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## 32.768 kHz Tuning Fork

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### Features

- $\pm 20$  ppm Initial Accuracy
- $-20^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  or  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  Operating Temperature Range
- Small, Industry Standard Packages
- Products are Compliant to RoHS Directive and Fully Compatible with Lead-Free Assembly

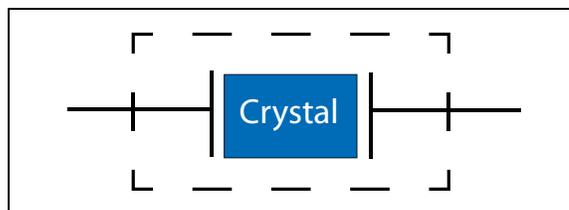
### Applications

- Realtime Clocks
- Microprocessors
- Wearables
- IoT
- Bluetooth Low Energy
- Medical, Hearing Aids, Meters and Monitors
- Security

### General Description

The VMK series 32.768 kHz tuning fork is used as a building block for 32.768 kHz oscillator clocks, and associated divide-by to generate a 1 Hz/1 second clock signal. The VMK3 is a 3.2 mm x 1.5 mm ceramic hermetically sealed package and the VMK4 is 2.0 mm x 1.2 mm.

### Block Diagram



## 1.0 ELECTRICAL CHARACTERISTICS

### VMK3 ELECTRICAL PERFORMANCE

Parameter	Symbol	Min.	Typ.	Max.	Units
Nominal Frequency	$f_{\text{NOM}}$	—	32.768	—	kHz
Crystal Mode	—	Tuning Fork			—
Operating Temperature Range, <i>ordering option</i>	$T_{\text{OP}}$	-20	—	+70	°C
		-40	—	+85	
<b>Frequency Stability</b>					
Stability over $T_{\text{OP}}$	$f_{\text{STAB}}$	—	—	-0.04	ppm/°C <sup>2</sup>
Turnover Temperature	—	20	25	30	°C
Frequency Tolerance, referenced to +25°C	$f_{\text{TOL}}$	—	—	±20	ppm
Load Capacitance, <i>ordering option</i>	$C_{\text{L}}$	6, 7, 9, or 12.5			pF
Equivalent Series Resistance	ESR	—	—	70	kΩ
Shunt Capacitance	$C_{\text{O}}$	—	1.2	3.0	pF
Motional Capacitance	$C_{\text{1}}$	—	3.5	—	fF
Drive Level	—	—	—	1.0	μW
Aging, 1st Year	$f_{\text{AGE}}$	—	—	±3	ppm
Storage Temperature	$T_{\text{STO}}$	-55	—	+125	°C
Package	—	3.2 x 1.5			mm
Weight	—	—	13	—	mg

**Note 1:** Product is compliant with RoHS directive and fully compatible with lead-free assembly.

### VMK4 ELECTRICAL PERFORMANCE

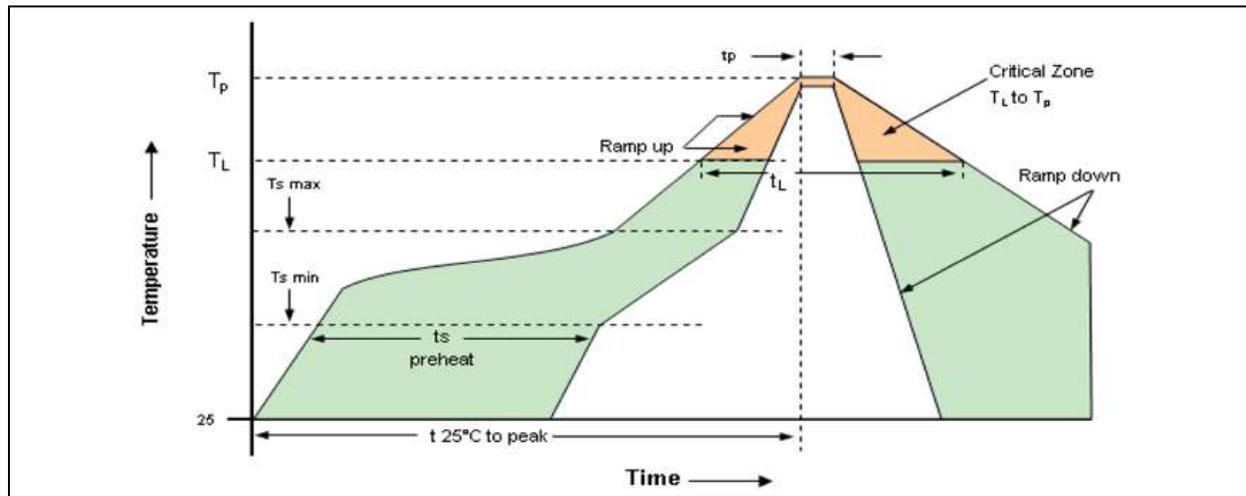
Parameter	Symbol	Min.	Typ.	Max.	Units
Nominal Frequency	$f_{\text{NOM}}$	—	32.768	—	kHz
Crystal Mode	—	Tuning Fork			—
Operating Temperature Range, <i>ordering option</i>	$T_{\text{OP}}$	-20	—	+70	°C
		-40	—	+85	
<b>Frequency Stability</b>					
Stability over $T_{\text{OP}}$	$f_{\text{STAB}}$	—	—	-0.045	ppm/°C <sup>2</sup>
Turnover Temperature	—	20	25	30	°C
Frequency Tolerance, referenced to +25°C	$f_{\text{TOL}}$	—	—	±20	ppm
Load Capacitance, <i>ordering option</i>	$C_{\text{L}}$	6, 7, 9, or 12.5			pF
Equivalent Series Resistance	ESR	—	—	90	kΩ
Shunt Capacitance	$C_{\text{O}}$	—	—	1.5	pF
Motional Capacitance	$C_{\text{1}}$	—	4.7	—	fF
Drive Level	—	—	—	1.0	μW
Aging, 1st Year	$f_{\text{AGE}}$	—	—	±3	ppm
Storage Temperature	$T_{\text{STO}}$	-55	—	+125	°C
Package	—	2.0 x 1.2			mm
Weight	—	—	6	—	mg

**Note 1:** Product is compliant with RoHS directive and fully compatible with lead-free assembly.

## 2.0 RELIABILITY AND IR COMPLIANCE

**TABLE 2-1: ENVIRONMENTAL COMPLIANCE**

Parameter	Conditions
Mechanical Shock	MIL-STD-883, Method 2002, Condition A
Mechanical Vibration	MIL-STD-883, Method 2007, Condition A
Temperature Cycle	MIL-STD-883, Method 1010, Condition B
Solderability	MIL-STD-202-210, Condition B
Gross and Fine Leak	MIL-STD-883, Method 1014
Altitude	MIL-STD-883, Method 1001, Condition B
Moisture Sensitivity Level	MSL 1



**FIGURE 2-1:** Solder Reflow Profile.

**TABLE 2-2: REFLOW PROFILE**

Parameter	Symbol	Value
Pre-Heat Time	$t_s$	60 sec. min.; 260 sec. max.
$T_s$ min.	—	+150°C
$T_s$ max.	—	+200°C
Ramp Up	$R_{UP}$	3°C/sec. max.
Time Above 217°C	$t_L$	60 sec. min.; 150 sec. max.
Time to Peak Temperature	$t_{AMB-P}$	480 sec. max.
Time at 260°C	$t_p$	10 sec. max.
Ramp Down	$R_{DN}$	6°C/sec. max.

Tuning fork products oscillate at frequency bands that are close to ultrasonic cleaning processes. This may cause electrical resonance deterioration and even damaging the overall structure of devices. Using ultrasonic cleaning machine to clean tuning fork devices should be avoided. If the use of this method to clean tuning fork devices is required, it's recommended to qualify the process and functionality of devices before and after the cleaning process.

## 3.0 TAPE AND REEL

TABLE 3-1: TAPE AND REEL DIMENSIONS

Tape Dimensions (mm)						Reel Dimensions (mm)							
Part #	W	F	Do	Po	P1	A	B	C	D	N	W1	W2	# per Reel
VMK3	12	5.5	1.5	4.0	4.0	180	2	13	21	60	13.0	15.4	3000
VMK4	8	3.5	1.5	4.0	4.0	178	2.5	13	21	60	9	11.4	3000

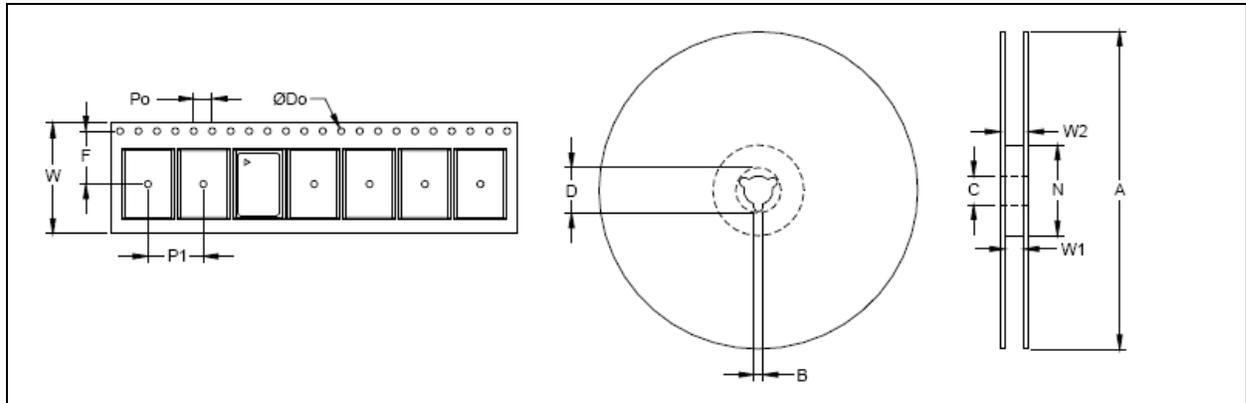


FIGURE 3-1: Tape and Reel Diagram.

## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

2-Lead VDFN\*

XXXXYWW

Example

327021

2-Lead CDFP\*

XXXXYWW

Example

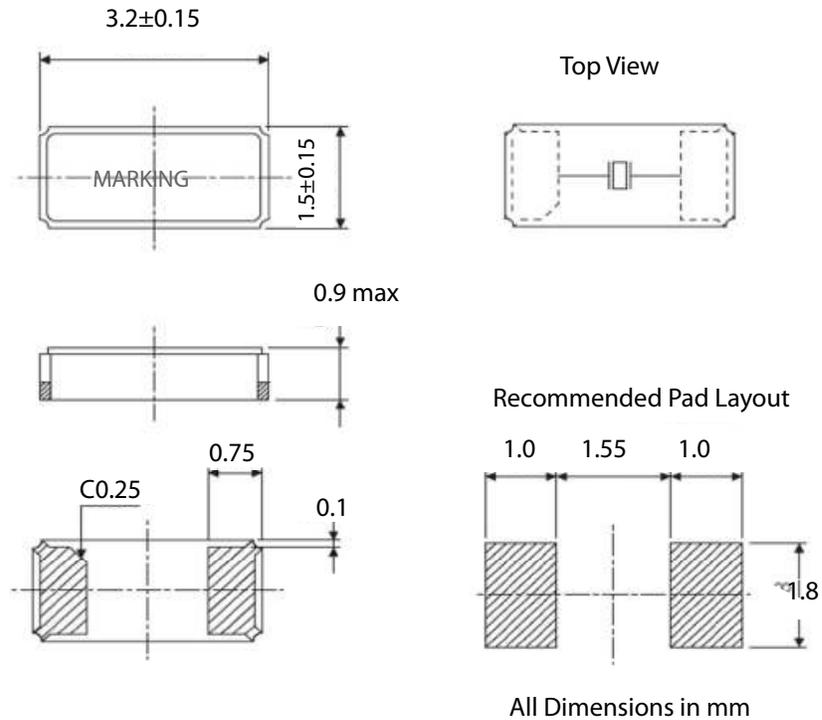
327935

**Legend:** 327 32.768 kHz  
 Y Year code (last digit of calendar year)  
 WW Week code (week of January 1 is week '01')  
 (e3) Pb-free JEDEC® designator for Matte Tin (Sn)  
 \* This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.  
 •, ▲, ▼ Pin one index is identified by a dot, delta up, or delta down (triangle mark).

**Note:** In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.  
 Underbar ( \_ ) and/or Overbar ( ¯ ) symbol may not be to scale.

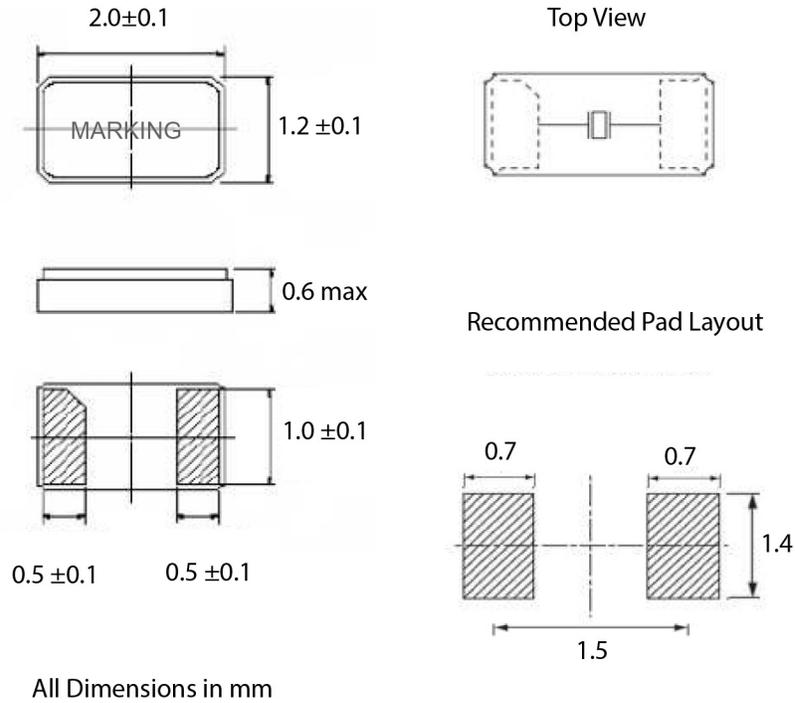
## 2-Lead VDFN 3.2 mm x 1.5 mm Package Outline and Recommended Land Pattern

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



## 2-Lead CDFP Package Outline and Recommended Land Pattern

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



## APPENDIX A: REVISION HISTORY

### Revision A (January 2021)

- Initial release of VMK3/VMK4 as Microchip data sheet DS20006440A.

## PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

<u>Part No.</u>	<u>X</u>	<u>-X</u>	<u>X</u>	<u>X</u>	<u>-XX</u>	<u>XXXXXXXXXX</u>	<u>XX</u>
Device	Package	Mode	Frequency Tolerance	Operating Temperature	Load Capacitance	Frequency (in kHz)	Media Type
<b>Device:</b>	VMK:	32.768 kHz Tuning Fork					
<b>Package:</b>	3	=	2-Lead 3.2 mm x 1.5 mm VDFN				
	4	=	2-Lead 2.0 mm x 1.2 mm CDFP				
<b>Mode:</b>	1	=	Fundamental Tuning Fork				
<b>Frequency Tolerance:</b>	E	=	±20 ppm				
	J	=	-40°C to +85°C				
<b>Operating Temperature:</b>	E	=	-40°C to +85°C				
	J	=	-20°C to +70°C				
<b>Load Capacitance:</b>	06	=	6 pF				
	07	=	7 pF				
	09	=	9 pF				
	12	=	12.5 pF				
<b>Frequency:</b>	32K7680000	=	Frequency in kHz				
<b>Packing Option:</b>	<blank>	=	Cut Tape/non-TR Quantities				
	TR	=	3,000/Reel				
<b>Examples:</b>							
a) VMK3-1EE-06-32K7680000TR: 32.768 kHz Tuning Fork, 3.2 mm x 1.5 mm VDFN, Fundamental Tuning Fork, ±20 ppm Frequency Tolerance, -40°C to +85°C Temp. Range, 6 pF Load Capacitance, 3,000/Reel							
b) VMK4-1EJ-12-32K7680000TR: 32.768 kHz Tuning Fork, 2.0 mm x 1.2 mm CDFP, Fundamental Tuning Fork, ±20 ppm Frequency Tolerance, -20°C to +70°C Temp. Range, 12.5 pF Load Capacitance, 3,000/Reel							
<b>Note 1:</b> Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.							

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