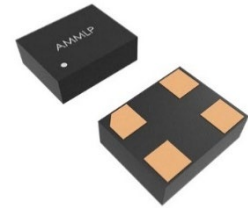


### Description

The Abracon AMMLP series is a programmable MEMS oscillator, offering three different package size configurations (2016mm, 2520mm, 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, 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:  $\pm 20$ ppm,  $\pm 25$ ppm,  $\pm 50$ 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	$f_0 = 20MHz, V_{DD} = 3.3V, \text{no load, output enabled}$
Standby Current Consumption ( $I_{STBY}$ )			1		$\mu A$	$V_{DD} = 1.8V/2.5V$
			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, <a href="#">Note 1</a>
Aging (@ +25°C)			$\pm 5$		ppm	First year
			$\pm 1$			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 <sub>IH</sub>	0.7*V <sub>DD</sub>		V	Input logic High, <a href="#">Note 3</a>
	V <sub>IL</sub>		0.3*V <sub>DD</sub>		Input logic Low, <a href="#">Note 3</a>
Power Supply Ramp (t <sub>PU</sub> )	0.1		100	ms	<a href="#">Note 2</a>
Start-up Time (t <sub>SU</sub> )		2.5		ms	From 90% V <sub>DD</sub> until the output start toggling
Output Enable Time (t <sub>OE</sub> )			1	μs	Pin 1 configured as OE
			2	ms	Pin 1 configured as Standby
Output Disable Time (t <sub>ODS</sub> )		15		ns	From OE toggle to output OFF
Rise (T <sub>r</sub> ) / Fall (T <sub>f</sub> ) Time 20% ↔ 80%, CL= 10 pF		1.4/1.3		ns	V <sub>DD</sub> = 1.8V
		1.1/1.0			V <sub>DD</sub> = 2.5V
		1.2/1.0			V <sub>DD</sub> = 3.3V
Cycle-to-Cycle Jitter (Peak) F <sub>OUT</sub> = 25MHz		40		ps	V <sub>DD</sub> = 1.8V
		18			V <sub>DD</sub> = 2.5V
		15			V <sub>DD</sub> = 3.3V
Period Jitter (Peak-to-Peak) F <sub>OUT</sub> = 25MHz		45		ps	V <sub>DD</sub> = 1.8V
		20			V <sub>DD</sub> = 2.5V
		18			V <sub>DD</sub> = 3.3V
RMS Period Jitter F <sub>OUT</sub> = 25MHz		6		ps	V <sub>DD</sub> = 1.8V
		2.5			V <sub>DD</sub> = 2.5V
		2.5			V <sub>DD</sub> = 3.3V
RMS Phase Jitter		1		ps	V <sub>DD</sub> = 3.3V, T <sub>a</sub> = 25°C± 3°C, 12kHz to 20MHz, F <sub>OUT</sub> = 100MHz

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

Note 2: Time to reach 90% of target V<sub>DD</sub>. Power ramp must be monotonic.

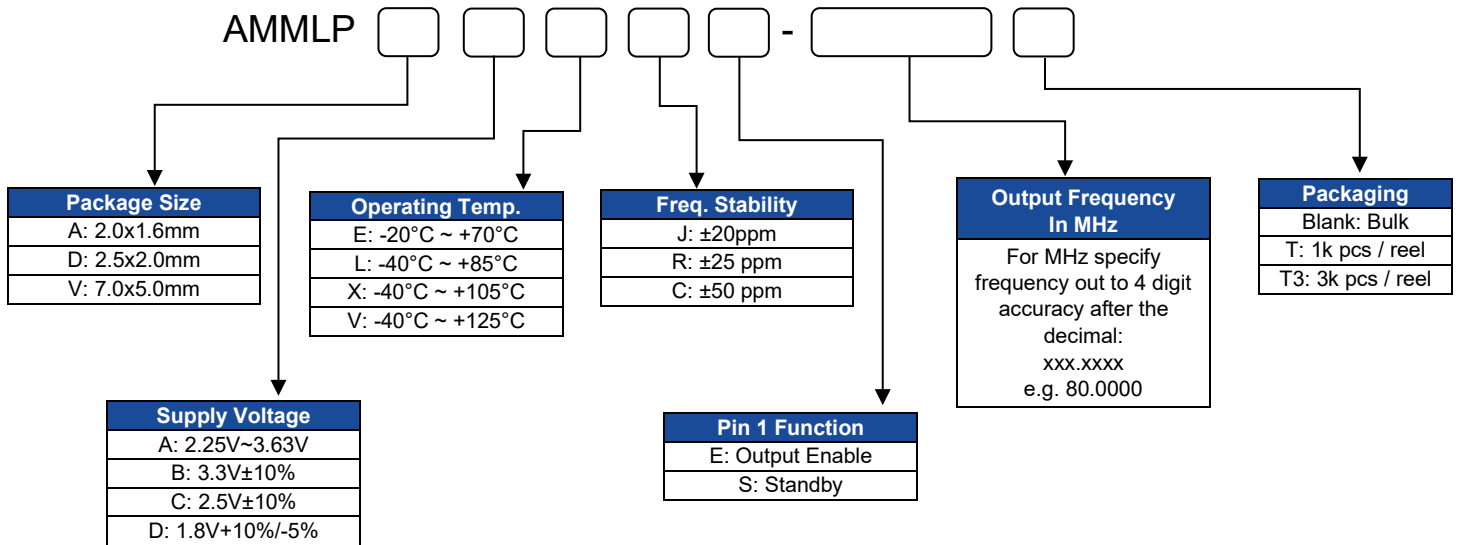
Note 3: Input waveform must be monotonic with rise/fall time <10 ms.

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

Parameters	Min.	Typ.	Max.	Units	Notes
Supply Voltage	-0.3		+4.0	V	
LVTTL Input Voltage	-0.3		V <sub>DD</sub> +0.3	V	
Maximum Junction Operating Temperature			+125	°C	
Ambient Operating Temperature Range	-40		+125	°C	Extended Industrial
Ambient Operating Temperature Range	-40		+105	°C	Extended Industrial
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, 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**

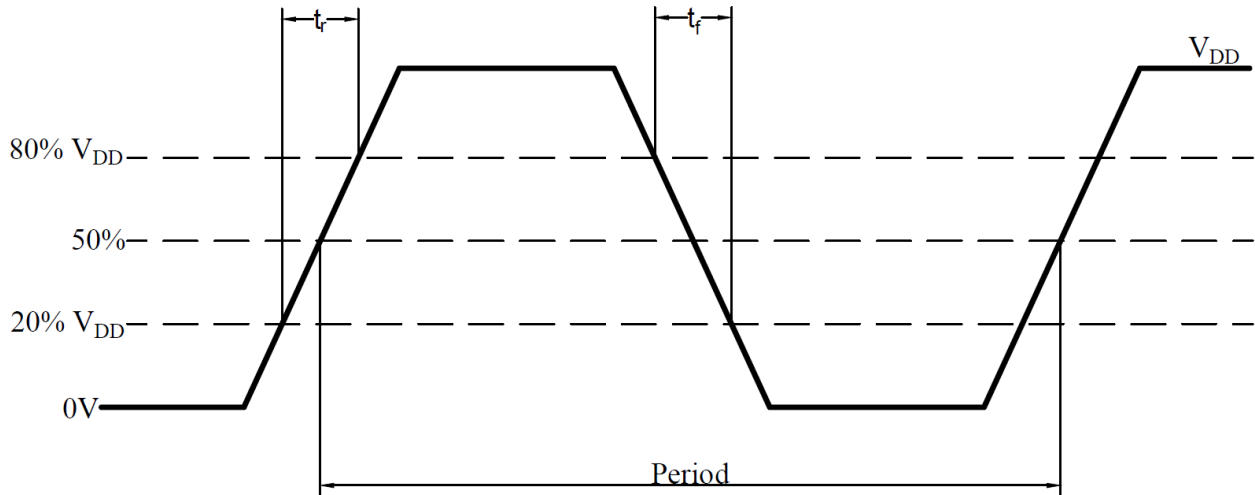
Pin #	Pin Name	Description
1	OE	<i>Output Enable:</i> <a href="#">Note 6&amp;8</a> Logic High or No Connect: Output Enabled Logic Low: Output Disabled (High impedance) External pull-up recommended for normal operation.
	STBY	<i>Standby:</i> <a href="#">Note 6&amp;8</a> Logic High or No Connect: Output Enabled Logic Low: Output Disabled - Device is in Standby (Both output buffer and PLL disabled) External pull-up recommended for normal operation.
2	GND	Ground
3	Output	Oscillator clock output
4	V <sub>DD</sub>	Power Supply: 1.71V to 3.63V <a href="#">Note 7</a>

Note 6: If pin 1 is high or floating, there will be frequency output. If pin 1 is low, output will be disabled.

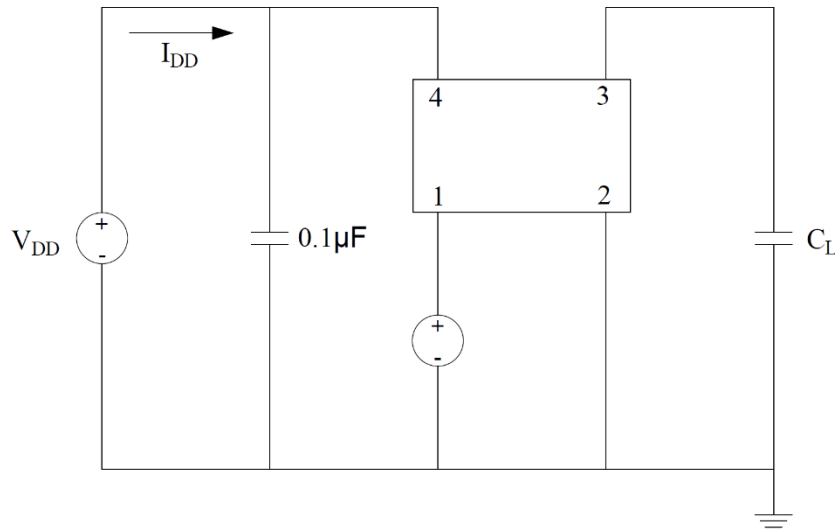
Note 7: Bypass with 0.1 μF capacitor placed as close to V<sub>DD</sub> pin as possible.

Note 8: 70 KΩ (minimum) internal pull-up resistor present on pin 1.

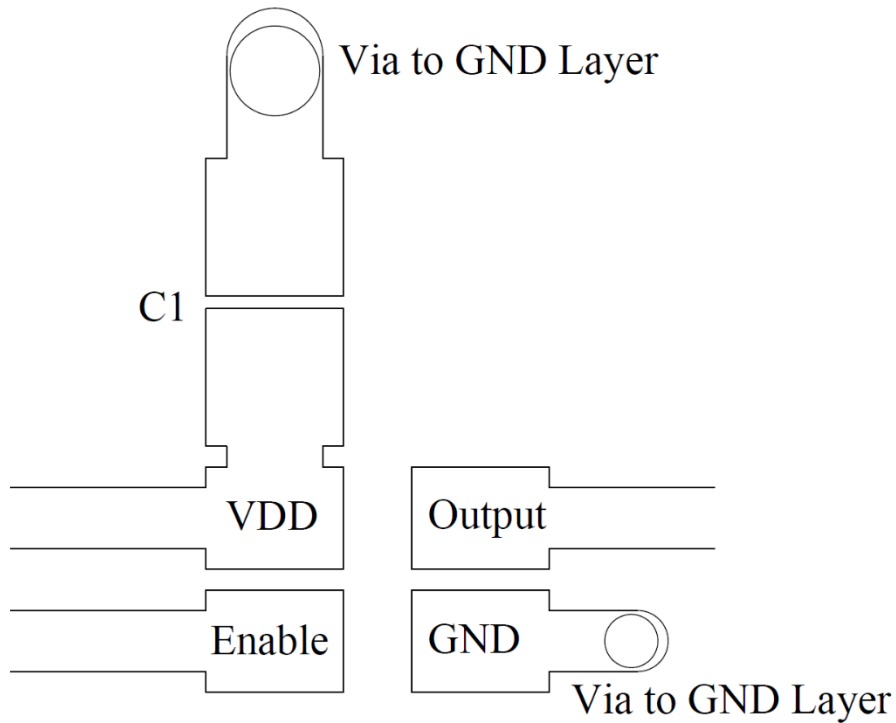
**Output Waveform**



**Test Circuit**

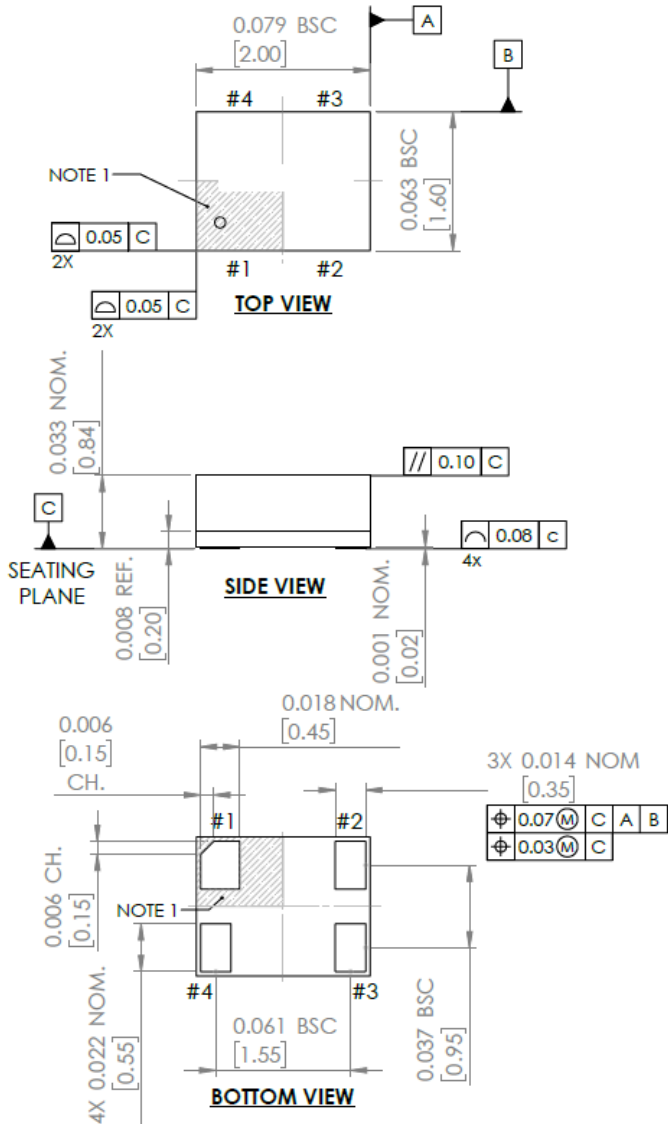


**Recommended Board Layout**

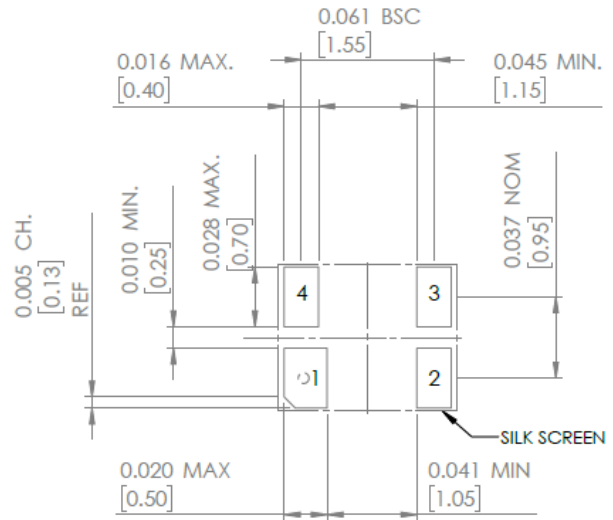


**Mechanical Dimensions**

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

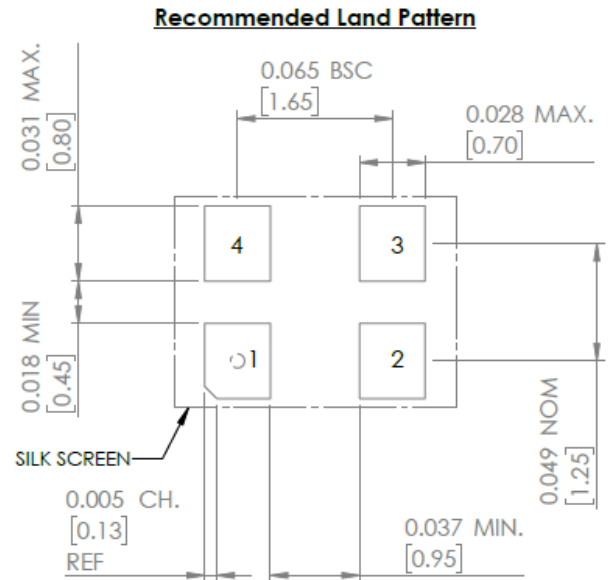
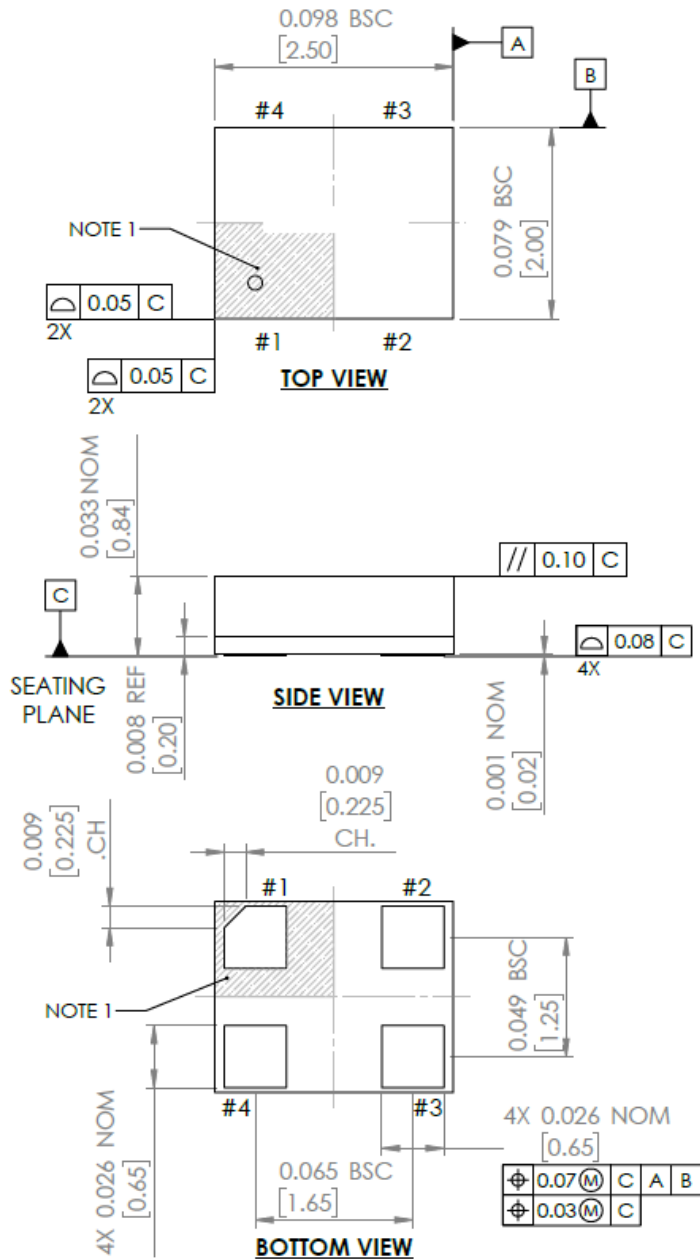
Note 3:  
Dimensioning and tolerance per ASME Y14.5M

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



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

Note 2:  
 Package is saw singulated

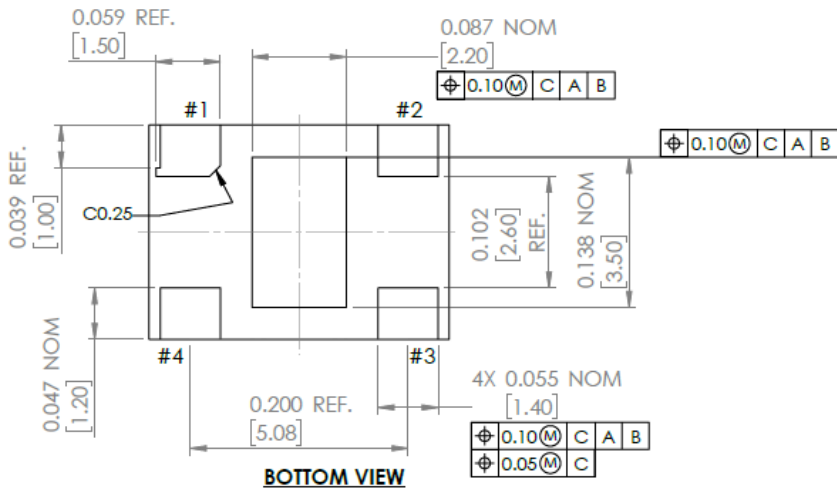
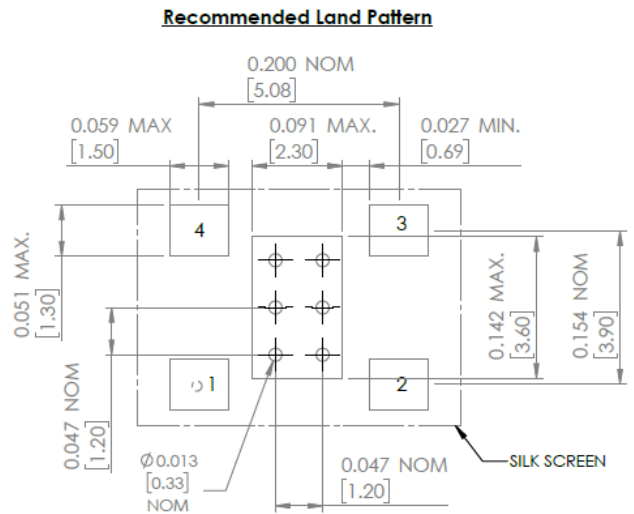
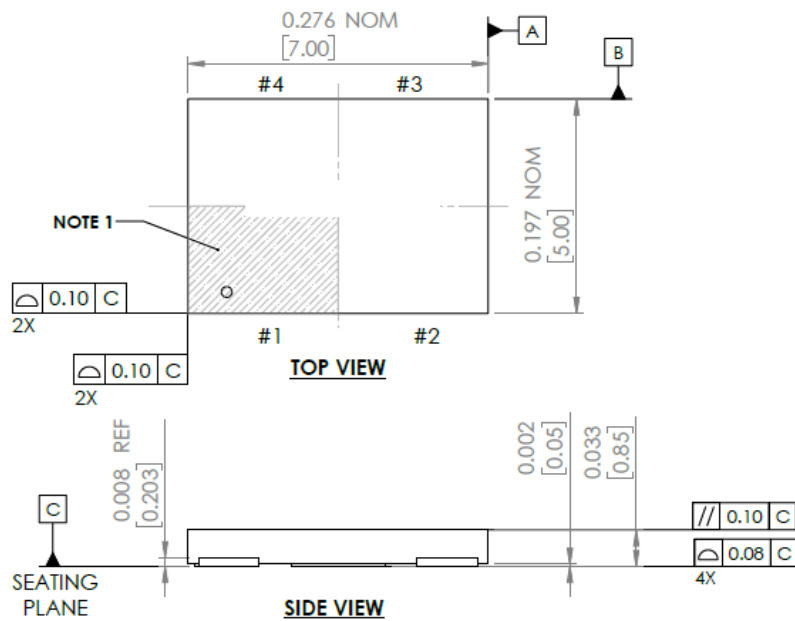
Note 3:  
 Dimensioning and tolerance per ASME Y14.5M

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]

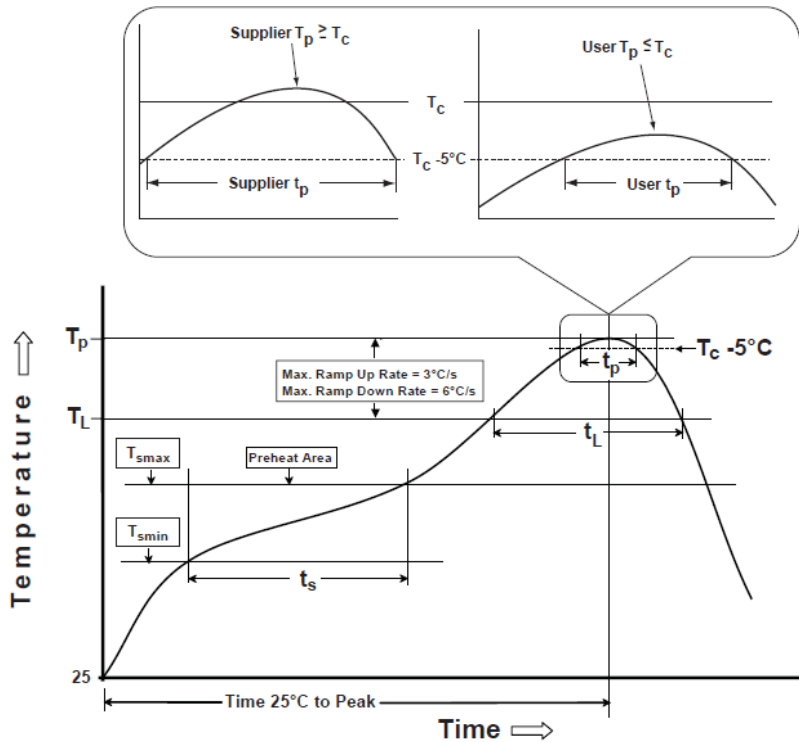


Table 1

SnPb Eutectic Process Classification Temperatures ( $T_c$ )		
Package Thickness	Volume $mm^3$ <350	Volume $mm^3$ $\geq$ 350
<2.5 mm	235 °C	220 °C
$\geq$ 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.

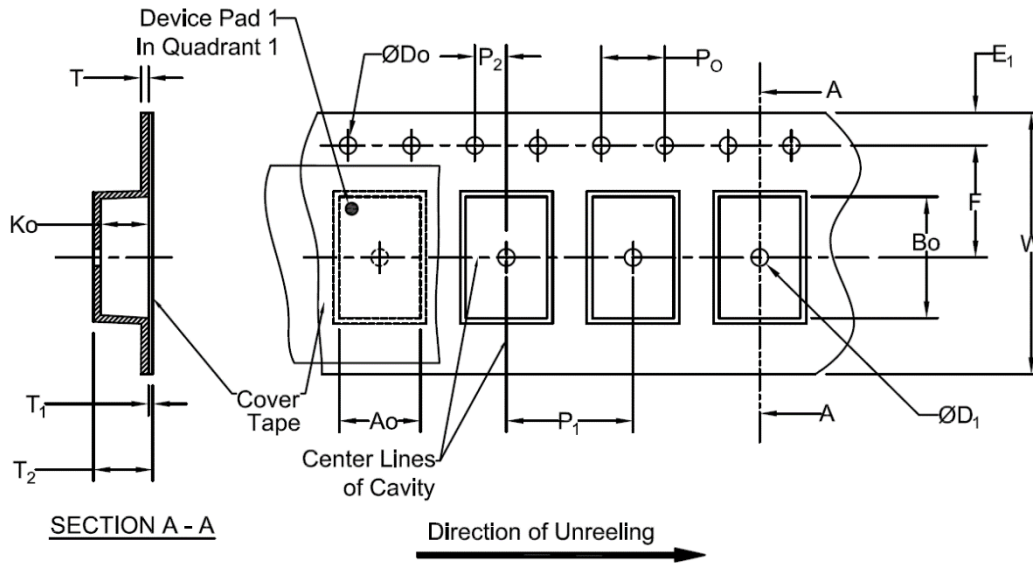
\*\*Tolerance for time at peak profile temperature ( $t_p$ ) is defined as supplier minimum and a user maximum.

**Packaging**

2.0 mm x 1.6 mm VFLGA

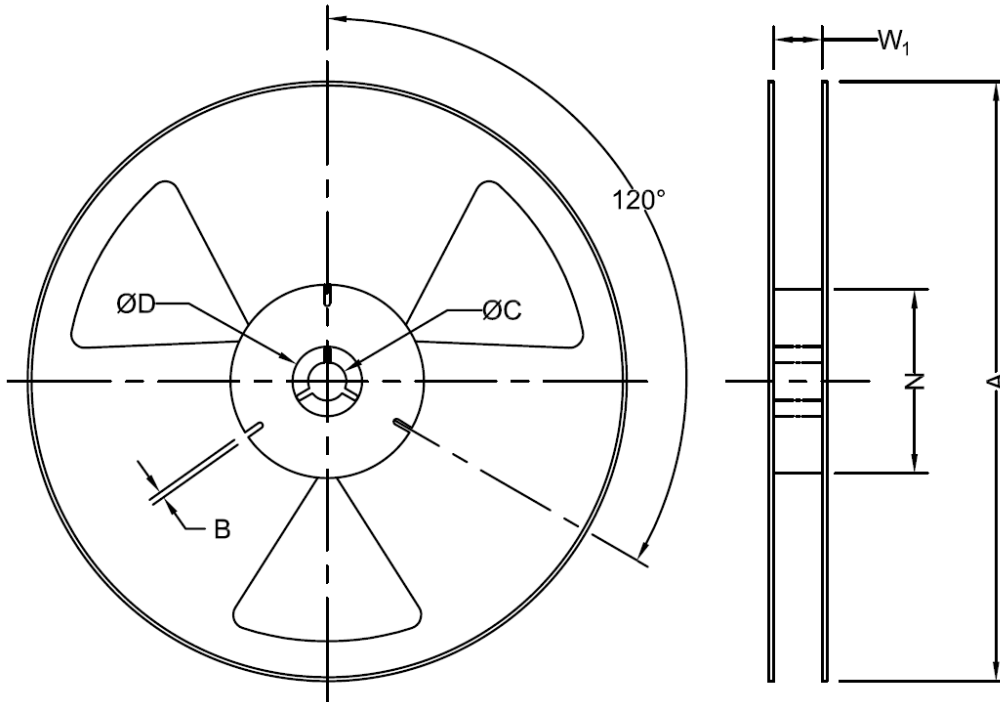
T=1,000pcs/reel

T3=3,000pcs/reel



Tape Specifications (mm)							
Width	Ao	Bo	Do	D <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	*
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**



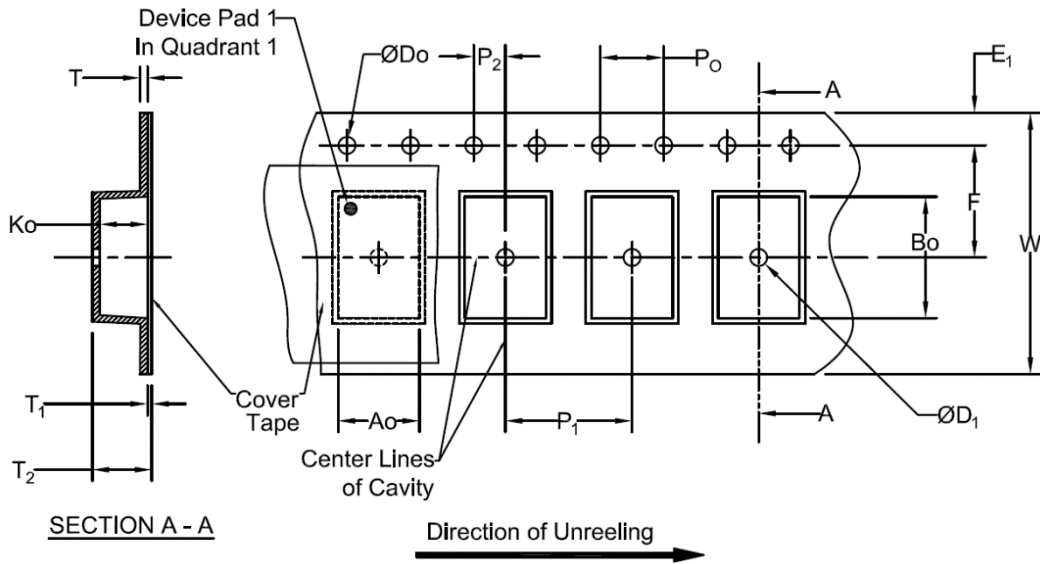
Reel Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W <sub>1</sub>
8mm	1000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0
	3000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0

**\*Note: Measured at Hub**

2.5 mm x 2.0 mm VLGA

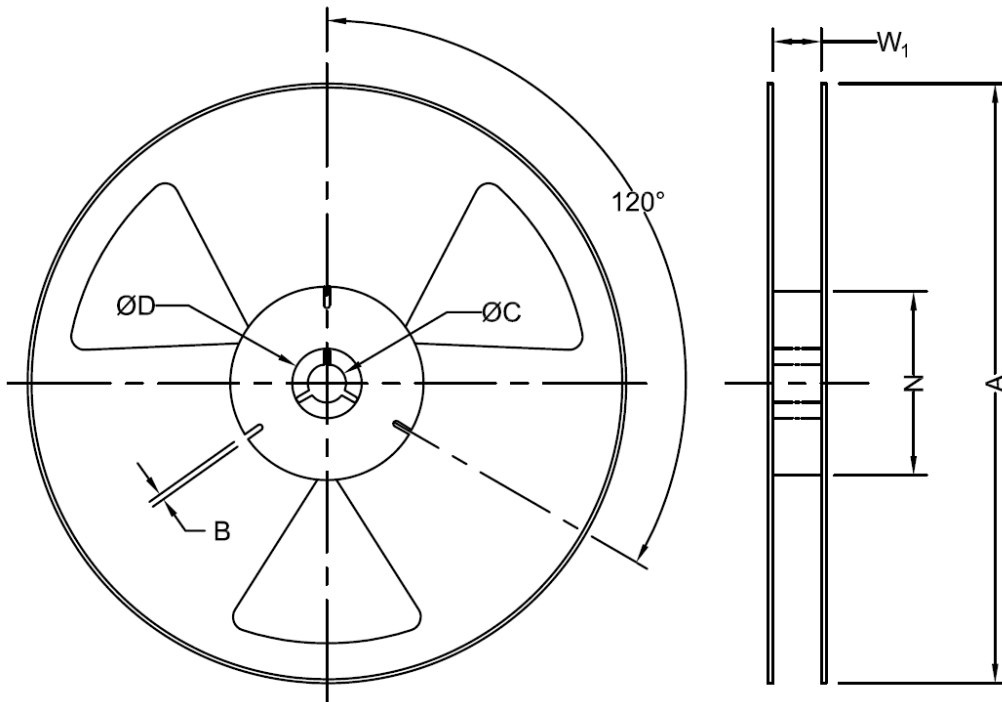
T= 1,000pcs/reel

T3= 3,000pcs/reel



Tape Specifications (mm)							
Width	Ao	Bo	Do	D <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	*
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



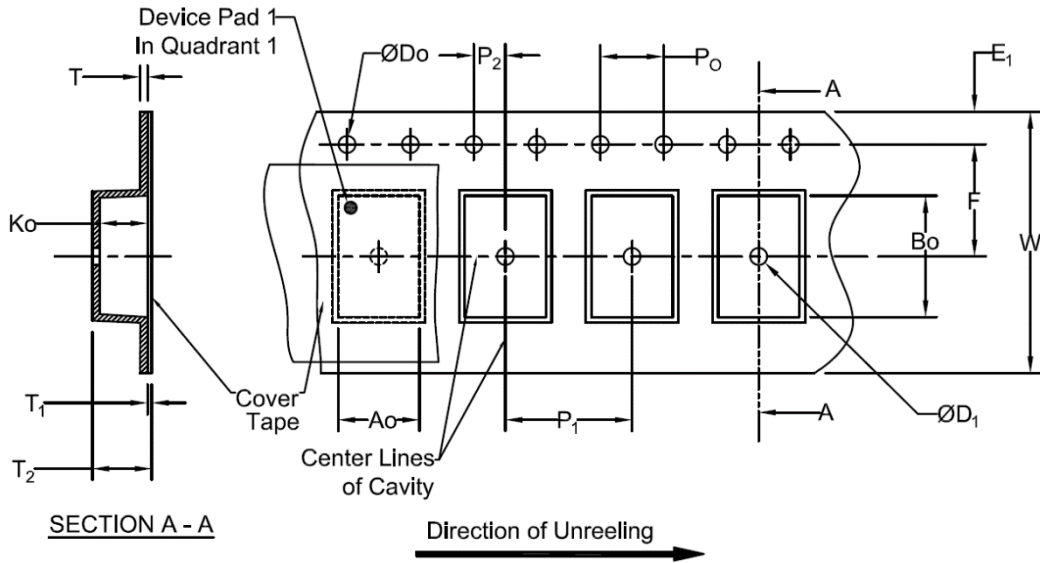
Reel Specifications (mm)							
Width	Qty/Reel	A (Nom)	B (Min)	C (Min)	D (Min)	N (Min)	*W <sub>1</sub>
8mm	1000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0
	3000	178	1.5	13.0+0.5/-0.2	20.2	50	8.4+1.5/-0.0

\*Note: Measured at Hub

7.0 mm x 5.0 mm VDFN

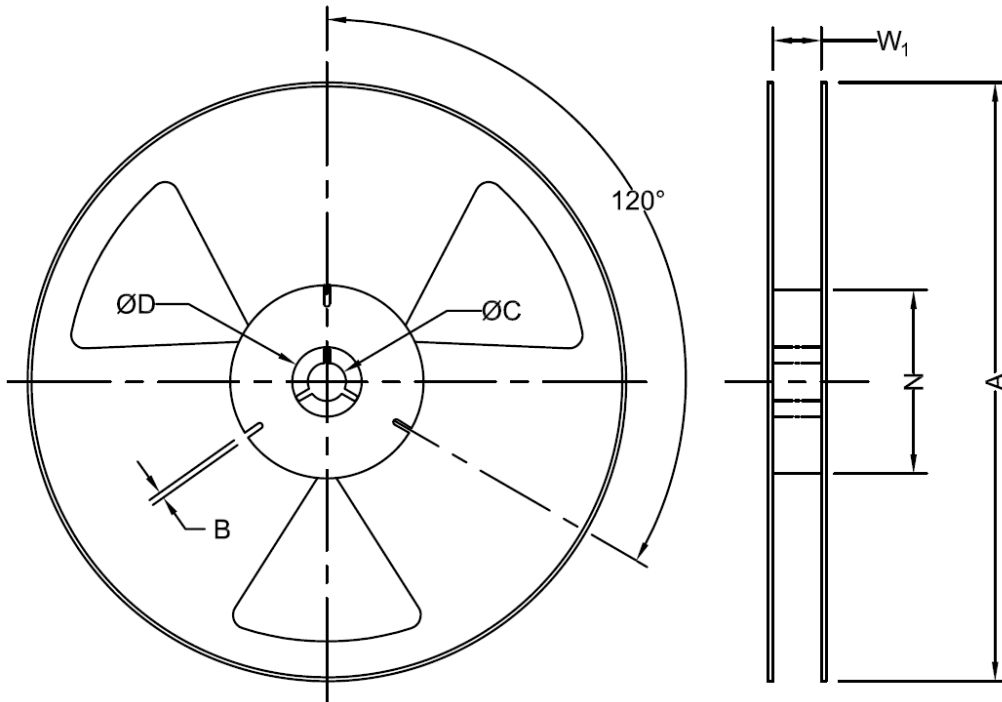
T= 1,000pcs/reel

T3= 3,000pcs/reel



Tape Specifications (mm)							
Width	Ao	Bo	Do	D <sub>1</sub> (Min)	E <sub>1</sub>	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 <sub>1</sub>
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**