

ClearClock™ Oscillator Family | Low-Power HCSL| 2.0x1.6mm XO

Description

Abracon's AK1LP offers the latest low power HCSL technology that allows for a simplified termination method compared to traditional HCSL, reduces overall power consumption, and a decreased bill of materials. The Abracon AK1LP is available with a compact 2.0 x 1.6 mm package capable of with a frequency stability of ± 25 ppm over an operating temperature range of -40°C to 85°C . Additional advantages include a various power supply options ranging from 1.8V, 2.5V, 3.3V and a continuous voltage range of 1.71V to 3.63V.



Features

- Available in industry standard frequencies between 100MHz & 156.25MHz
- ± 25 ppm stability over industrial operating temperature (-40°C to $+85^{\circ}\text{C}$)
- 1.8V, 2.5V, 3.3V, 1.71V to 3.63V Continuous supply voltage options
- Industry standard 2.0 x 1.6 x .83 mm footprint
- Available in Abracon's global distribution network

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		100		156.25	MHz	
Standard Available Frequencies		100.000, 156.250			MHz	Contact Abracon for availability of frequencies not listed
Supply Voltage (Vdd)		2.97	3.3	3.63	V	Option “A”
		2.375	2.5	2.625		Option “B”
		1.71	1.8	1.89		Option “C”
		1.71		3.63		Option “E”
Supply Current (Idd)	HCSL		10	15	mA	@ 100MHz, Vdd=3.3V
			15	20		@ 156.25MHz, Vdd=3.3V
Operating Temperature Range		-20		70	°C	Option “D”
		-40		85		Option “F” or “Q”
Storage Temperature		-55		150	°C	
Frequency Tolerance ^[Note 1]		-10	< ±5	10	ppm	
Frequency Stability over ^[Note 2,3] Operating Temperature Range		-15	< ±10	15	ppm	Option “D” (-20°C to +70°C)
		-20	< ±15	20		Option “Q” (-40°C to +85°C)
		-25	< ±20	25		Option “F” (-40°C to +85°C)
First Year Aging		-3		3	ppm	At 25°C
All-Inclusive Frequency Accuracy (Total Stability) ^[Note 4]		-40		40	ppm	Option “D” (-20°C to +70°C)
		-45		45		Option “Q” (-40°C to +85°C)
		-50		50		Option “F” (-40°C to +85°C)
Rise (Tr) / Fall (Tf) Time ^[Note 5]			0.45	0.7	ns	RL=No Load
Duty Cycle		45		55	%	
Start-up Time ^[Note 2]			< 2	5	ms	

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Electrical Specifications Cont.

Parameters			Min.	Typ.	Max.	Unit	Notes
Differential Output High Voltage (VOH) Output Low Voltage (VOL)	HCSL	V _{OH}	0.550		0.900	V	R _L = No Load
		V _{OL}	-0.15	0.00	0.15		
Output Voltage Swing (V _{opp})			0.550			V	
Output Enable & Disable Control			0.7*(V _{dd})			V	Output Enable or No Connect
					0.3*(V _{dd})		Output Disable (High Impedance)
Output Enable Time				< 1	2.0	ms	
Output Disable Time					0.2	μs	
Output Disable Current Consumption					10	μA	OE ≤ 0.3V
RMS Phase Jitter (12kHz to 20MHz from Carrier)			See Table 1 below				Vdd, output logic type and Carrier frequency dependent

Note 1: Frequency Accuracy (Initial Set-Tolerance), at time of shipment (pre-reflow), relative to carrier frequency, @ +25°C

Note 2: Relative to initial measured frequency @ +25°C

Note 3: Option Q only available in select frequencies. Please contact Abracon for availability

Note 4: Includes post reflow frequency accuracy, temperature stability, load pulling, power supply variation, and 10-year aging

Note 5: Measured over 20% to 80% of waveform

Table 1
RMS Phase Jitter 12kHz – 20MHz BW ^[Note 6,7]

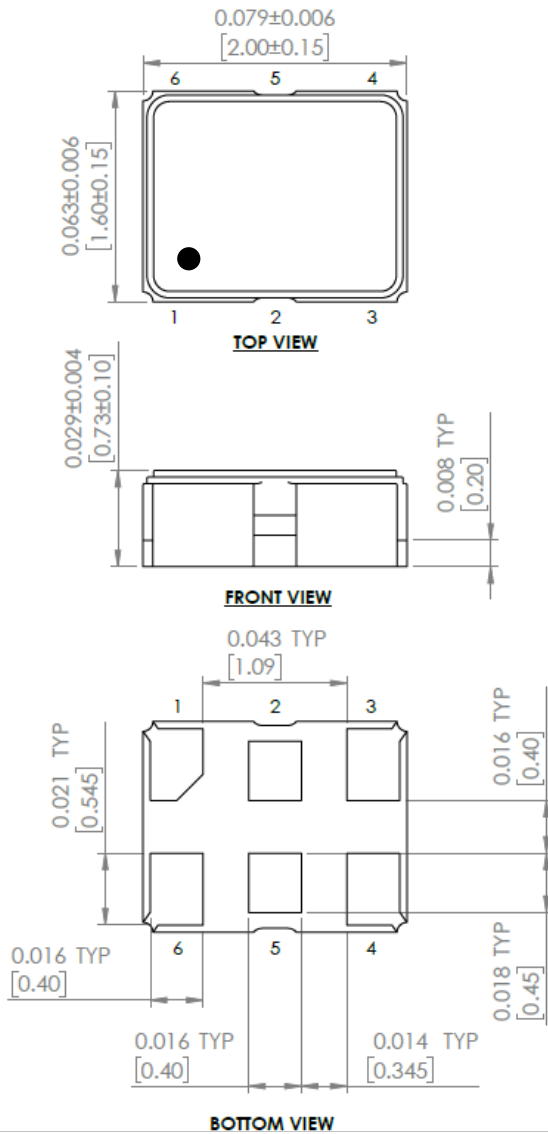
Frequency (MHz)	V _{dd} (V)	RMS Jitter	
		Typ. (fs)	Max (fs)
100	1.8	122	180
	2.5	120	180
	3.3	118	180
156.25	1.8	100	150
	2.5	100	150
	3.3	100	150

Note 6: Guaranteed by characterization; RMS Phase Jitter specifications are inclusive of any spurs

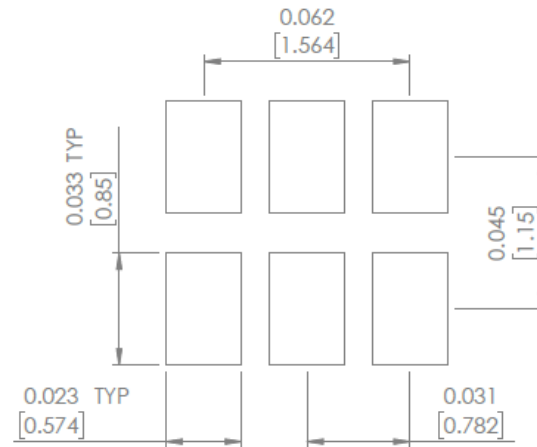
Note 7: Phase jitter measured with Keysight E5052B Signal Source Analyzer

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Mechanical Dimensions



RECOMMENDED LAND PATTERN



Case 1

Pin #1=Output
Enable/Disable Function
where OE is Active HIGH

Pin	Description
# 1	Output Enable = Logic High, "1", Vdd Output Disable = Logic Low, "0", GND
# 2	No Connect
# 3	GND
# 4	Output
# 5	Complementary output
# 6	Supply Voltage (Vdd)

Dimensions: Inches [mm]

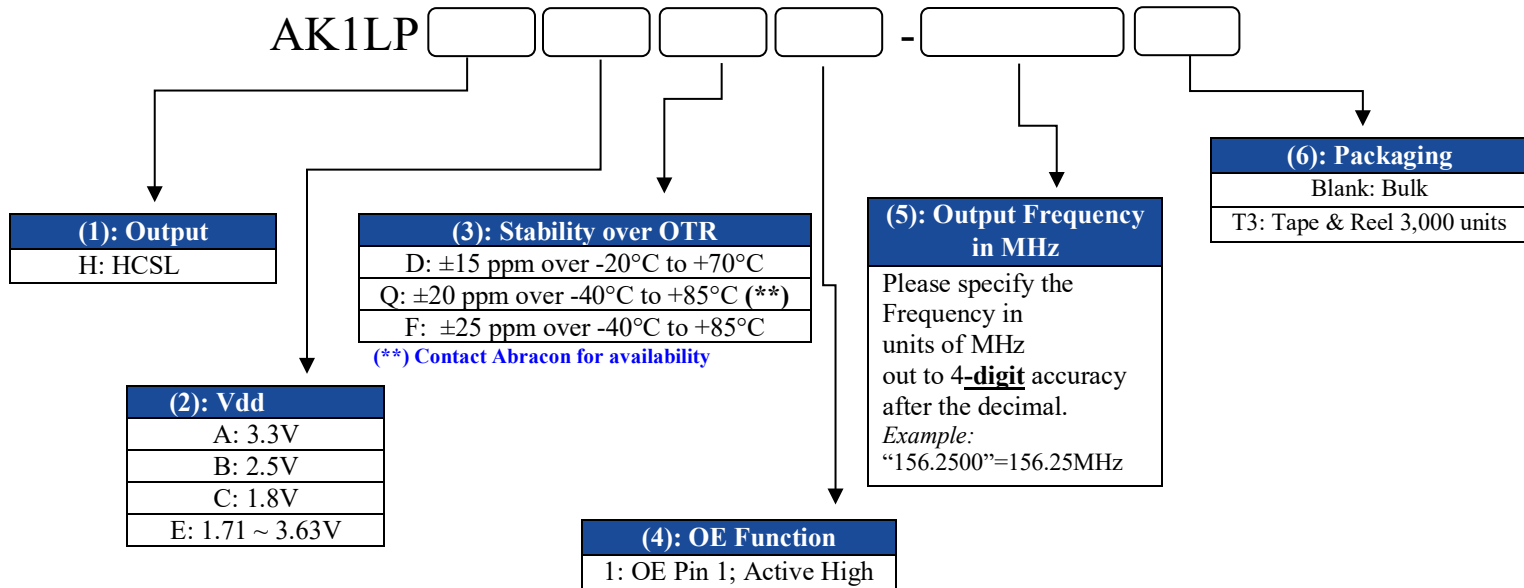
Revision:
Initial Release 10/16/2024

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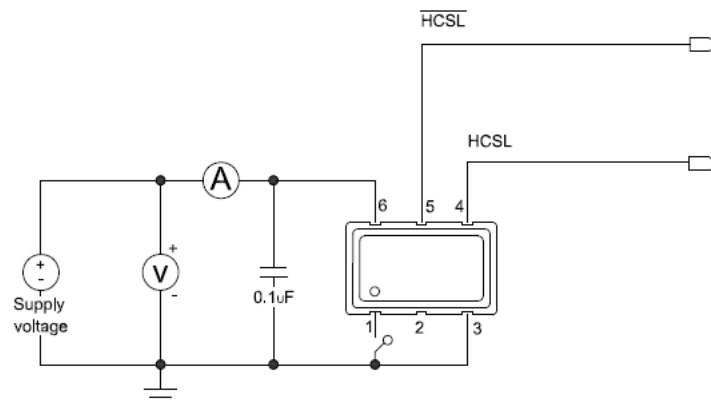
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Part Identification



Recommended Test Circuit

LP-HCSL



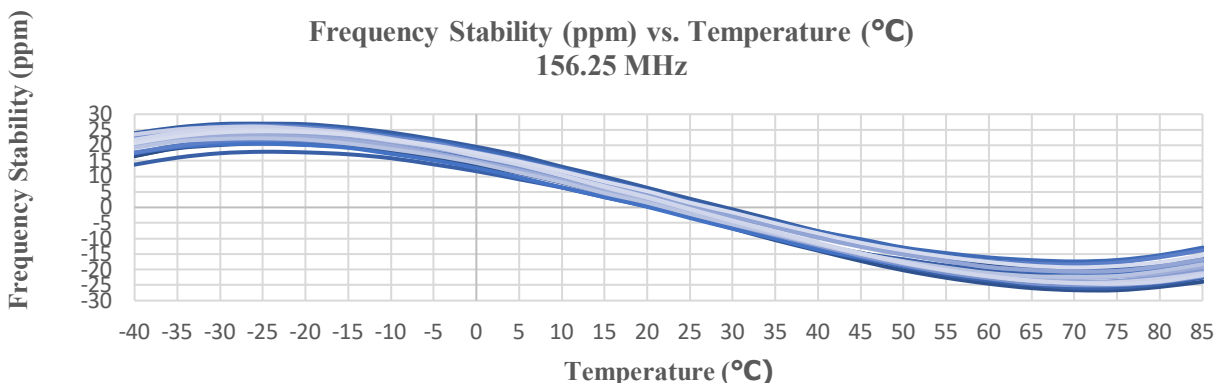
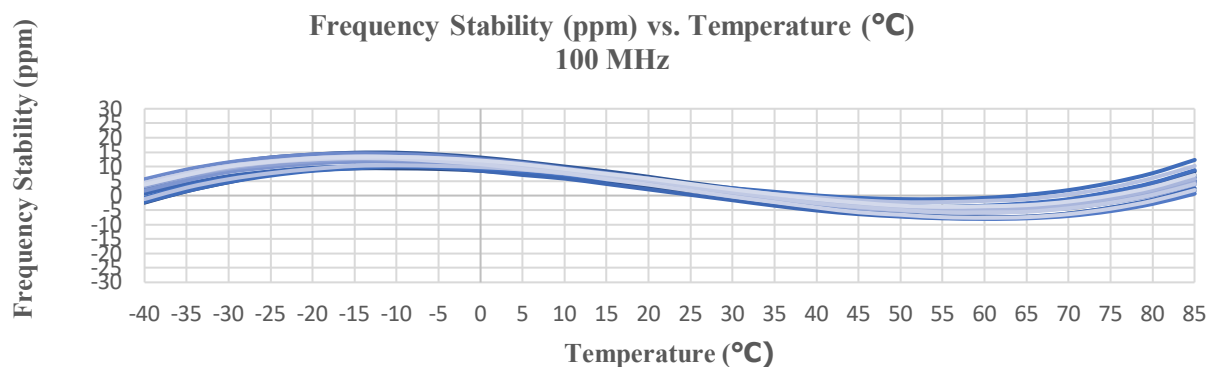
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Absolute Maximum Ratings ^[Note 8]

Parameters	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	$V_{SS}-0.5$		4.5	V	
Input Voltage	$V_{SS}-0.5$		$V_{DD}+0.5$	V	
Output Voltage	$V_{SS}-0.5$		$V_{DD}+0.5$	V	
Maximum Junction Operating Temperature			150	°C	
Ambient Operating Temperature Range	-40		85	°C	Industrial
Ambient Operating Temperature Range	-20		70	°C	Extended Commercial
Reflow Temperature			260	°C	See Reflow Profile
ESD Protection	4kV HBM, 300V MM, 2kV CDM				

Note 8: 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.

Typical Frequency vs Temperature Characteristics



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Reflow Profile [JEDEC J-STD-020]

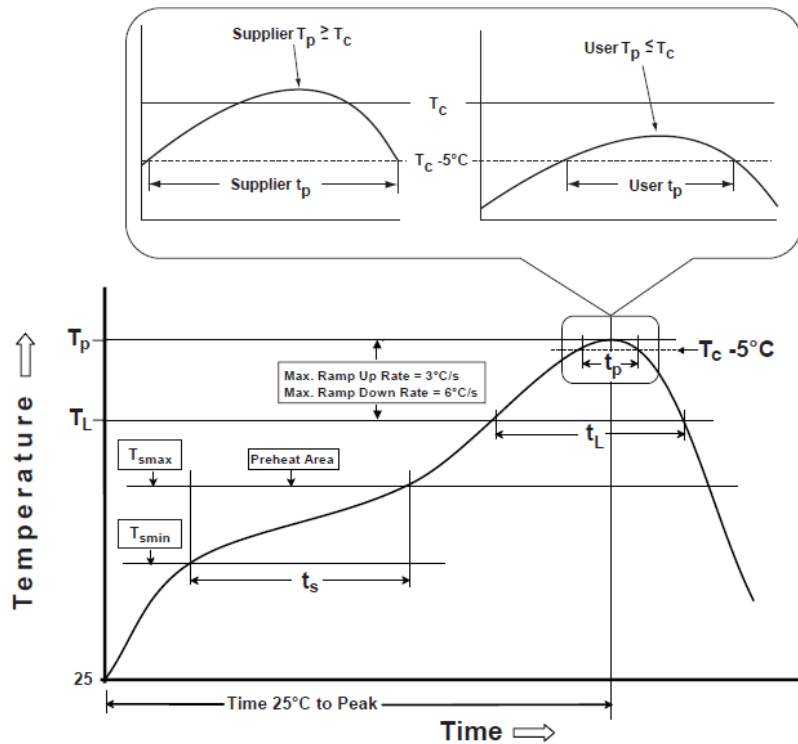


Table 1

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 - 120 sec.
Average ramp-up rate (T_{smax} to T_p)	3°C/sec. max	3°C/sec. max
Liquidous T_L	183°C	217°C
Time at li	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

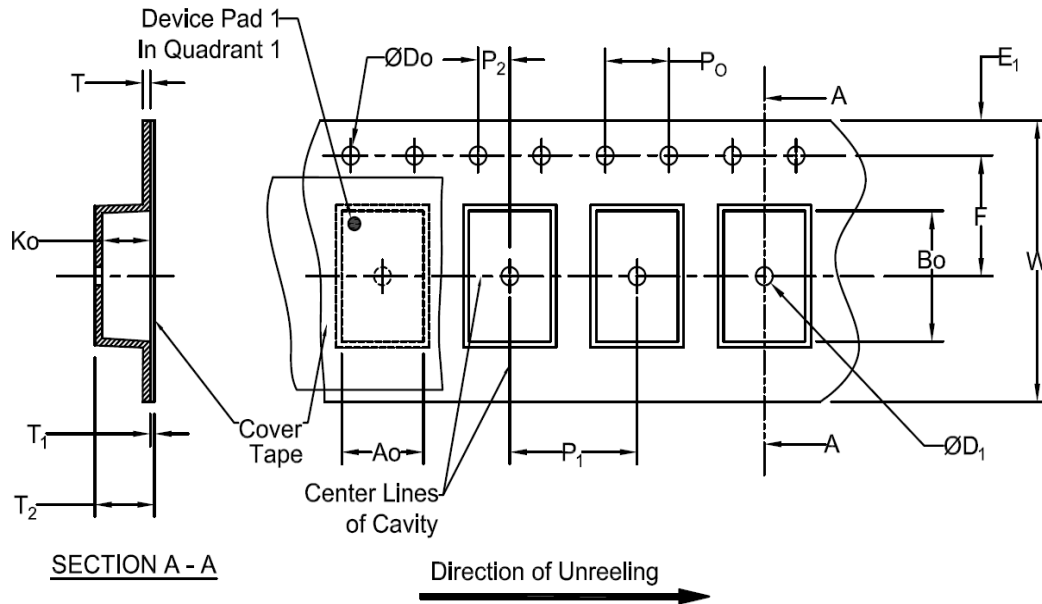
*Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.

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

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Packaging

T3: 3,000pcs/reel

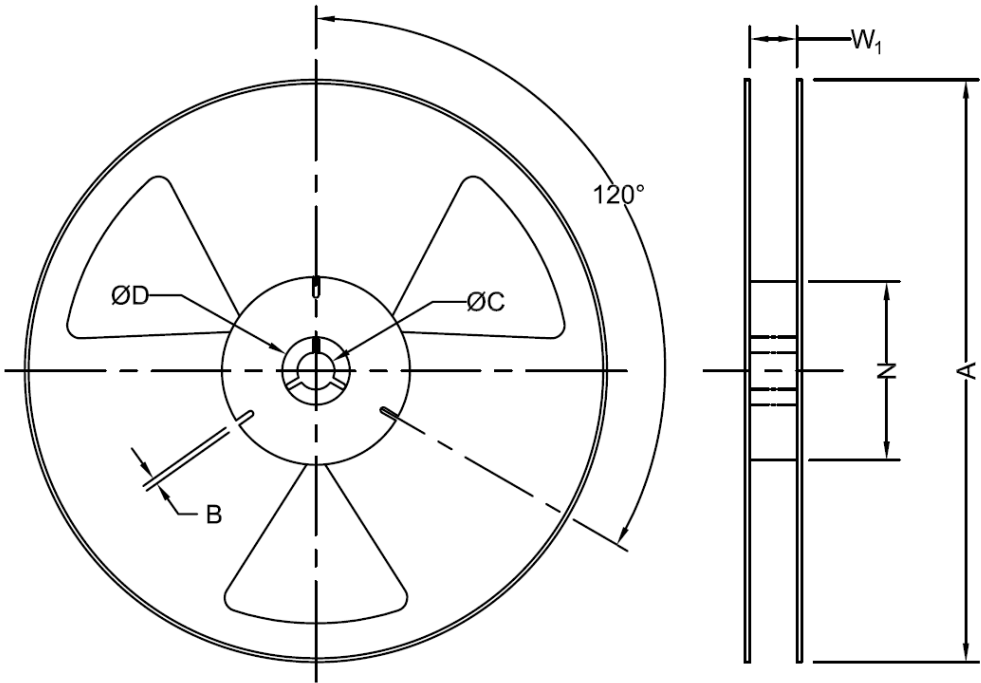


Tape Specifications (mm)							
Width	Ao	Bo	Do	D ₁ (Min)	E ₁	F	Ko
8mm	*	*	1.5+0.1/-0.0	1.0	1.75±0.1	3.5±0.05	*
Width	P ₁	P ₂	P ₀	T (Max)	T ₁ (Max)	T ₂ (Max)	W (Max)
8mm	4.0±0.1	2.0±0.05	4.0±0.1	0.6	0.1	2.5	8.3

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

Dimensions: mm

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

***Note: Measured at Hub**

Dimensions: mm