min)	E <sub>1</sub>	F	Ko
8mm	*	*	1.5+0.1/-0.0	1.0	1.75±0.1	3.5±0.05	*

\*Note: Compliant to EIA-481

Tape Specifications (mm)							
Width	P <sub>1</sub>	P <sub>2</sub>	P <sub>0</sub>	T (Max)	T <sub>1</sub> (Max)	T <sub>2</sub> (Max)	W (Max)
8mm	4.0±0.1	2.0±0.05	4.0±0.1	0.6	0.1	2.5	8.3

\*Note: Compliant to EIA-481



Unit: mm

Tape Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W <sub>1</sub>
8mm	3000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0

\*Note: Compliant to EIA-481