



**THE DATASHEET OF  
AMPMEFA-12.0000T3**



# POWER OPTIMIZED MEMS OSCILLATORS



## AMPM-SERIES



ESD Sensitive



RoHS/RoHS II Compliant

1.6 x 1.2 x 0.84 mm  
2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

MSL = MSL 1

### FEATURES

- Compact footprint as small as 1.6x1.2mm
- Low 0.84mm profile
- Low power consumption
- 1MHz to 80MHz output frequency range
- Short lead time for new frequencies
- Wide -40°C to +85°C operating temperature range
- Output enable or ultra-low power standby: 12µA (typ)
- Low operating current: 1.3mA IDD (typ)

### APPLICATIONS

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

### ELECTRICAL SPECIFICATIONS

Electrical characteristics unless otherwise indicated,  $V_{DD} = 1.8V -5\%$  to  $3.3V +10\%$ , temperature range  $-40^{\circ}C$  to  $85^{\circ}C$

Parameters	Min.	Typ.	Max.	Units	Note
Frequency Range	1.0000		80.0000	MHz	
Power Supply Voltage ( $V_{DD}$ )	1.71		3.63	V	
Current Consumption ( $I_{DD}$ )		1.3		mA	$f_{out} = 24MHz, V_{DD} = 1.8V,$ No Load
Standby Current Consumption ( $I_{STBY}$ )		12	30	µA	$V_{DD} = 1.8/2.5V$
		80	160		$V_{DD} = 3.3V$
Operating Temperature Range	-40		+85	°C	See Options
Storage Temperature	-55		+150	°C	
All Inclusive Frequency Stability	-25		+25	ppm	Options "D" or "F"
	-50		+50		Options "E" or "G"
Aging	-5		+5	ppm	1 <sup>st</sup> year @25°C
	-1		+1		Per year after first year
Duty Cycle	45		55	%	1 MHz to 39 MHz
	40		60		61 MHz to 80 MHz 40 MHz to 60 MHz
Output Logic Levels	$V_{OH}$	$0.8 * V_{DD}$		V	Logic High I = 1 mA
	$V_{OL}$		$0.2 * V_{DD}$		Logic Low I = -1 mA
Input Logic Levels	$V_{IH}$	$0.7 * V_{DD}$		V	Logic High
	$V_{IL}$		$0.3 * V_{DD}$		Logic Low
Enable Pull-Up Resistor		300		kΩ	
Power Supply Ramp ( $t_{PU}$ )	0.1		100	ms	Time to 90% targeted $V_{DD}$
Start-up Time ( $t_{SU}$ )			1.5	ms	From 90% $V_{DD}$ to valid clock output, @ 25°C

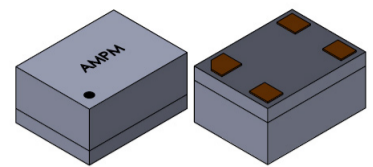


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2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

## ELECTRICAL SPECIFICATIONS

Parameters		min	Typ.	Max.	Units	Note
Output Enable Time ( $t_{EN}$ )				1	$\mu$ s	
Output Disable Time ( $t_{DA}$ )				200+2period	ns	
Rise( $T_r$ )/Fall ( $T_f$ ) Time	Low Drive 20% $\leftrightarrow$ 80%		2.5	3.5	ns	CL = 5 pF   $V_{DD} = 1.8V$
			1.5	2.2		CL = 5 pF $V_{DD} = 2.5V/3.3V$
	Std Drive 20% $\leftrightarrow$ 80%		1.2	2.0		CL = 10 pF   $V_{DD} = 1.8V$
			0.6	1.2		CL = 10 pF $V_{DD} = 2.5V/3.3V$
RMS Period Jitter	Low Drive $f_{out} = 27$ MHz		32	40	ps	$V_{DD} = 1.8V$
			25	32		$V_{DD} = 2.5/3.3V$
	Std Drive $f_{out} = 27$ MHz		23	30		$V_{DD} = 1.8V$
			20	28		$V_{DD} = 2.5/3.3V$
Cycle-to-Cycle Jitter (Peak)	Low Drive $f_{out} = 27$ MHz		180	240	ps	$V_{DD} = 1.8V$
			120	170		$V_{DD} = 2.5/3.3V$
	Std Drive $f_{out} = 27$ MHz		115	190		$V_{DD} = 1.8V$
			90	150		$V_{DD} = 2.5/3.3V$

## ABSOLUTE MAXIMUM RATINGS

Parameters	min	Typ.	Max.	Units	Note
Supply Voltage	-0.3		+4.0	V	
Input Voltage	-0.3		$V_{DD} + 0.3$	V	
Maximum Junction Temperature			+150	$^{\circ}C$	
Ambient Operating Temperature	-40		+85	$^{\circ}C$	Industrial
Ambient Operating Temperature	-20		+70	$^{\circ}C$	Extended Commercial
Storage Ambient Temperature Range	-55		+150	$^{\circ}C$	
Soldering Temperature		+260		$^{\circ}C$	
ESD Protection	4 kV HBM, 400V MM, 2 kV CDM				



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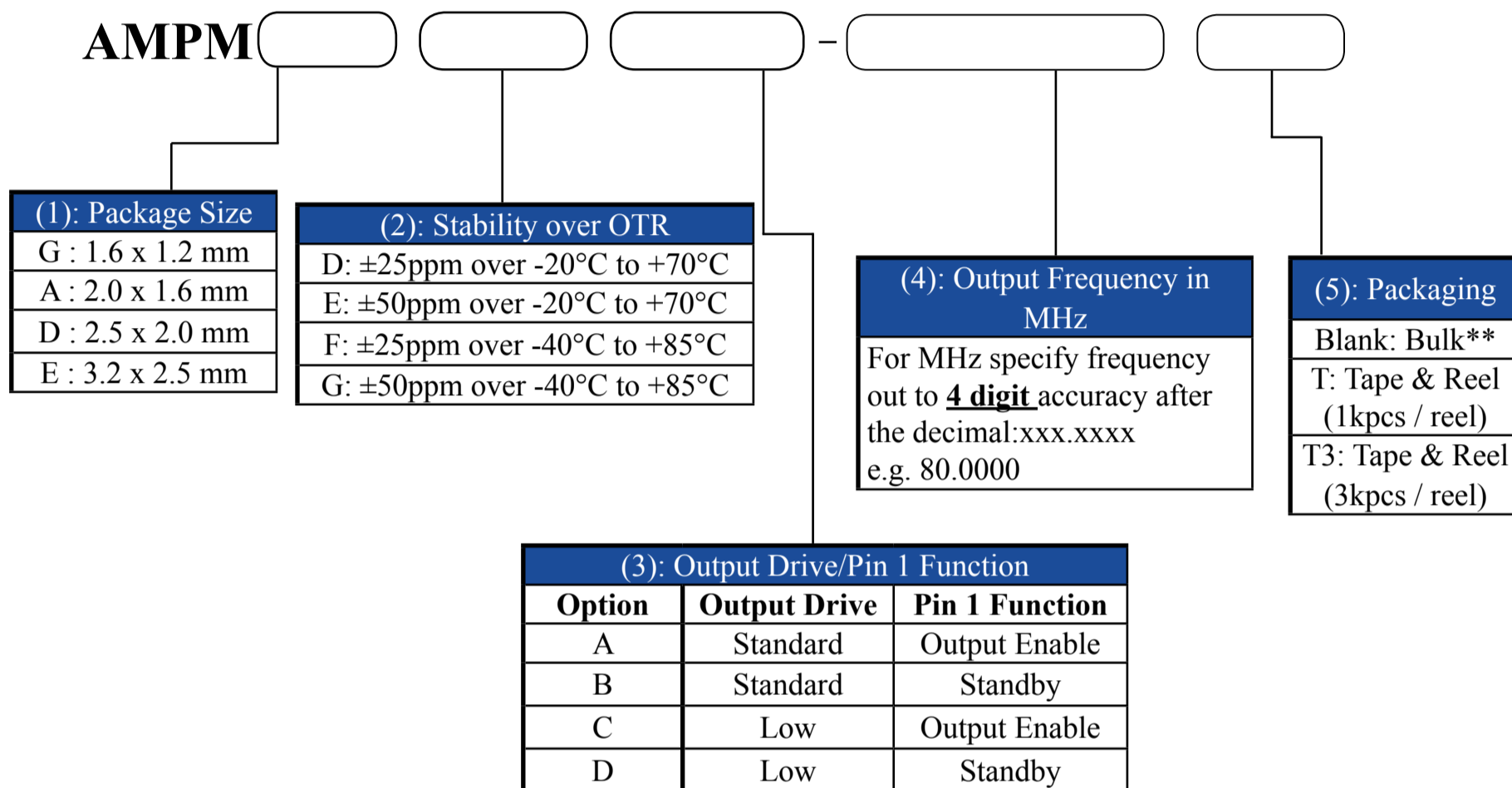


RoHS/RoHS II Compliant

MSL = MSL 1

1.6 x 1.2 x 0.84 mm  
2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

## OPTIONS AND PART IDENTIFICATION



*Part Number Example:*

**AMPMGGD - 16.0000T**

\*\*MOQ per package:

1.6x1.2mm: 100pcs/bag

2.0x1.6mm: 100pcs/bag

2.5x2.0mm: 140 pcs/tube

3.2x2.5mm: 110 pcs/tube

For Quick turn-around programmable sample orders less than MOQ represented above:

Due to the immediate availability of stock and the qty of the order, the parts may be delivered as Cut Tape, Loose parts in Antistatic Bag or in Tube(s).

For orders equal to or greater than MOQ and less than 1000pcs:

Due to packaging, the order must be a multiple of MOQ per package size above

For orders equal to or greater than 1000pcs:

Bulk is not an option. Please refer to tape and reel packaging.



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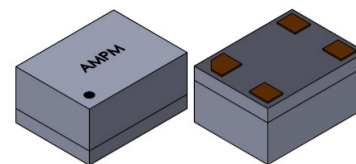
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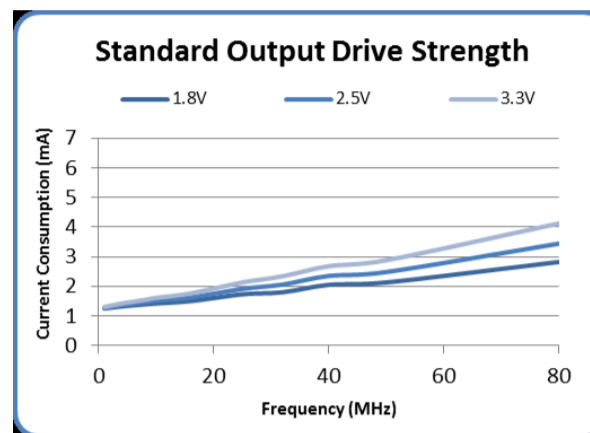
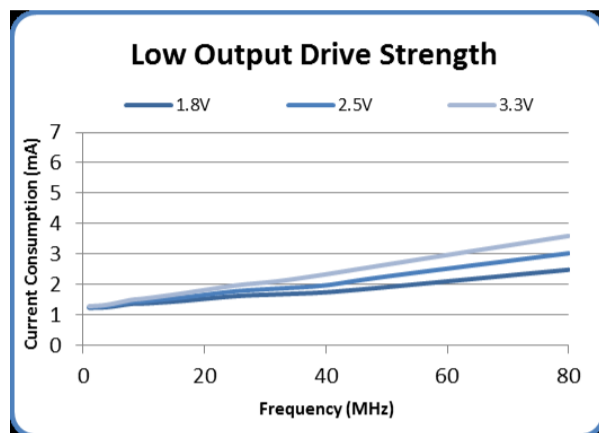
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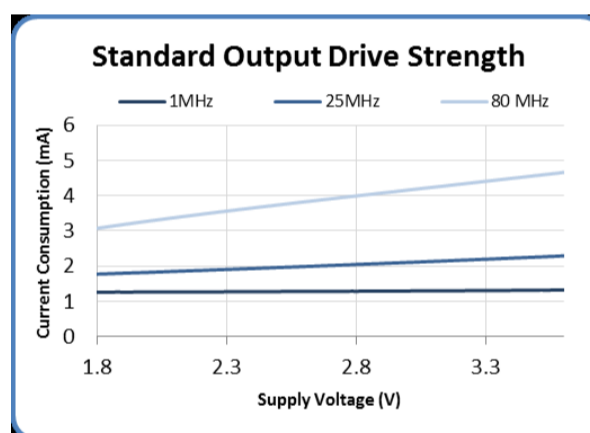
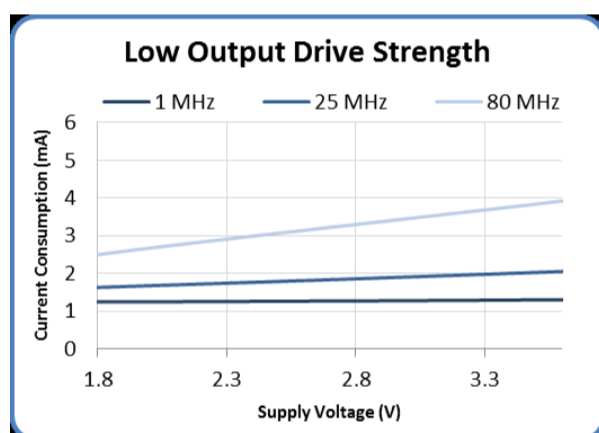
1.6 x 1.2 x 0.84 mm  
2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

## TYPICAL PERFORMANCE DATA @ 25°C ± 3°C

### Current Consumption vs Frequency



### Current Consumption vs Supply Voltage



## PINFUNCTIONS

Pin Number	Pin Name	Description
1	OE	Output Enable <sup>Note 1&amp;3</sup> : High or Open = Specified Frequency Output Low = Output is high impedance
	STBY	Standby <sup>Note 1&amp;3</sup> : High or Open = Specified Frequency Output Low = Output is high impedance, Device is in low power mode, Supply current is $I_{STBY}$
2	GND	Power Supply Ground
3	Output	Oscillator clock output
4	V <sub>DD</sub>	Power supply <sup>Note 2</sup>

### Notes :

1. If pin 1 is high or floating, there will be frequency output. If pin 1 is low, output will be disengaged.
2. Bypass with 0.1  $\mu$ F capacitor placed as close to VDD pin as possible.
3. 300 K $\Omega$  internal pull-up resistor present on pin 1.



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## OUTPUT BUFFER OPTIONS

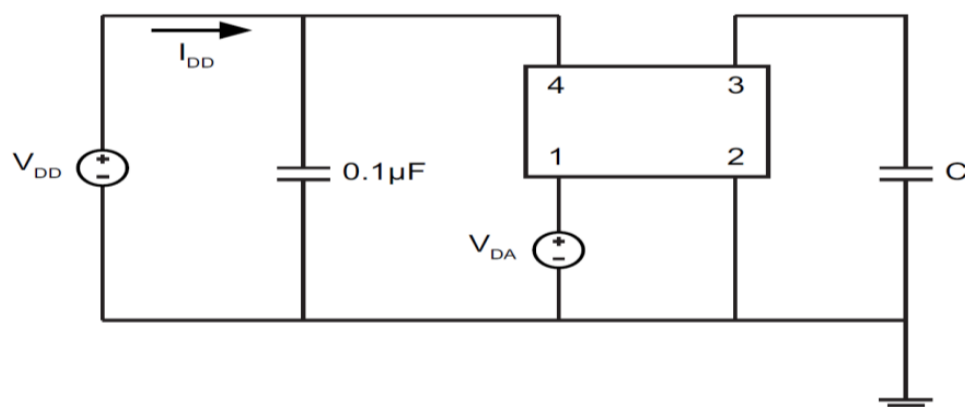
The AMPM Series is available in multiple output driver configurations. The low-power driver minimizes current consumption and EMI while delivering greater than 1 mA output current at 20% to 80% of the supply voltage. The standard-drive delivers greater than 3 mA output current at 20% to 80% of the supply voltage.

## DIAGRAMS

### Output Waveform



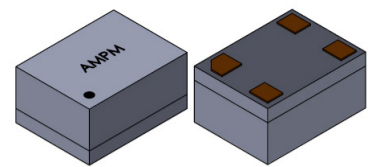
### Test Circuit



### Recommended Board Layout



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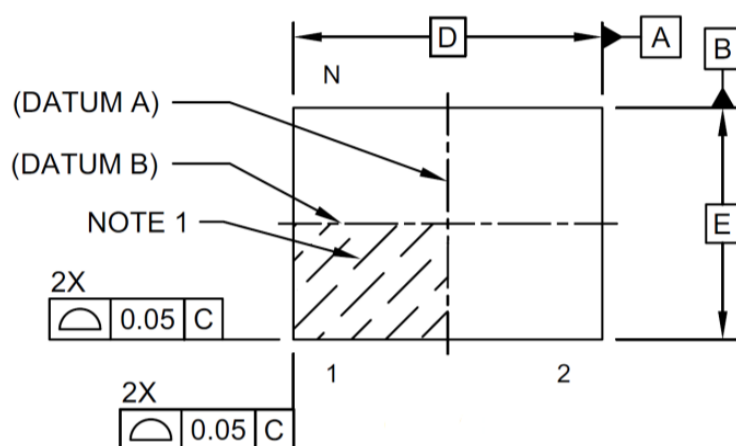
1.6 x 1.2 x 0.84 mm  
2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

MSL = MSL 1

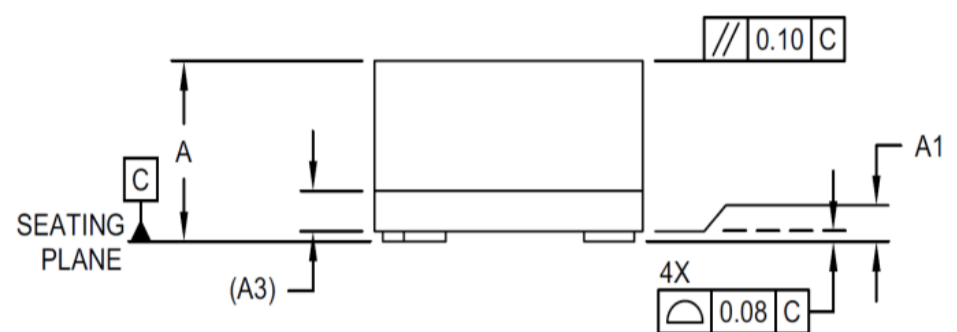
## MECHANICAL DIMENSIONS

### 1.6 x 1.2 mm VFLGA Package Outline

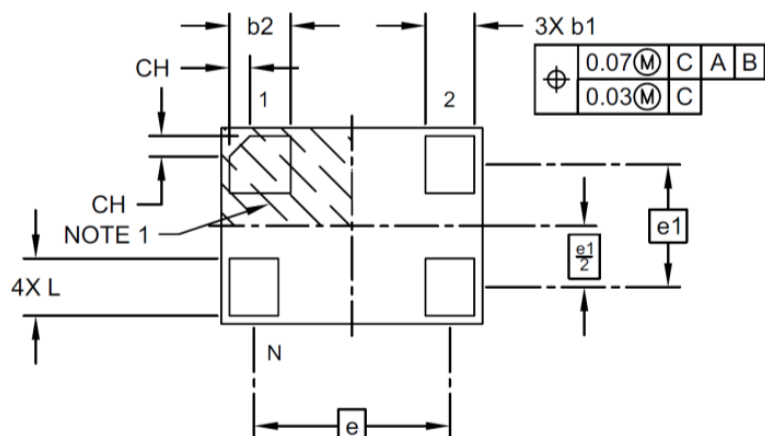
#### Top View



#### Side View



#### Bottom View



Description	Marker	Dimensions (mm)
Number of Terminals	N	4
Terminal Pitch	e	1.20 BSC
Terminal Pitch	e1	0.75 BSC
Overall Height	A	0.84 ± 0.05
Standoff*	A1	.02
Substrate Thickness (with Terminals)	A3	0.20REF
Overall Length	D	1.60BSC
Overall Width	E	1.20BSC
Terminal Width	b1	0.30 ± 0.05
Terminal Width	b2	0.375 ± 0.05
Terminal Length	L	0.35 ± 0.05
Terminal 1 Index Chamfer	CH	0.125

\*Standoff max .05 mm and min 0.00 mm

Dimensioning and tolerance per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances

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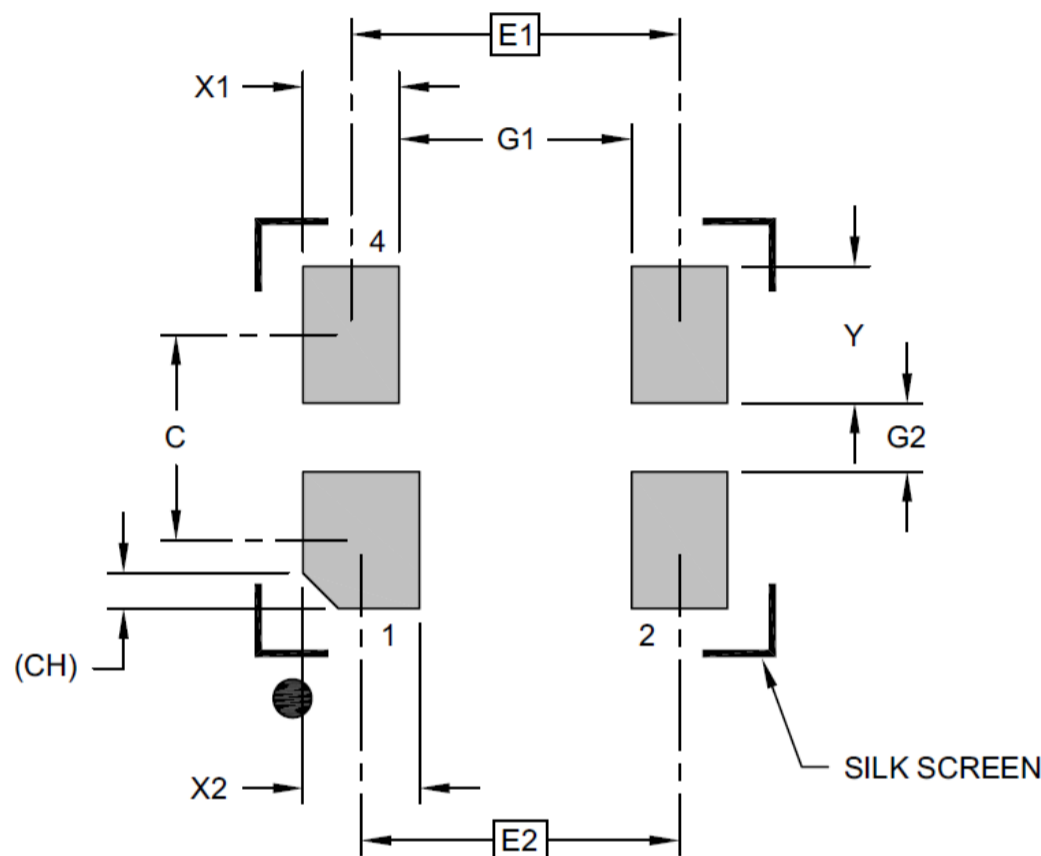
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2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

## MECHANICAL DIMENSIONS

### Recommended Landing Pattern



Description	Marker	Max	Typ	Max	Unit
Contact Pitch	E1	1.20 BSC			mm
Contact Pitch	E2	1.16 BSC			
Contact Spacing	C		0.75		
Contact Width	X1			0.35	
Contact Width	X2			0.43	
Contact Pad Length	Y			0.50	
Space Between Contacts	G1	0.85			
Space Between Contacts	G2	0.25			
Contact 1 Index Chamfer	CH	0.13 x 45° REF			

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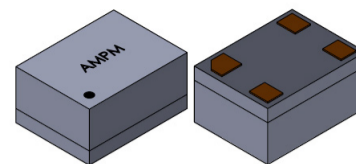


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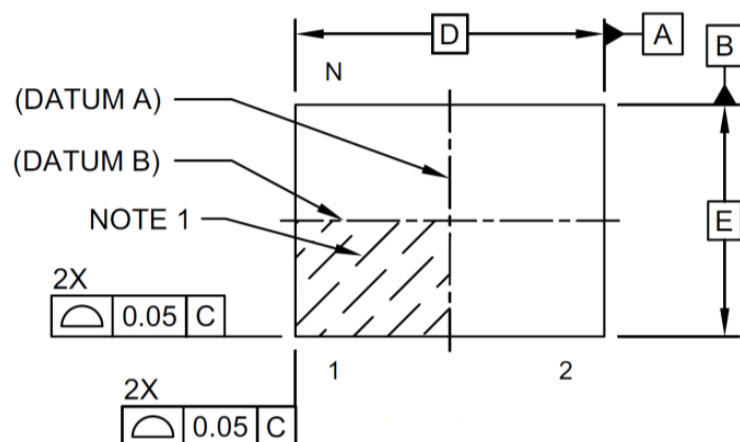
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2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

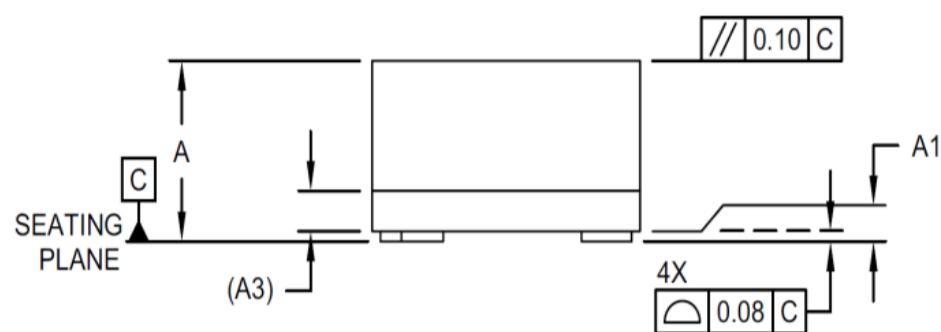
## MECHANICAL DIMENSIONS

### 2.0 x 1.6 mm VFLGA Package Outline

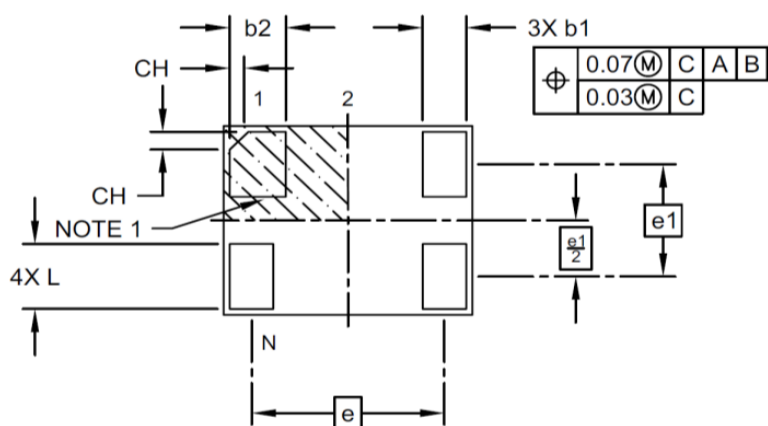
#### Top View



#### Side View



#### Bottom View



Description	Marker	Dimensions (mm)
Number of Terminals	N	4
Terminal Pitch	e	1.55 BSC
Terminal Pitch	e1	0.95 BSC
Overall Height	A	0.84 ± 0.05
Standoff*	A1	.02
Substrate Thickness (with Terminals)	A3	0.20 REF
Overall Length	D	2.00 BSC
Overall Width	E	1.60 BSC
Terminal Width	b1	0.35 ± 0.05
Terminal Width	b2	0.45 ± 0.05
Terminal Length	L	0.55 ± 0.05
Terminal 1 Index Chamfer	CH	0.15

\*Standoff max .05 mm and min 0.00 mm

Dimensioning and tolerance per ASME Y14.5M

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2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

MSL = MSL 1

## MECHANICAL DIMENSIONS

### Recommended Landing Pattern



Description	Marker	Max	Typ	Max	Unit
Contact Pitch	E2	1.55 BSC			mm
Contact Spacing	C		0.95		
Contact Width	X1			0.50	
Contact Width	X2			0.40	
Contact Pad Length	Y			0.70	
Space Between Contacts	G1	1.05			
Space Between Contacts	G2	0.25			
Contact 1 Index Chamfer	CH	0.13 x 45° REF			

Dimensioning and tolerance per ASME Y14.5M

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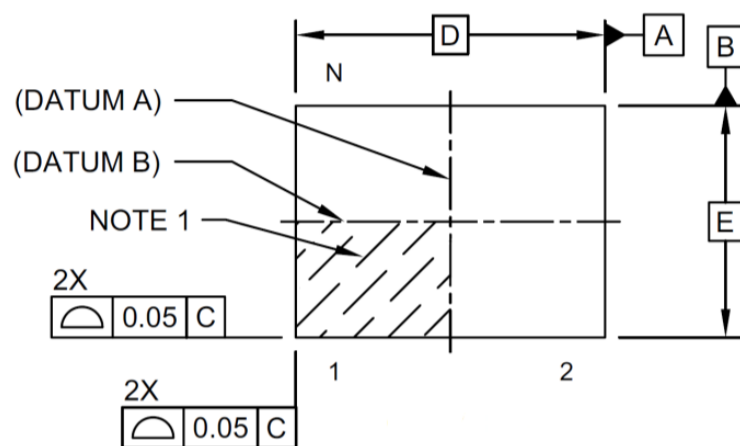
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2.0 x 1.6 x 0.84 mm  
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3.2 x 2.5 x 0.85 mm

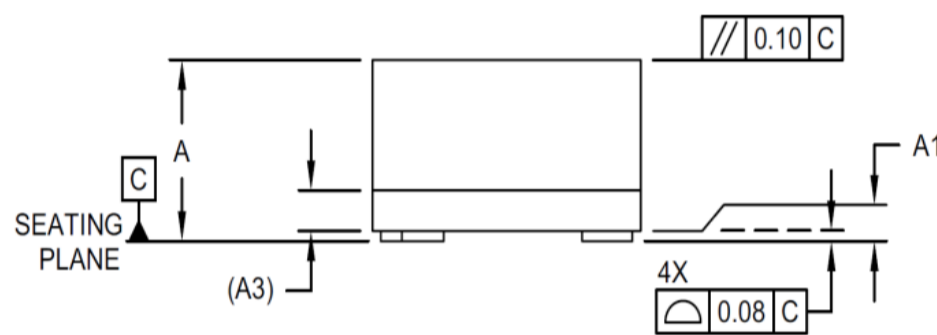
## MECHANICAL DIMENSIONS

### 2.5 x 2.0 mm VLGA Package Outline

#### Top View



#### Side View



#### Bottom View



Description	Marker	Dimensions (mm)
Number of Terminals	N	4
Terminal Pitch	e	1.65 BSC
Terminal Pitch	e1	1.25 BSC
Overall Height	A	0.84 ± 0.05
Standoff*	A1	.02
Substrate Thickness (with Terminals)	A3	0.20REF
Overall Length	D	2.50BSC
Overall Width	E	2.00BSC
Terminal Width	b1	0.65 ± 0.05
Terminal Length	L	0.65 ± 0.05
Terminal 1 Index Chamfer	CH	0.225

\*Standoff max .05 mm and min 0.00 mm

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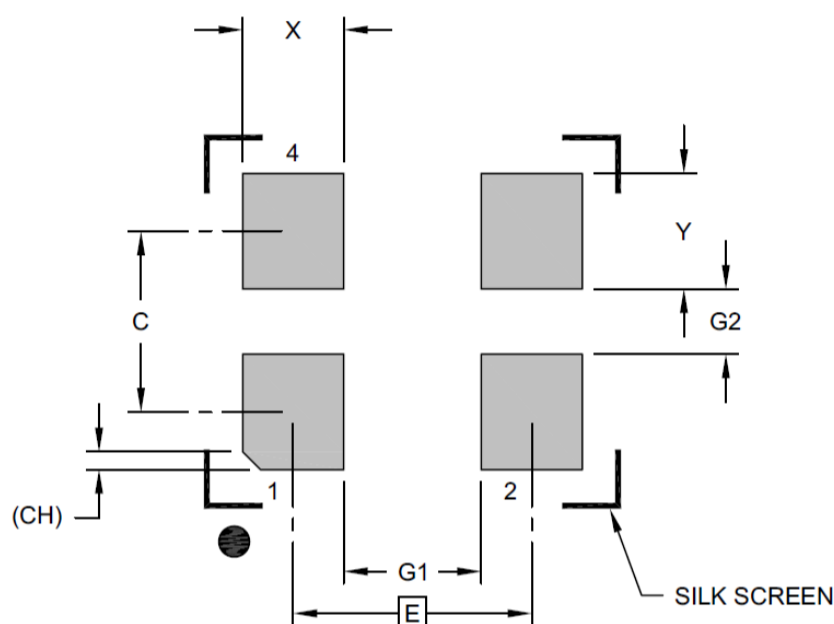
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2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

## MECHANICAL DIMENSIONS

### Recommended Landing Pattern



Description	Marker	Max	Typ	Max	Unit
Contact Pitch	E	1.65 BSC			mm
Contact Spacing	C		1.25		
Contact Width	X1			0.70	
Contact Width	X2			0.80	
Contact Pad Length	Y			0.50	
Space Between Contacts	G1	0.95			
Space Between Contacts	G2	0.45			
Contact 1 Index Chamfer	CH	0.13 x 45° REF			

Dimensioning and tolerance per ASME Y14.5M

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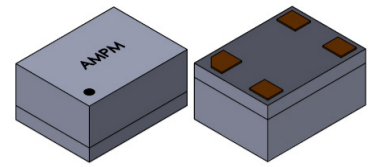


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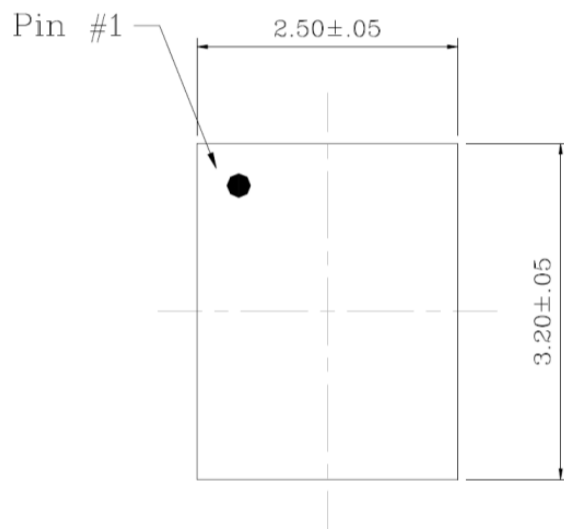
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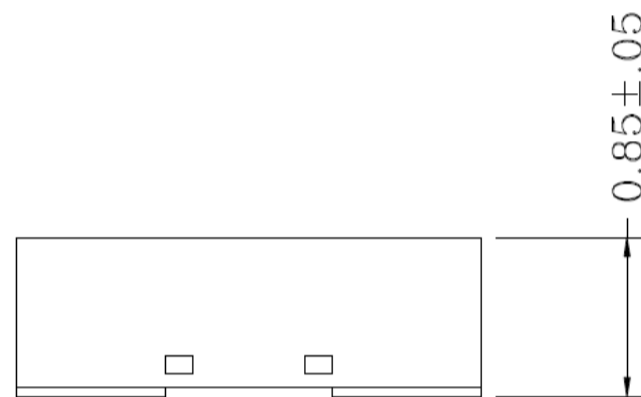
## MECHANICAL DIMENSIONS

### 3.2 x 2.5 mm DFN Package Outline

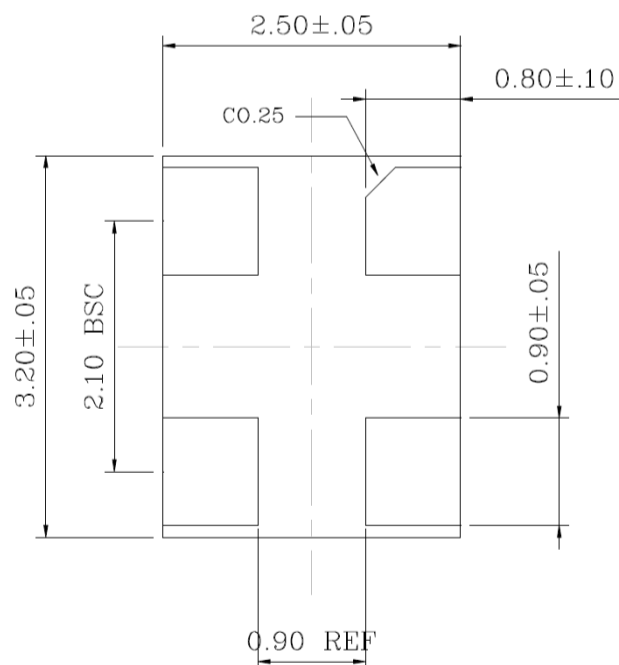
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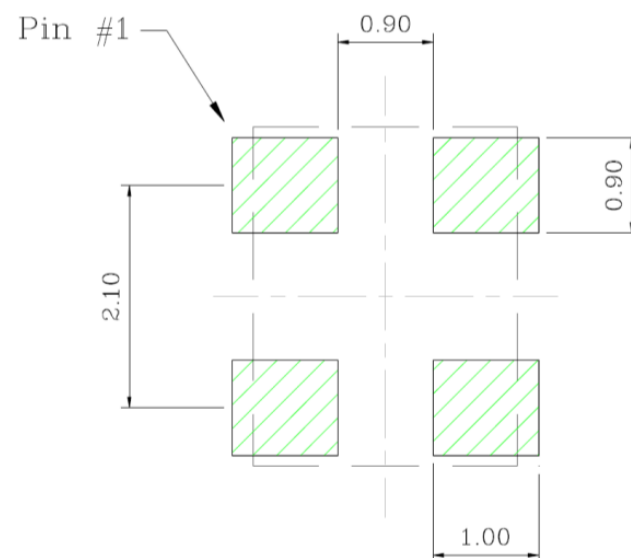
#### Side View



#### Bottom View



#### Recommended Landing Pattern



Dimensions : mm



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1.6 x 1.2 x 0.84 mm  
2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

MSL = MSL 1

## 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.

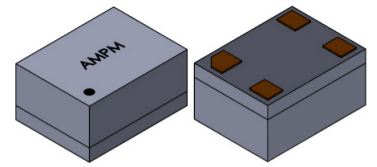


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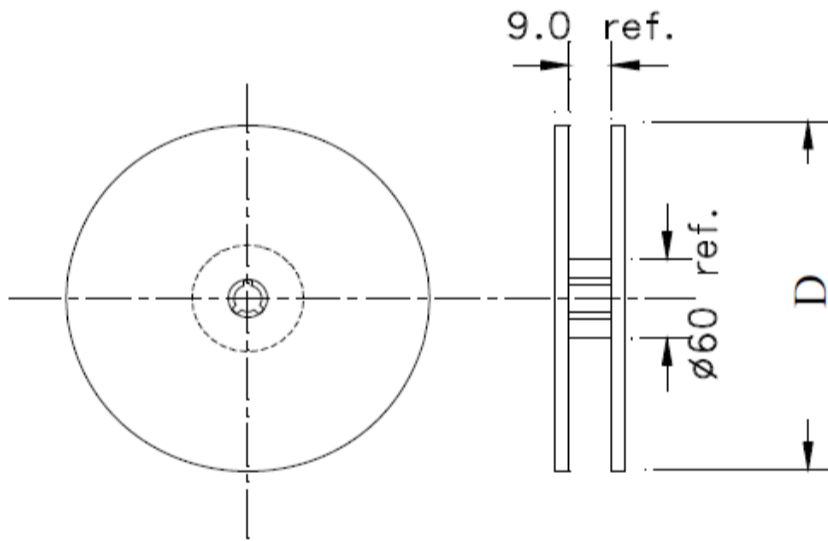
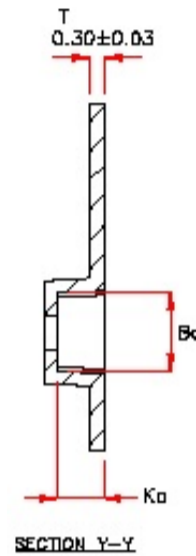
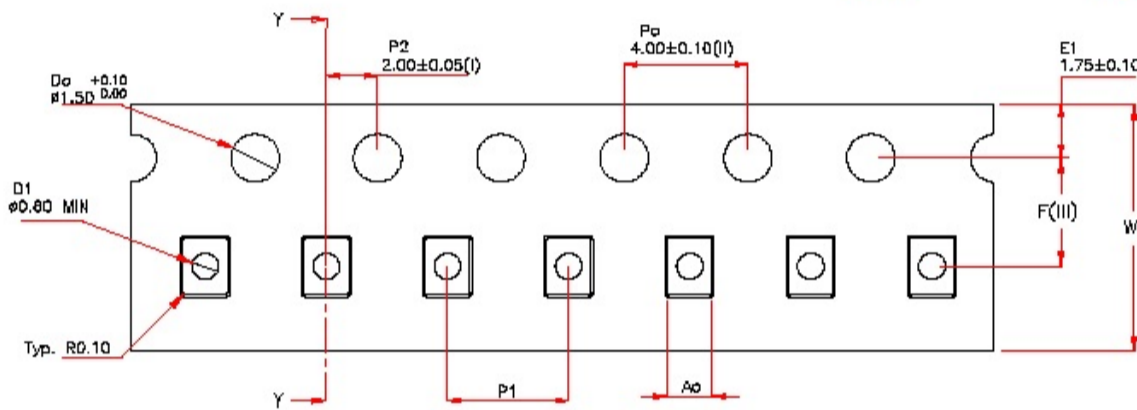
1.6 x 1.2 x 0.84 mm  
2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

MSL = MSL 1

## PACKAGING

Bulk MOQ= 100pcs/Bag\*  
T= 1,000pcs/reel (D=180mm)  
T3= 3,000pcs/reel (D=180mm)

Affected Package Size:  
1.6 mm x 1.2 mm VFLGA



$A_0$	$1.40 \pm 0.05$
$B_0$	$1.80 \pm 0.05$
$K_0$	$1.05 \pm 0.05$
F	$3.50 \pm 0.05$
$P_1$	$4.00 \pm 0.10$
W	$8.00 +0.30/-0.10$

### Dimensions : mm

\* For Quick turn-around programmable sample orders less than MOQ represented above:  
Due to the immediate availability of stock and the qty of the order, the parts may be delivered as Cut Tape,  
Loose parts in Antistatic Bag or in Tube(s).

For orders equal to or greater than MOQ and less than 1000pcs:  
Due to packaging, the order must be a multiple of MOQ per package size above

For orders equal to or greater than 1000 pcs:  
Bulk is not an option. Please refer to tape and reel packaging.



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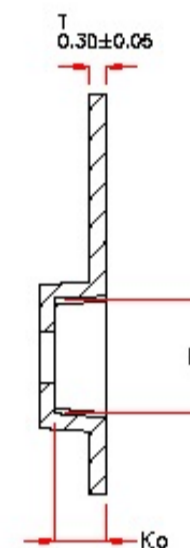
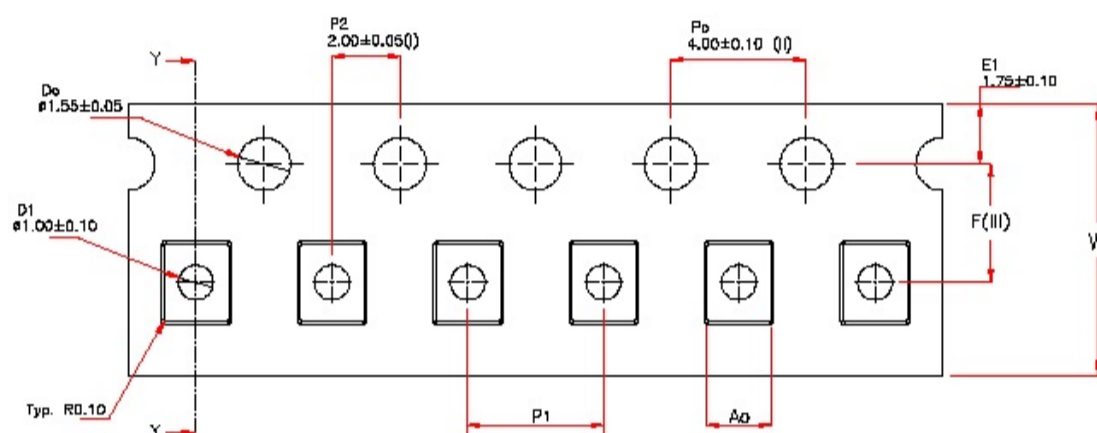
MSL = MSL 1

1.6 x 1.2 x 0.84 mm  
2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

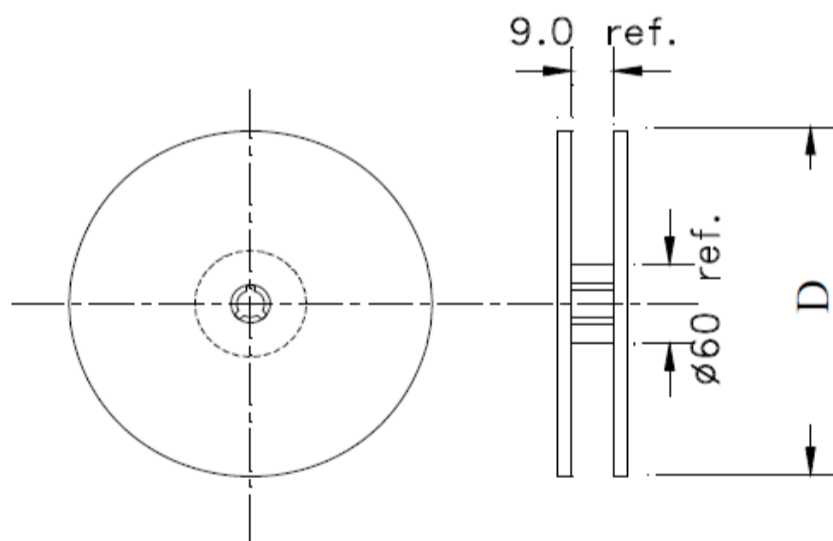
## PACKAGING

Bulk MOQ= 100pcs/Bag\*  
T= 1,000pcs/reel (D=180mm)  
T3= 3,000pcs/reel (D=180mm)

Affected Package Sizes:  
2.0 mm x 1.6 mm VFLGA



SECTION Y-Y



$A_0$	$1.90 \pm 0.05$
$B_0$	$2.30 \pm 0.05$
$K_0$	$1.05 \pm 0.05$
F	$3.50 \pm 0.05$
$P_1$	$4.00 \pm 0.10$
W	$8.00 +0.30/-0.10$

### Dimensions : mm

\* For Quick turn-around programmable sample orders less than MOQ represented above:  
Due to the immediate availability of stock and the qty of the order, the parts may be delivered as Cut Tape,  
Loose parts in Antistatic Bag or in Tube(s).

For orders equal to or greater than MOQ and less than 1000pcs:  
Due to packaging, the order must be a multiple of MOQ per package size above

For orders equal to or greater than 1000 pcs:  
Bulk is not an option. Please refer to tape and reel packaging.

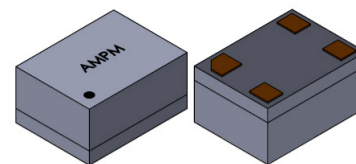


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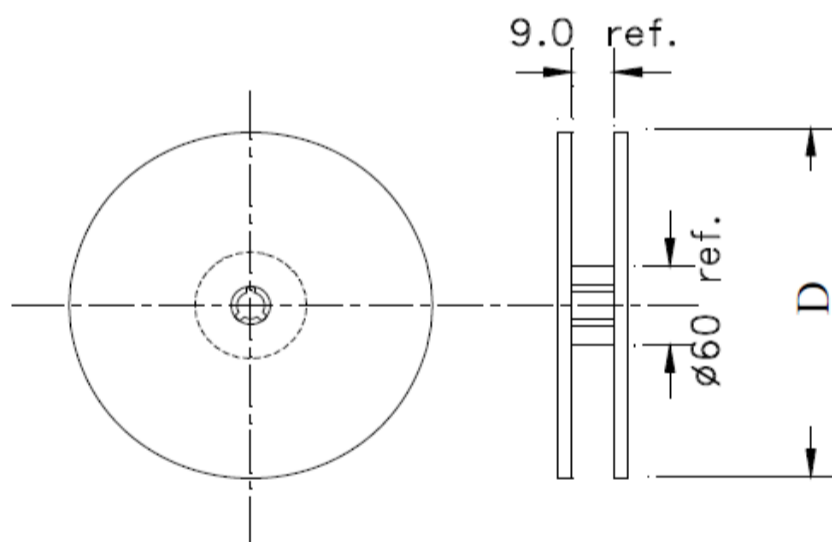
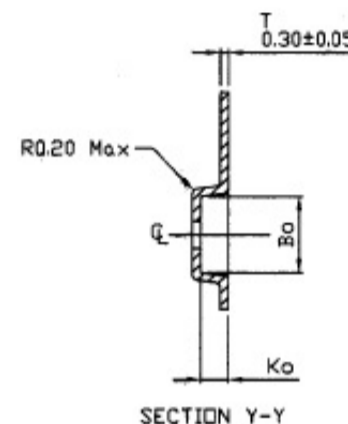
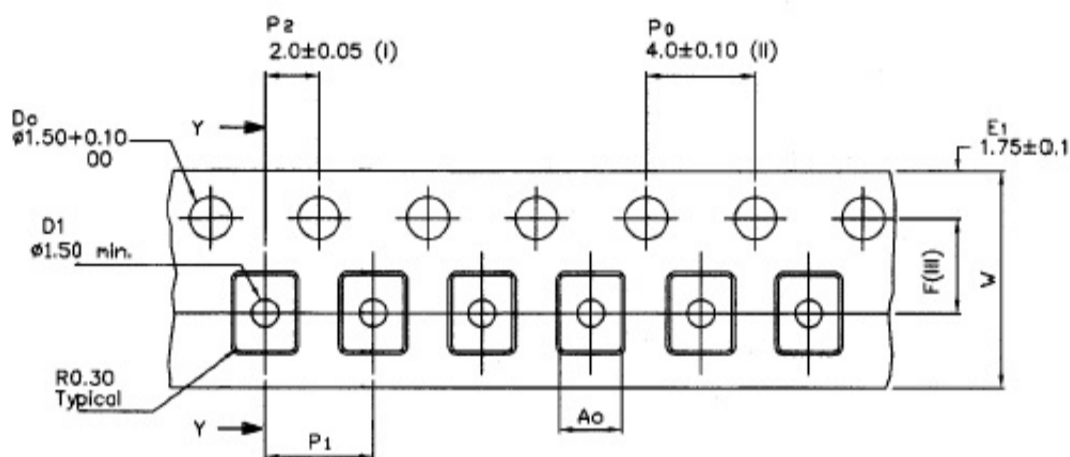
MSL = MSL 1

1.6 x 1.2 x 0.84 mm  
2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

## PACKAGING

Bulk MOQ= 140pcs/Tube\*  
T= 1,000pcs/reel (D=180mm)  
T3= 3,000pcs/reel (D=180mm)

Affected Package Sizes:  
2.5 mm x 2.0 mm VLGA



$A_0$	$2.25 \pm 0.05$
$B_0$	$2.80 \pm 0.05$
$K_0$	$1.10 \pm 0.05$
F	$3.50 \pm 0.05$
$P_1$	$4.00 \pm 0.10$
W	$8.00 + 0.30 / - 0.10$

### Dimensions : mm

\* For Quick turn-around programmable sample orders less than MOQ represented above:  
Due to the immediate availability of stock and the qty of the order, the parts may be delivered as Cut Tape,  
Loose parts in Antistatic Bag or in Tube(s).

For orders equal to or greater than MOQ and less than 1000pcs:  
Due to packaging, the order must be a multiple of MOQ per package size above

For orders equal to or greater than 1000 pcs:  
Bulk is not an option. Please refer to tape and reel packaging.

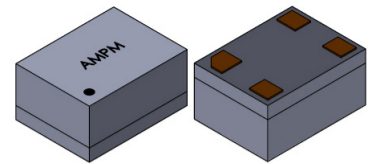


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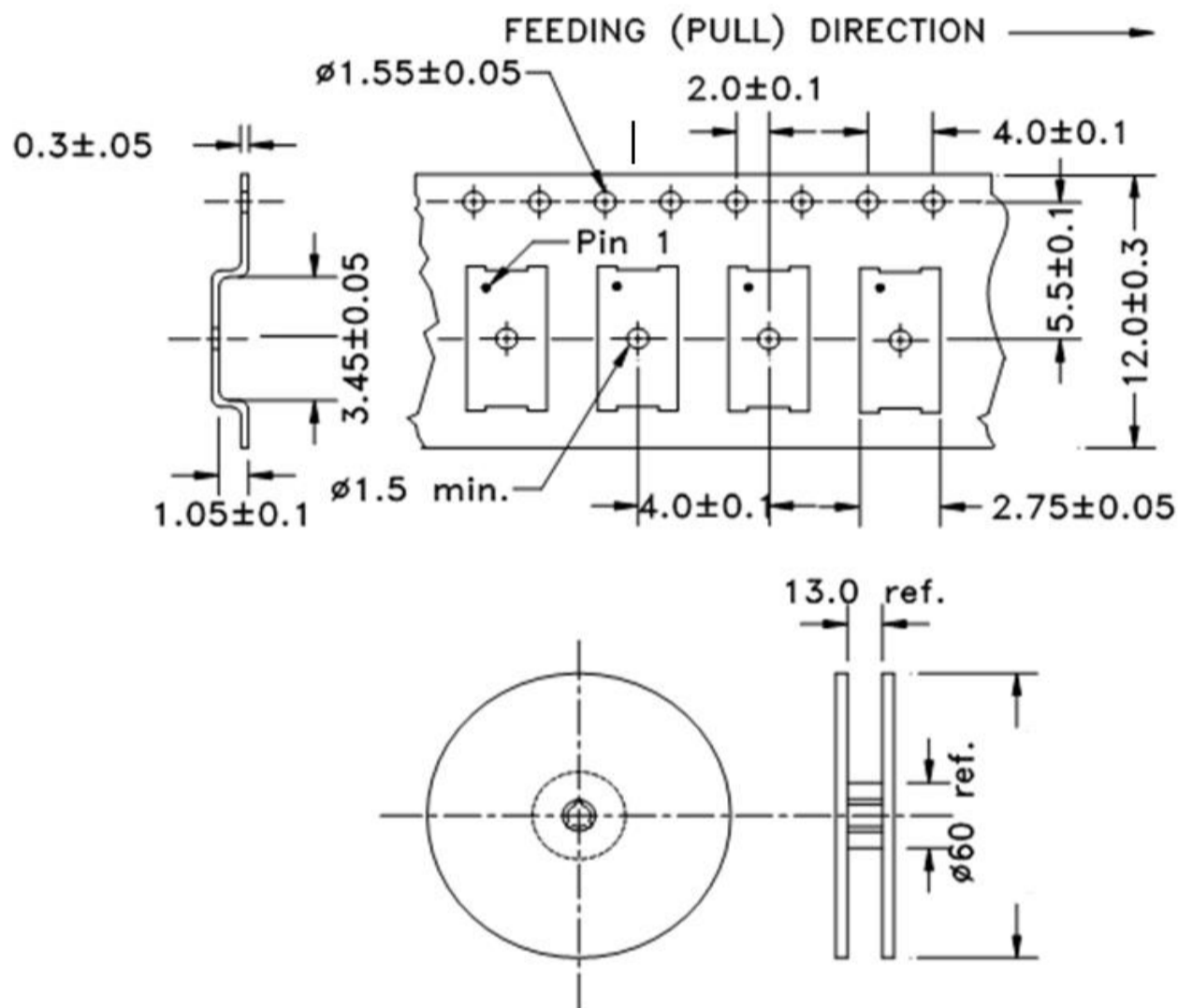
1.6 x 1.2 x 0.84 mm  
2.0 x 1.6 x 0.84 mm  
2.5 x 2.0 x 0.84 mm  
3.2 x 2.5 x 0.85 mm

MSL = MSL 1

## PACKAGING

Bulk MOQ= 110pcs/Tube\*  
T= 1,000pcs/reel (D=180mm)  
T3= 3,000pcs/reel (D=180mm)

Affected Package Sizes:  
3.2 mm x 2.5 mm DFN



### Dimensions : mm

\* For Quick turn-around programmable sample orders less than MOQ represented above:  
Due to the immediate availability of stock and the qty of the order, the parts may be delivered as Cut Tape,  
Loose parts in Antistatic Bag or in Tube(s).

For orders equal to or greater than MOQ and less than 1000pcs:  
Due to packaging, the order must be a multiple of MOQ per package size above

For orders equal to or greater than 1000pcs:  
Bulk is not an option. Please refer to tape and reel packaging.





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