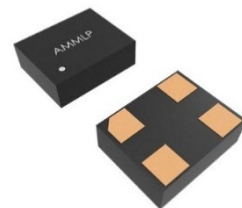


Description

The Abracon AMMLP series is a programmable MEMS oscillator, offering five different package size configurations (2016mm, 2520mm, 3225mm, 5032mm and 7050mm). This series features low power consumption, a wide frequency range, excellent phase noise, tight stabilities, and short lead times for industrial, consumer, and other applications. The AMMLP series supports four supply voltage options: 1.8V, 2.5V, 3.3V, and continuous 2.25V to 3.63V, enabling inventory consolidation and use of a single device configuration.



Features

- Industry Standard package sizes: 2.0 x 1.6 x 0.89mm, 2.5 x 2.0 x 0.89mm, 3.2 x 2.5 x 0.89mm, 5.0 x 3.2 x 0.89mm, 7.0 x 5.0 x 0.9mm
- CMOS output
- Low power consumption
- Any frequency between 2.3MHz to 170MHz
- Supply Voltage options: 3.3V, 2.5V, 1.8V, 2.25V ~ 3.63V
- Frequency Stability options: ± 20 ppm, ± 25 ppm, ± 50 ppm over -20 to +70°C, -40 to +85°C, -40°C to +105°C, & -40°C to +125°C
- Output enable or standby function
- [REACH/RoHS II Compliant](#) | [MSL Level 1](#)

Typical Applications

- Wearables
- Internet of Things (IoT)
- Industrial IoT
- Consumer devices
- Portable devices
- Audio and video
- Drones and robotics

Electrical Specifications

All Min and Max limits are specified over temperature and rated operating voltage with 10pF output load unless otherwise stated. Typical values are at 25°C and nominal supply voltage and 10pF output load.

Parameters		Min.	Typ.	Max.	Units	Notes
Frequency Range (F)		2.3		170	MHz	$V_{DD} = 3.3V, V_{DD} = 2.5V$
		2.3		125		$V_{DD} = 1.8V$
Supply Voltage (V_{DD})		2.25		3.63	V	See Options
		2.97	3.3	3.63		
		2.25	2.5	2.75		
		1.71	1.8	1.98		
Current Consumption (I_{DD})			6.5	7.5	mA	$f_0 = 20MHz, V_{DD} = 3.3V$, no load, output enabled
Standby Current Consumption (I_{STBY})			1		μA	$V_{DD} = 1.8V/2.5V$
			1.8			$V_{DD} = 3.3V$
Operating Temperature Range (T_{USE})		-40		+85	°C	See Options
Storage Temperature Range (T_{STR})		-55		+150	°C	
All Inclusive Frequency Stability (Fstab)		-20		+20	ppm	See Options, Note 1
Aging (@ +25°C)			± 5		ppm	First year
			± 1			Per year after first year
Duty Cycle		47		53	%	
Output Logic High, V_{OH}	$V_{DD} = 3.3V$	$0.8 \cdot V_{DD}$			V	$I_{OH} = -16mA$
	$V_{DD} = 2.5V$	$0.8 \cdot V_{DD}$				$I_{OH} = -10mA$
	$V_{DD} = 1.8V$	$0.8 \cdot V_{DD}$				$I_{OH} = -4mA$
Output Logic Low, V_{OL}	$V_{DD} = 3.3V$			$0.2 \cdot V_{DD}$	V	$I_{OL} = 16mA$
	$V_{DD} = 2.5V$			$0.2 \cdot V_{DD}$		$I_{OL} = 10mA$
	$V_{DD} = 1.8V$			$0.2 \cdot V_{DD}$		$I_{OL} = 4mA$

Electrical Specifications *continued*

Parameters	Min.	Typ.	Max.	Units	Notes
Input Logic Levels	V_{IH}	$0.7 \cdot V_{DD}$		V	Input logic High, Note 3
	V_{IL}		$0.3 \cdot V_{DD}$		Input logic Low, Note 3
Power Supply Ramp (t_{PU})	0.1		100	ms	Note 2
Start-up Time (t_{SU})		2.5		ms	From 90% V_{DD} until the output start toggling
Output Enable Time (t_{OE})			1	μs	Pin 1 configured as OE
			2	ms	Pin 1 configured as Standby
Output Disable Time (t_{ODS})		15		ns	From OE toggle to output OFF
Rise (T_r) / Fall (T_f) Time 20% $\leftrightarrow$ 80%, $CL = 10$ pF		1.4/1.3		ns	$V_{DD} = 1.8V$
		1.1/1.0			$V_{DD} = 2.5V$
		1.2/1.0			$V_{DD} = 3.3V$
Cycle-to-Cycle Jitter (Peak) $F_{OUT} = 25MHz$		40		ps	$V_{DD} = 1.8V$
		18			$V_{DD} = 2.5V$
		15			$V_{DD} = 3.3V$
Period Jitter (Peak-to-Peak) $F_{OUT} = 25MHz$		45		ps	$V_{DD} = 1.8V$
		20			$V_{DD} = 2.5V$
		18			$V_{DD} = 3.3V$
RMS Period Jitter $F_{OUT} = 25MHz$		6		ps	$V_{DD} = 1.8V$
		2.5			$V_{DD} = 2.5V$
		2.5			$V_{DD} = 3.3V$
RMS Phase Jitter		1		ps	$V_{DD} = 3.3V$, $T_a = 25^\circ C \pm 3^\circ C$, 12kHz to 20MHz, $F_{OUT} = 100MHz$

Note 1: Overall frequency stability includes initial frequency tolerance @25°C $\pm$ 3°C and stability over the operating temperature range.

Note 2: Time to reach 90% of target V_{DD} . Power ramp must be monotonic.

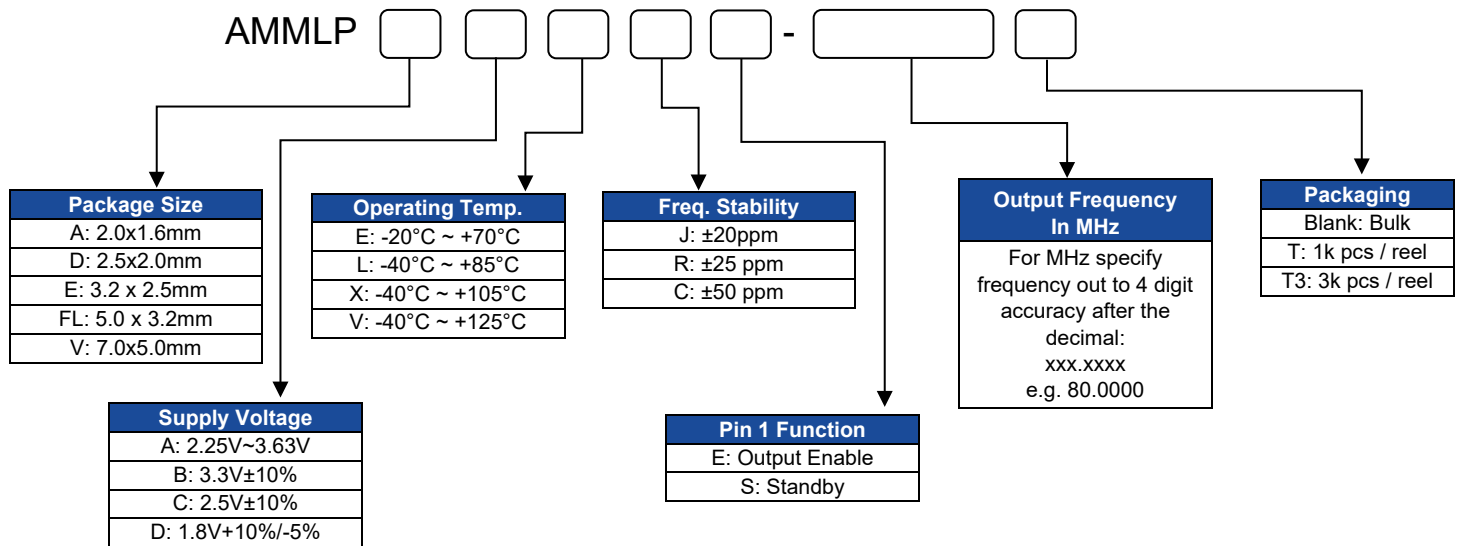
Note 3: Input waveform must be monotonic with rise/fall time <10 ms.

Absolute Maximum Ratings ([Note 4](#))

Parameters	Min.	Typ.	Max.	Units	Notes
Supply Voltage	-0.3		+4.0	V	
LVTTL Input Voltage	-0.3		$V_{DD} + 0.3$	V	
Maximum Junction Operating Temperature			+125	$^\circ C$	
Ambient Operating Temperature Range	-40		+125	$^\circ C$	Extended Industrial
Ambient Operating Temperature Range	-40		+105	$^\circ C$	Extended Industrial
Ambient Operating Temperature Range	-40		+85	$^\circ C$	Industrial
Ambient Operating Temperature Range	-20		+70	$^\circ C$	Extended Commercial
Reflow Temperature			+260	$^\circ C$	See Reflow Profile
ESD Protection	4kV HBM, 400V MM, 2kV CDM				

Note 4: 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.

Options and Part Identification



Part Number Example:

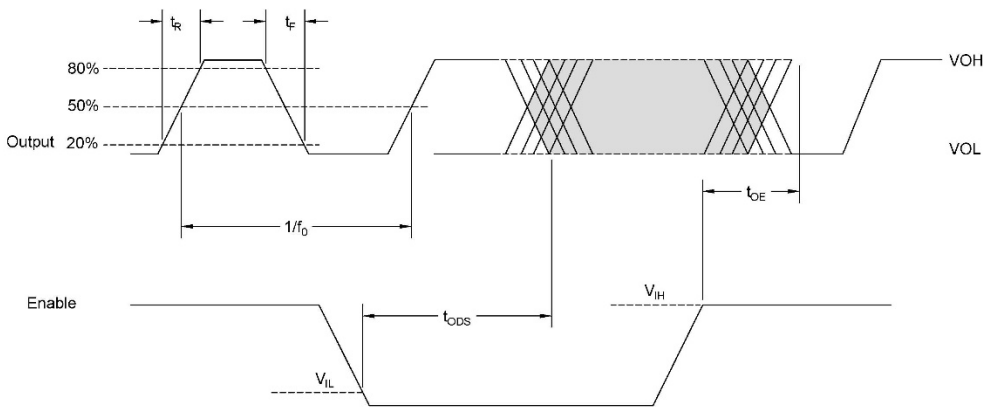
AMMLPADLRE-24.0000T

Pin Functions

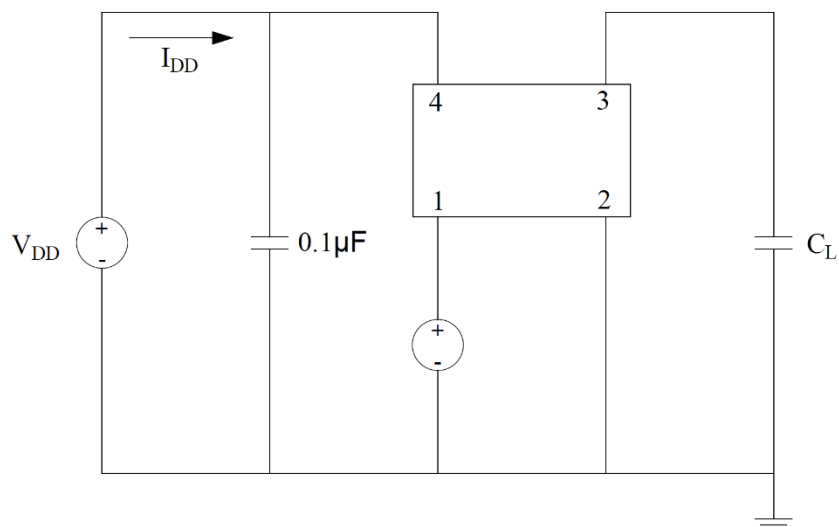
Pin #	Pin Name	Description
1	OE	<i>Output Enable:</i> Note 6 Logic High or No Connect: Output Enabled Logic Low: Output Disabled (High impedance)
	STBY	<i>Standby:</i> Note 6 Logic High or No Connect: Output Enabled Logic Low: Output Disabled (High impedance) Note 8
2	GND	Ground
3	Output	Oscillator clock output
4	V _{DD}	Power Supply: 1.71V to 3.63V Note 7

Note 6: If pin 1 is high or floating, there will be frequency output. If pin 1 is low, output will be disabled.
Note 7: Bypass with 0.1 μ F capacitor placed as close to V_{DD} pin as possible.
Note 8: Device is in Standby (Both output buffer and PLL disabled)

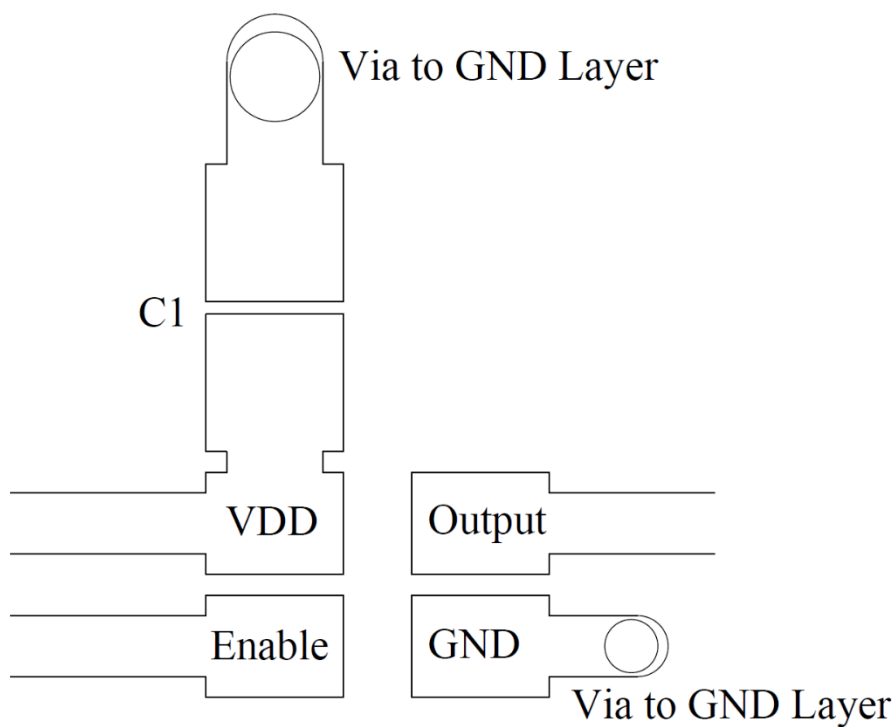
Output Waveform



Test Circuit

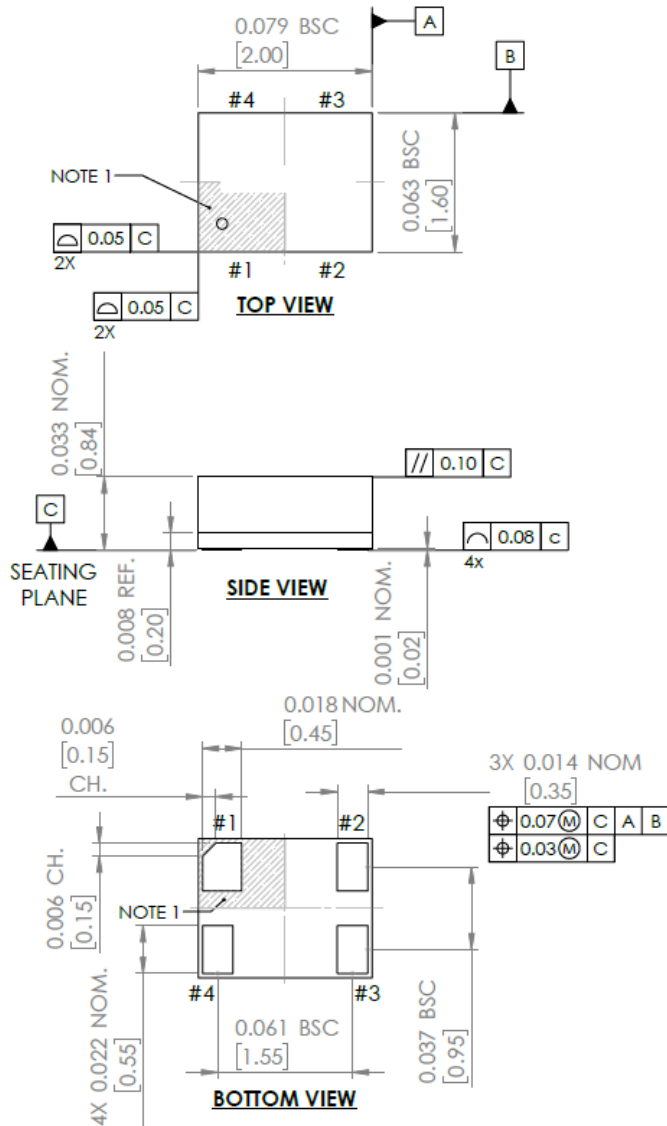


Recommended Board Layout

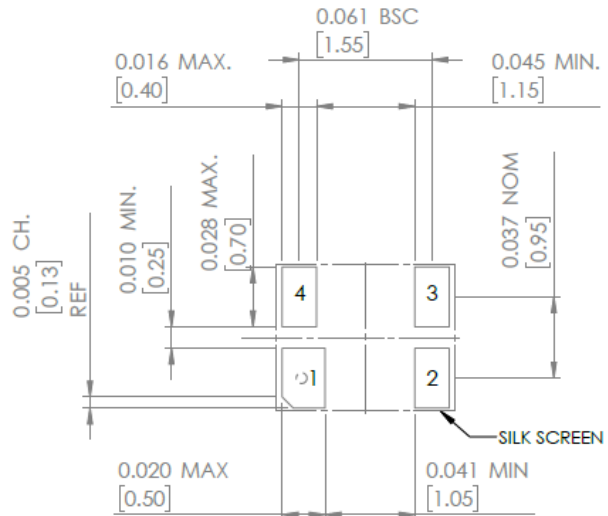


Mechanical Dimensions

2.0 mm x 1.6 mm VFLGA Package Outline



Recommended Land Pattern



Note 1:

Pin 1 visual index feature may vary, but must be located within the hatched area.

Note 2:

Package is saw singulated

Note 3:

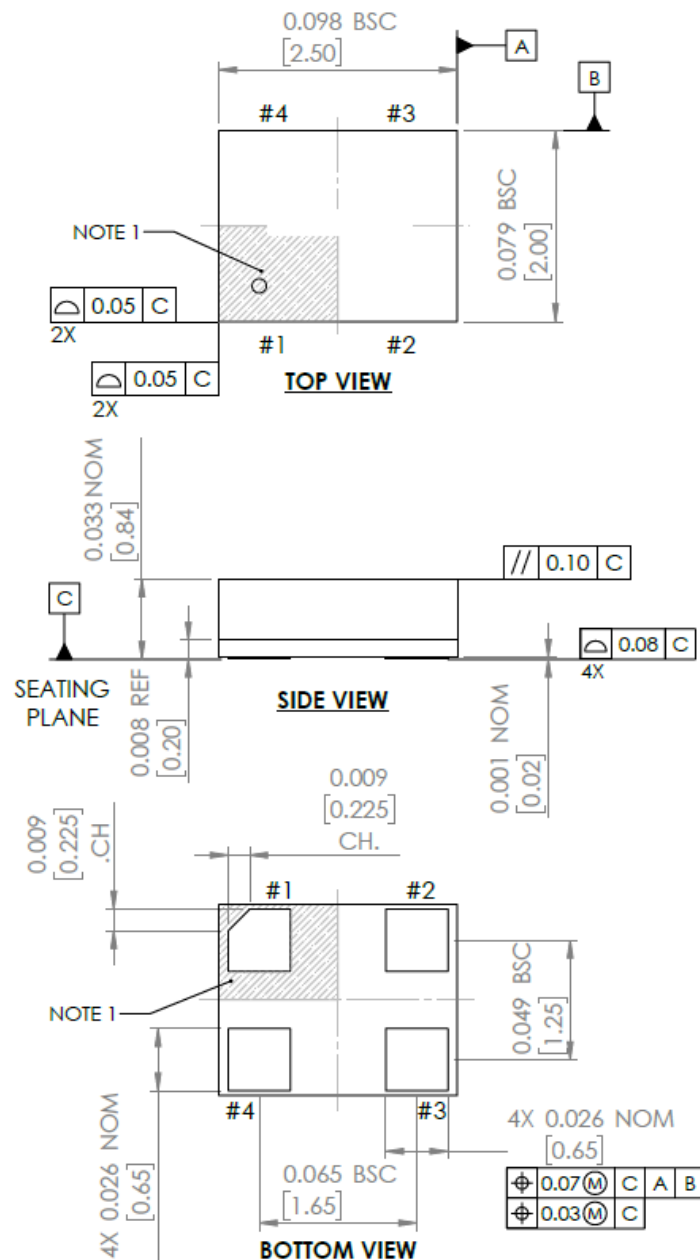
Dimensioning and tolerance per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances

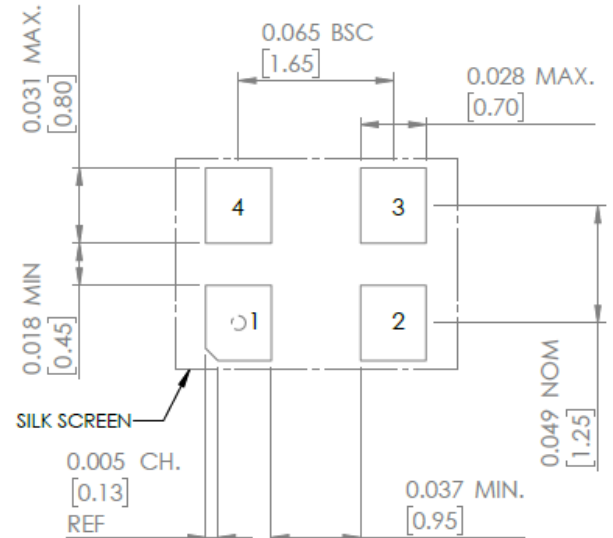
REF: Reference Dimension, usually without tolerance, for information purposes only

Dimensions: inches [mm]

2.5 mm x 2.0 mm VLGA Package Outline



Recommended Land Pattern



Note 1:

Pin 1 visual index feature may vary, but must be located within the hatched area.

Note 2:

Package is saw singulated

Note 3:

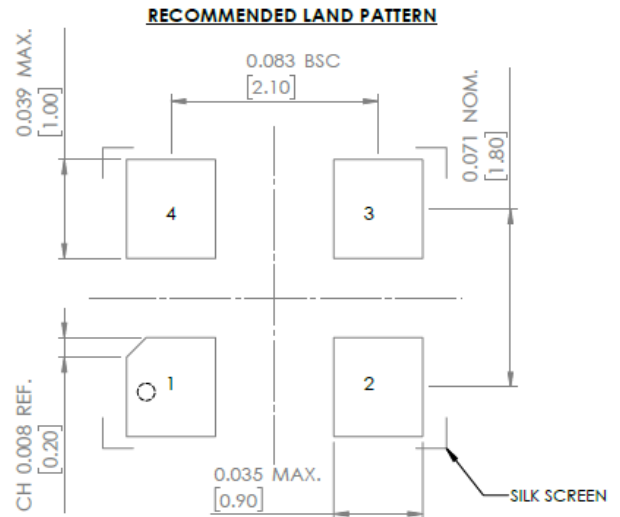
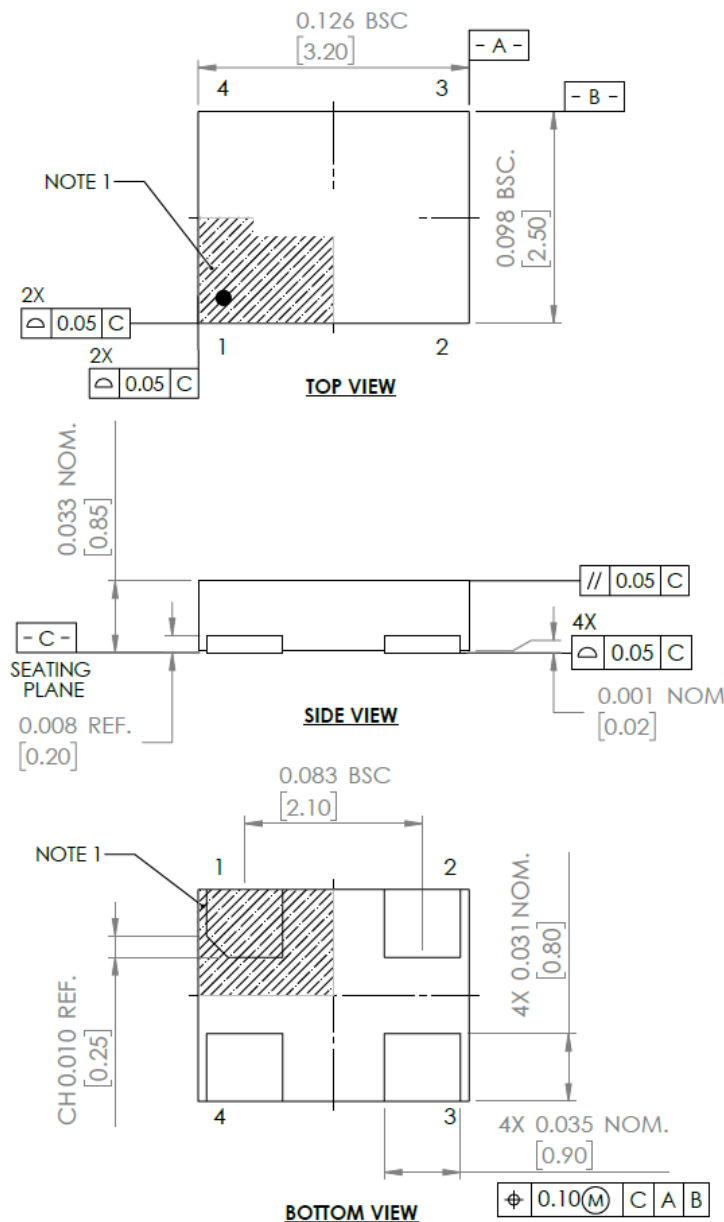
Dimensioning and tolerance per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances

REF: Reference Dimension, usually without tolerance, for information purposes only

Dimensions: inches [mm]

3.2 mm x 2.5 mm VDFN Package Outline



Note 1:

Pin 1 visual index feature may vary, but must be located within the hatched area.

Note 2:

Package is saw singulated

Note 3:

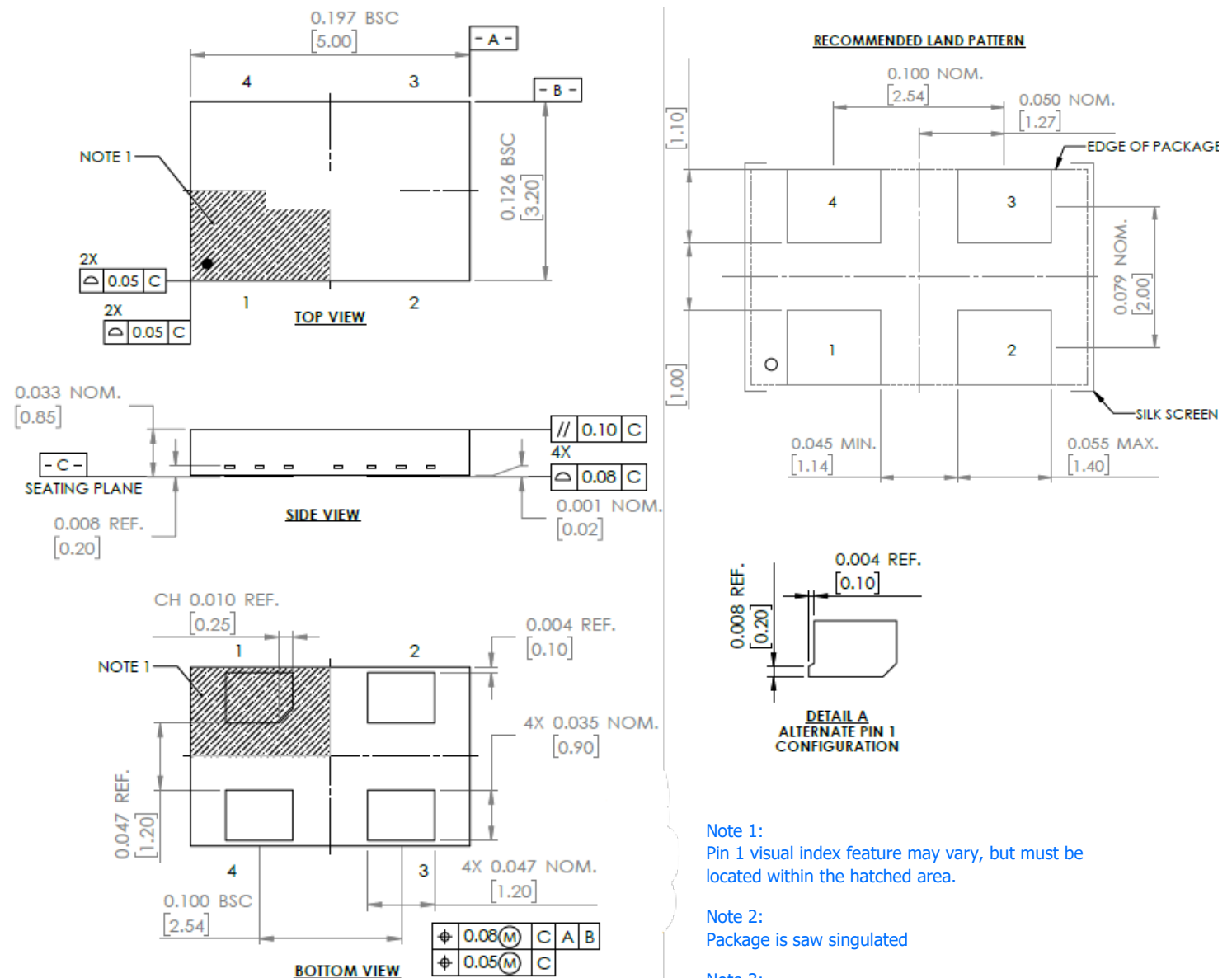
Dimensioning and tolerance per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances

REF: Reference Dimension, usually without tolerance, for information purposes only

Dimensions: inches [mm]

5.0 mm x 3.2 mm VDFN Package Outline



Note 1:
Pin 1 visual index feature may vary, but must be located within the hatched area.

Note 2:
Package is saw singulated

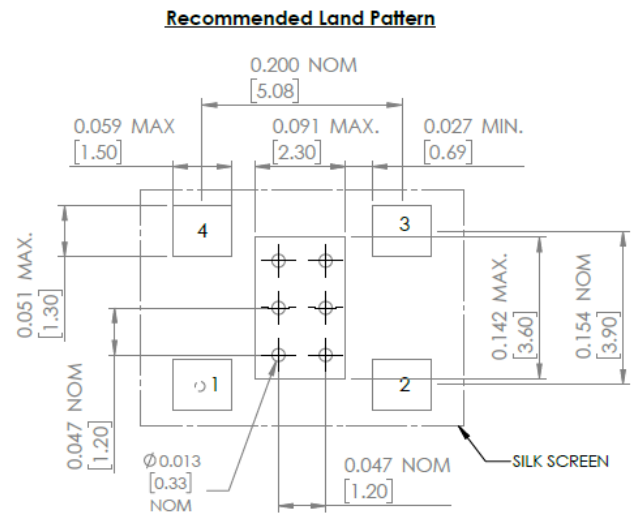
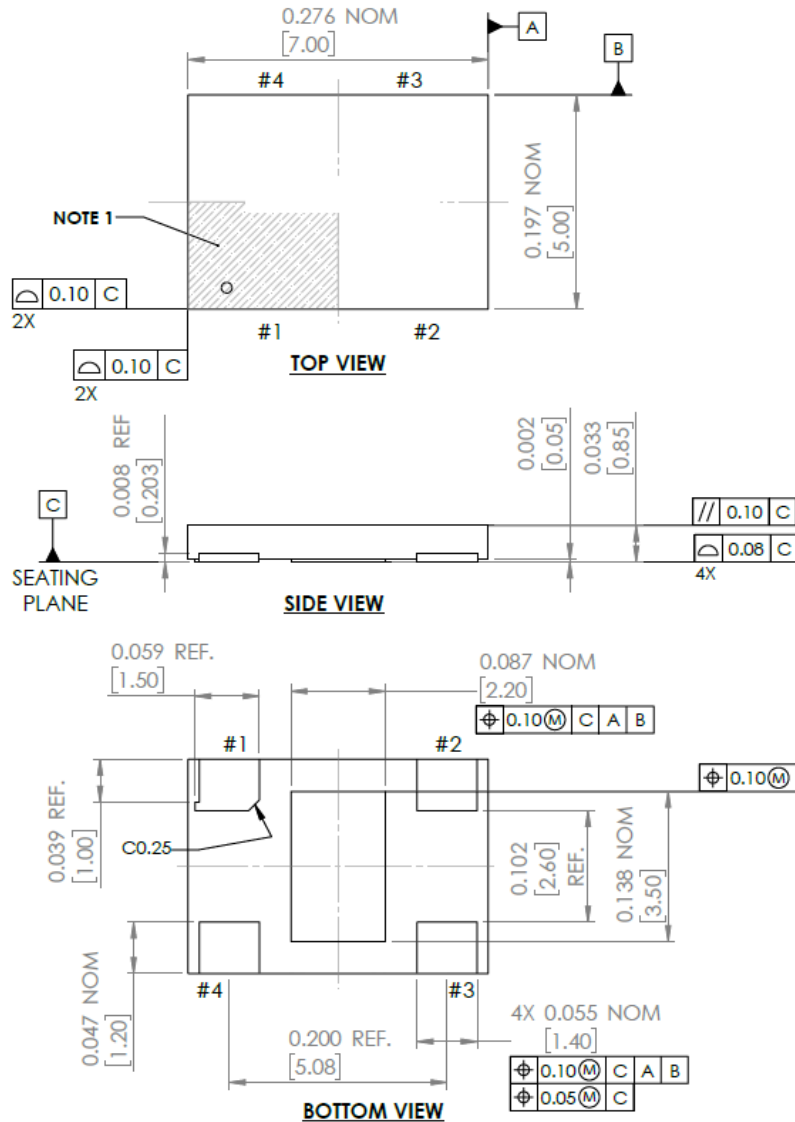
Note 3:
Dimensioning and tolerance per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances

REF: Reference Dimension, usually without tolerance, for information purposes only

Dimensions: inches [mm]

7.0 mm x 5.0 mm VDFN Package Outline



Note 1:

Pin 1 visual index feature may vary, but must be located within the hatched area.

Note 2:

Package is saw singulated

Note 3:

Dimensioning and tolerance per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances

REF: Reference Dimension, usually without tolerance, for information purposes only

Dimensions: inches [mm]

Reflow Profile [JEDEC J-STD-020]

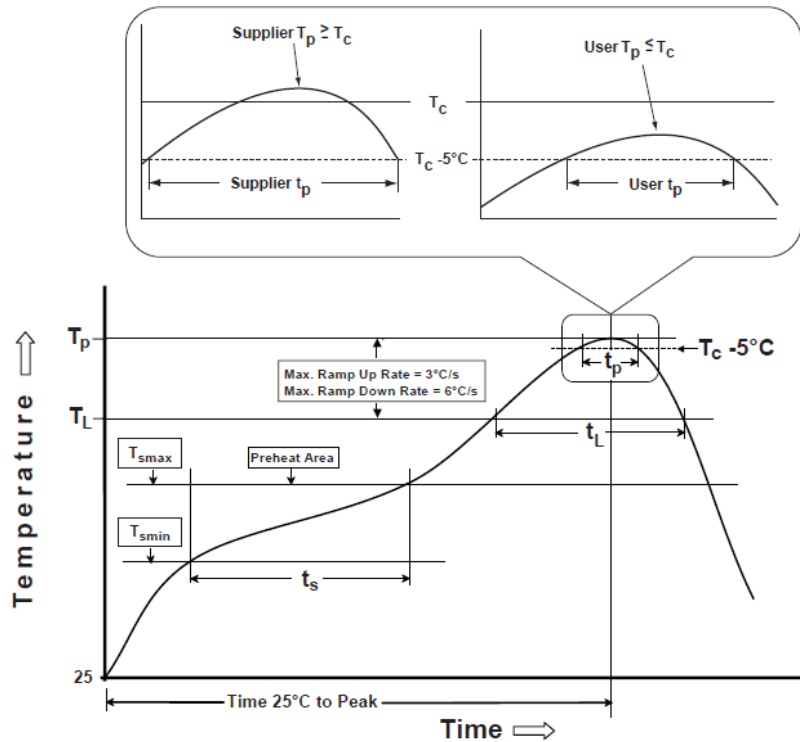


Table 1

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)

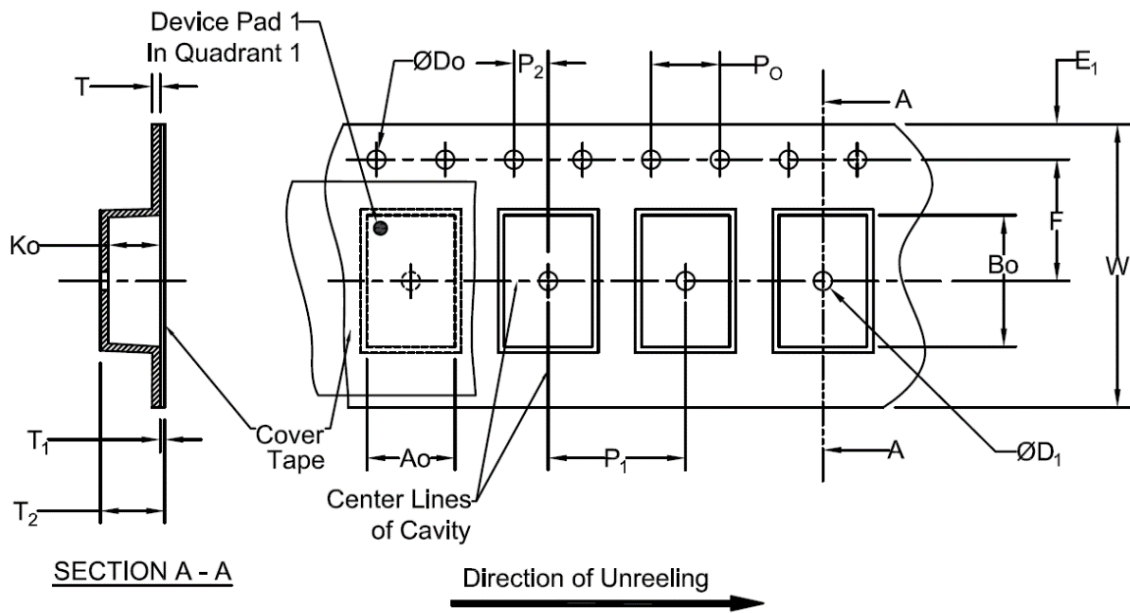
Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
>2.5 mm	250 °C	245 °C	245 °C

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 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.

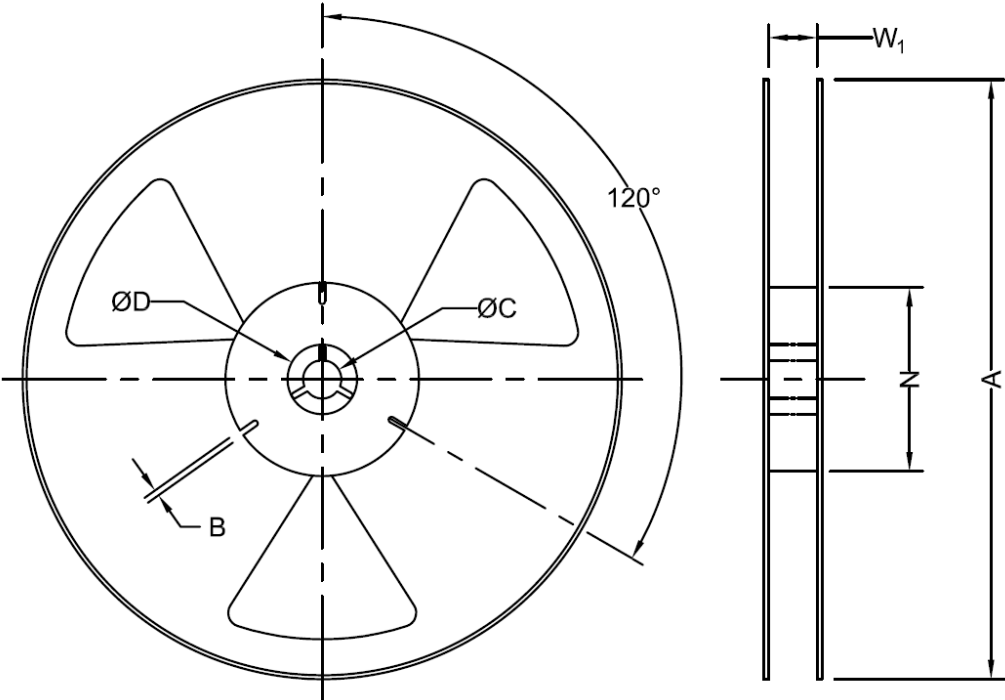
Packaging

2.0 mm x 1.6 mm VFLGA
T=1,000pcs/reel
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	P1	P2	P0	T (Max)	T1 (Max)	T2 (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**



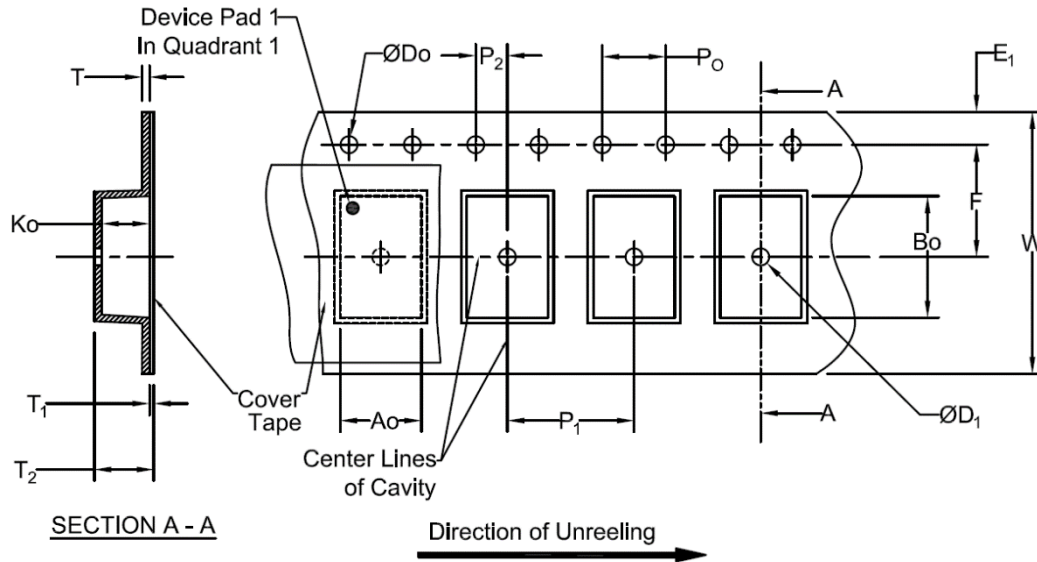
Reel Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W ₁
8mm	1000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0
	3000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0

***Note: Measured at Hub**

2.5 mm x 2.0 mm VLGA

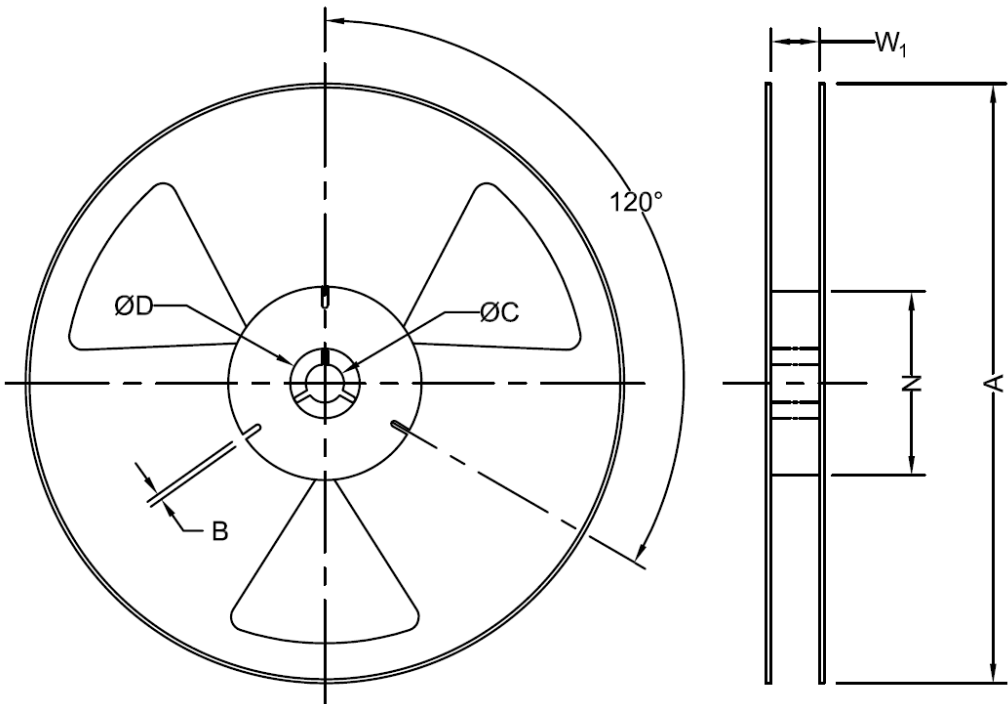
T= 1,000pcs/reel

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**



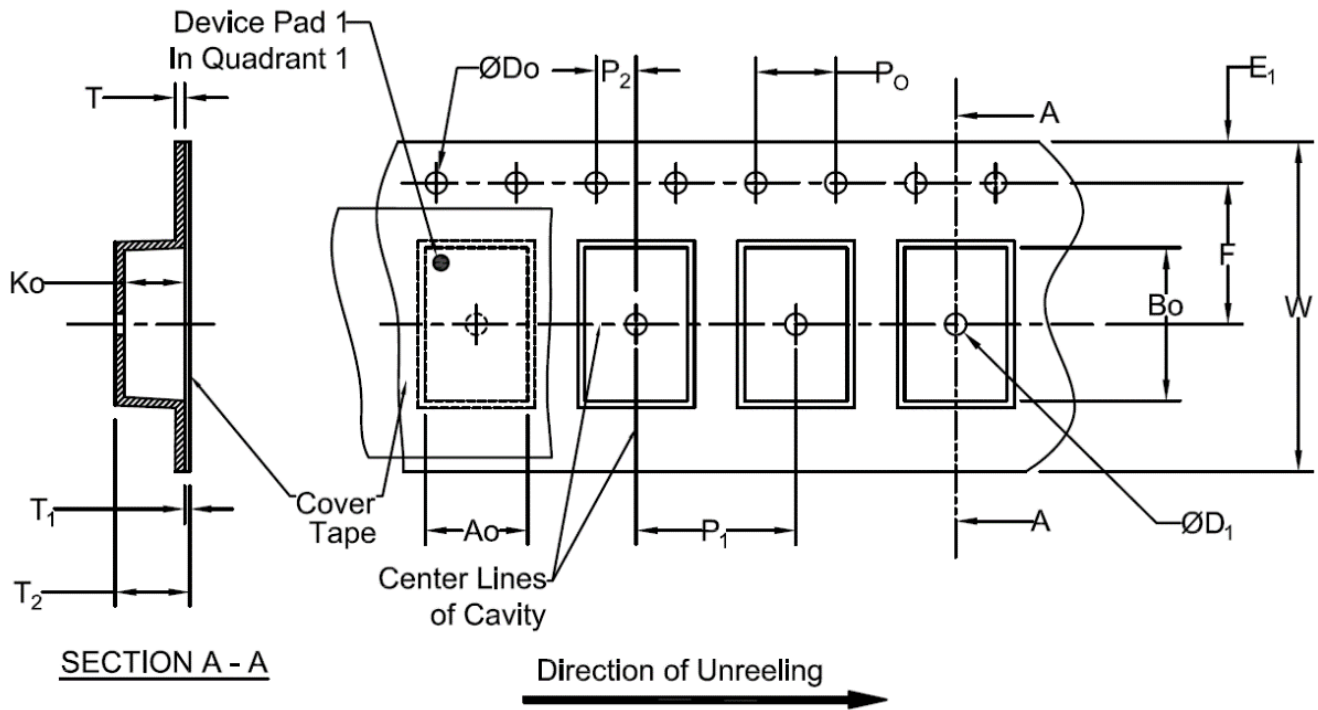
Reel Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W ₁
8mm	1000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0
	3000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0

***Note: Measured at Hub**

3.2 mm x 2.5 mm VDFN

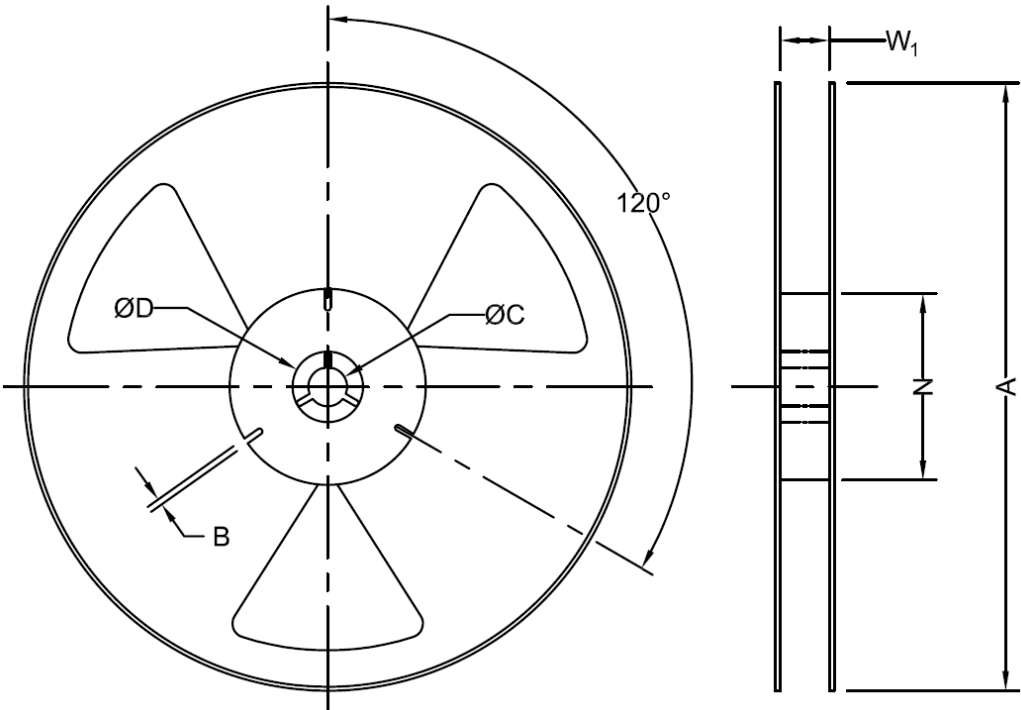
T= 1,000pcs/reel

T3= 3,000pcs/reel



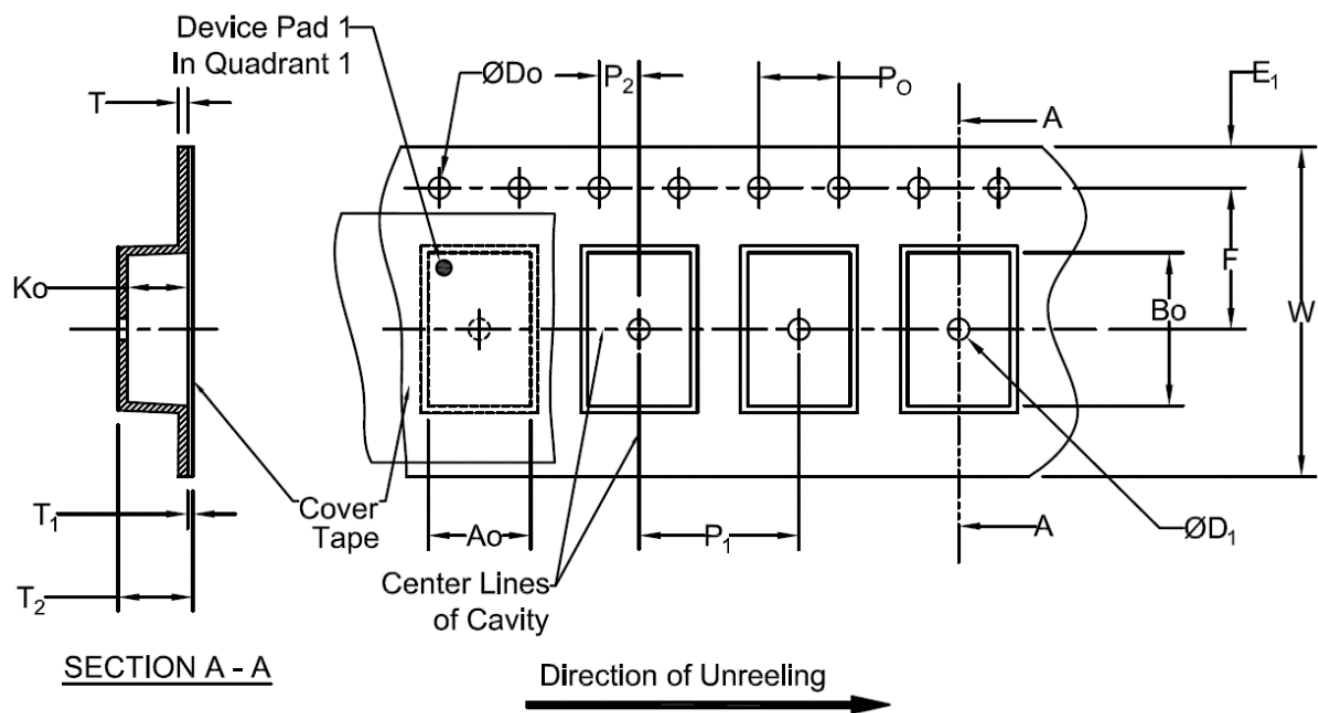
SECTION A - A

Tape Specifications (mm)							
Width	Ao	Bo	Do	D_1 (Min)	E_1	F	Ko
12mm	*	*	$1.5+0.1/-0.0$	1.0	1.75 ± 0.1	5.5 ± 0.05	*
Width	P_1	P_2	P_0	T (Max)	T_1 (Max)	T_2 (Max)	W (Max)
12mm	4.0 ± 0.1	2.0 ± 0.05	4.0 ± 0.1	0.6	0.1	6.5	12.3
*Note: Compliant to EIA-481							

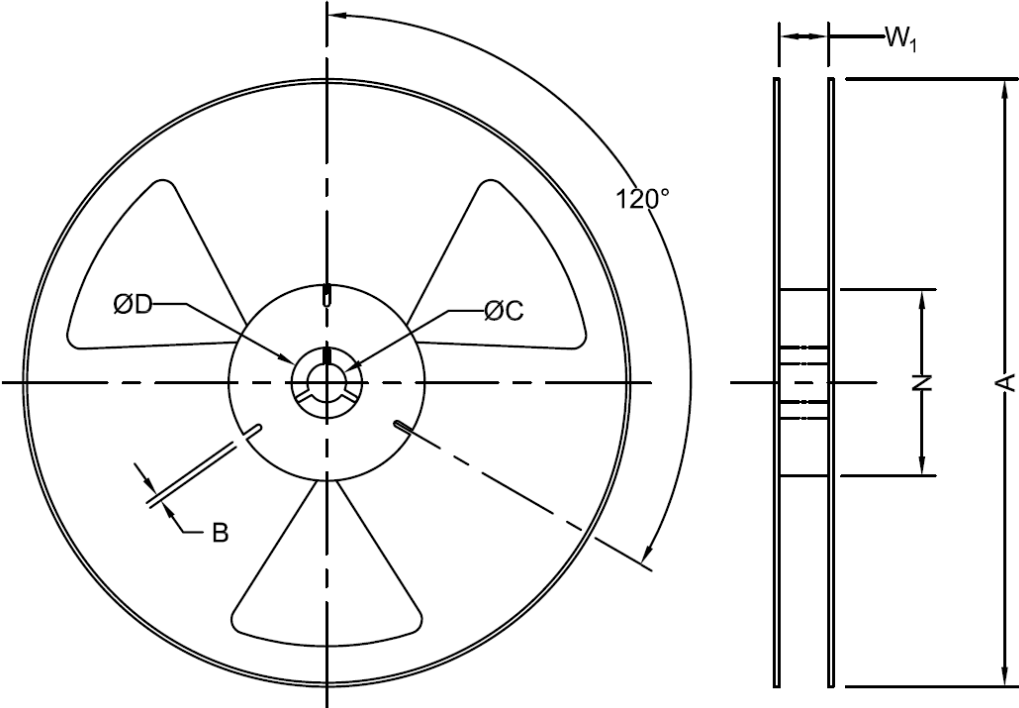


Reel Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W ₁
12mm	1000	178	1.5	13.0+0.5/-0.2	20.2	50	12.4+2.0/-0.0
	3000	178	1.5	13.0+0.5/-0.2	20.2	50	12.4+2.0/-0.0
*Note: Measured at Hub							

5.0 mm x 3.2 mm VDFN
T= 1,000pcs/reel
T3= 3,000pcs/reel



Tape Specifications (mm)							
Width	Ao	Bo	Do	D1 (Min)	E1	F	Ko
12mm	*	*	1.5+0.1/-0.0	1.0	1.75±0.1	5.5±0.05	*
Width	P1	P2	P0	T (Max)	T1 (Max)	T2 (Max)	W (Max)
12mm	8.0±0.1	2.0±0.05	4.0±0.1	0.6	0.1	6.5	12.3
*Note: Compliant to EIA-481							



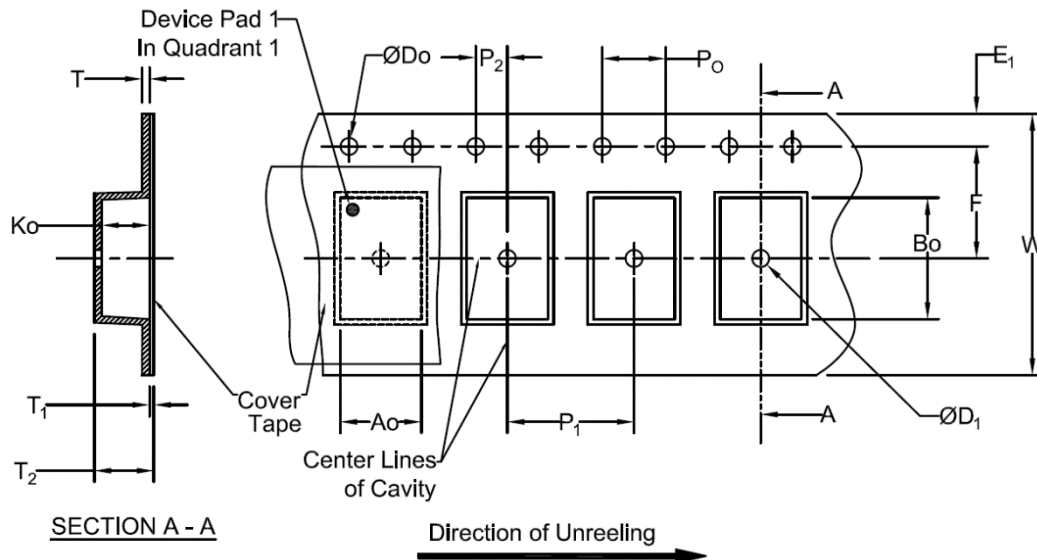
Reel Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W ₁
12mm	1000	178	1.5	13.0+0.5/-0.2	20.2	50	12.4+2.0/-0.0
	3000	330	1.5	13.0+0.5/-0.2	20.2	50	12.4+2.0/-0.0
*Note: Measured at Hub							

Dimensions: mm

7.0 mm x 5.0 mm VDFN

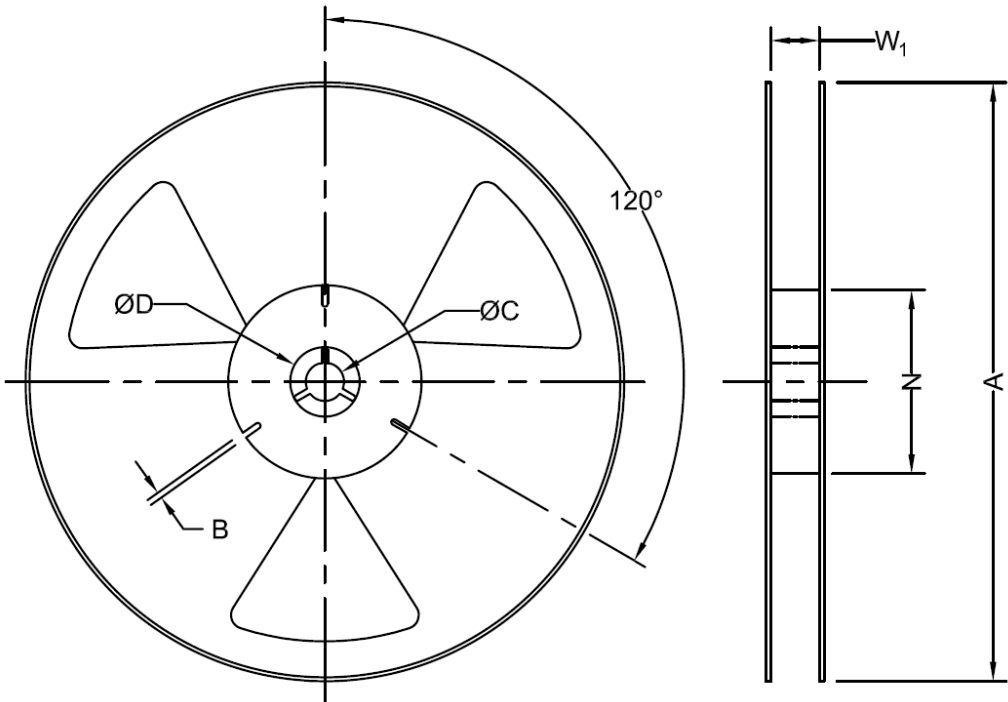
T= 1,000pcs/reel

T3= 3,000pcs/reel



Tape Specifications (mm)							
Width	Ao	Bo	Do	D ₁ (Min)	E ₁	F	Ko
16mm	*	*	1.5+0.1/-0.0	1.5	1.75±0.1	7.5±0.10	*
Width	P1	P2	P0	T (Max)	T1 (Max)	T2 (Max)	W (Max)
16mm	8.0±0.1	2.0±0.1	4.0±0.1	0.6	0.1	8.0	16.3

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



Reel Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W ₁
16mm	1000	178	1.5	13.0+0.5/-0.2	20.2	50	16.4+2.0/-0.0
16mm	3000	330	1.5	13.0+0.5/-0.2	20.2	50	16.4+2.0/-0.0

*Note: Measured at Hub