

# MAS9270

## IC FOR 10.00 – 30.00 MHz VCTCXO

- Wide Supply Voltage Range
- True Sine Wave Output
- Very High Level of Integration
- Electrically Trimmable
- Very Low Phase Noise
- Low Cost
- Minimum Operating Temperature  $-40\text{ }^{\circ}\text{C}$

### DESCRIPTION

The MAS9270 is an integrated circuit well suited to build VCTCXO for mobile communication. Temperature calibration is achieved in three calibration temperatures only. The trimming is done through a serial bus and the calibration information is stored in an internal PROM. This means no rework for trimming is needed.

To build a VCTCXO additionally only crystal is required. The compensation method is fully analog, working continuously without generating any steps or other interference.

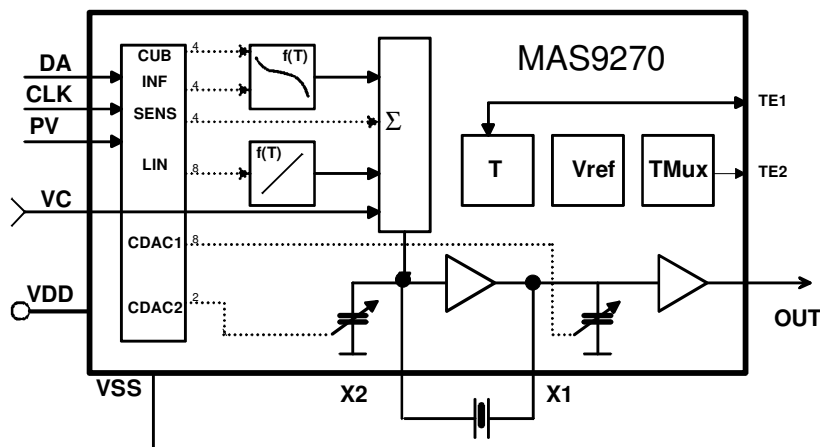
### FEATURES

- Very small size
- Minor current draw
- Wide operating temperature range
- Phase noise  $<-120\text{ dBc/Hz}$  at 100Hz offset
- Programmable VC-sensitivity
- Minimum Operating Temperature  $-40\text{ }^{\circ}\text{C}$  for MAS9270Cxx3

### APPLICATIONS

- VCTCXO for mobile phones
- VCTCXO for other telecommunications systems

### BLOCK DIAGRAM



## PIN DESCRIPTION

| Pin Description                   | Symbol | x-coordinate | y-coordinate |
|-----------------------------------|--------|--------------|--------------|
| Power Supply Voltage              | VDD    | 166          | 1430         |
| Programming Input                 | PV     | 420          | 1435         |
| Serial Bus Clock Input            | CLK    | 979          | 1441         |
| Serial Bus Data Input             | DA     | 1234         | 1441         |
| Temperature Output                | TE1    | 1488         | 1441         |
| Test Multiplexer Output           | TE2    | 1742         | 1441         |
| Voltage Control Input             | VC     | 185          | 153          |
| Crystal Oscillator Output         | X1     | 439          | 149          |
| Crystal/Varactor Oscillator Input | X2     | 1357         | 149          |
| Power Supply Ground               | VSS    | 1790         | 166          |
| Buffer Output                     | OUT    | 2046         | 153          |

**Note:** Because the substrate of the die is internally connected to GND, the die has to be connected to GND or left floating. Make sure that GND is the first pad to be bonded. Pick-and-place and all component assembly are recommended to be performed in ESD protected area.

**Note:** Pad coordinates are measured from the left bottom corner of the chip to the center of the pads. The coordinates may vary depending on sawing width and location, however, distances between pads are accurate.

## ABSOLUTE MAXIMUM RATINGS

| Parameter           | Symbol            | Min            | Max            | Unit | Note |
|---------------------|-------------------|----------------|----------------|------|------|
| Supply Voltage      | $V_{DD} - V_{SS}$ | -0.3           | 6.0            | V    |      |
| Input Pin Voltage   |                   | $V_{SS} - 0.3$ | $V_{DD} + 0.3$ | V    | 1)   |
| Power Dissipation   | $P_{MAX}$         |                | 20             | mW   |      |
| Storage Temperature | $T_{ST}$          | -55            | 150            | °C   |      |

**Note 1:** Not valid for programming pin PV

## RECOMMENDED OPERATION CONDITIONS

| Parameter                   | Symbol   | Conditions                    | Min | Typ | Max | Unit   | Note |
|-----------------------------|----------|-------------------------------|-----|-----|-----|--------|------|
| Supply Voltage              | $V_{DD}$ |                               | 2.7 | 2.8 | 5.5 | V      | 1)   |
| Supply Current              | $I_{CC}$ | Vdd = 2.8 Volt                |     |     | 1.8 | mA     |      |
| Operating Temperature       | $T_{OP}$ |                               | -30 |     | +85 | °C     | 2)   |
| Storage Temperature         | $T_S$    | Relative humidity = 15%...70% | -45 |     | +40 | °C     |      |
| Crystal Pulling Sensitivity | S        |                               |     | 30  |     | ppm/pF |      |
| Crystal Load Capacitance    | $C_L$    |                               |     | 10  |     | pF     |      |

**Note 1:** Minimum Supply Voltage 2.6 V for MAS9270Cxx2 version.

**Note 2:** Minimum Operating Temperature -40 °C for MAS9270Cxx3 version.

## ELECTRICAL CHARACTERISTICS

(recommended operation conditions)

| Parameter                              | Symbol       | Min   | Typ | Max       | Unit                             | Note |
|--|--------------|-------|-----|-----------|----------------------------------|------|
| Frequency Range                        | $f_o$        | 10.00 |     | 30.00     | MHz                              |      |
| Voltage Control Range                  | $V_C$        | 0     |     | Vdd       | V                                |      |
| Voltage Control Sensitivity (VCR = 0)  | $V_{CSSENS}$ | 9     |     | 15        | ppm/V                            | 1)   |
| Voltage Control Sensitivity (VCR = 1)  | $V_{CSSENS}$ | 4     |     | 8         | ppm/V                            |      |
| Frequency vs. Supply Voltage           | $df_o$       |       |     | $\pm 0.2$ | ppm                              | 2)   |
| Frequency vs. Load Change              | $df_o$       |       |     | $\pm 0.2$ | ppm                              | 3)   |
| Output Voltage (10k $\Omega$ // 10 pF) | $V_{out}$    |       | 1.0 |           | Vpp                              |      |
| Compensation Range $\pm 2.5$ ppm       | $T_C$        | -30   |     | 85        | $^{\circ}C$                      |      |
| Compensation Range $\pm 2.0$ ppm       | $T_C$        | -25   |     | 75        | $^{\circ}C$                      |      |
| Compensation Range $\pm 2.5$ ppm       | $T_C$        | -40   |     | 85        | $^{\circ}C$                      | 4)   |
| Compensation Range Linear Part         | a1           | -0.7  |     | 0.0       | ppm/K                            |      |
| Compensation Inflection Point          | INF          | 25    |     | 31        | $^{\circ}C$                      |      |
| Compensation Range Cubic Part          | a3           |       | 95  |           | ppm <sup>2</sup> /K <sup>3</sup> |      |
| Compensation CDAC1 (7 Bit)             | $C_{X1}$     | C10   |     | C10 + 18  | pF                               | 5)   |
| Compensation CDAC2 (2 Bit)             | $C_{X2}$     | C20   |     | C20 + 4   | pF                               | 6)   |
| Start up Time                          | $T_{START}$  |       | 2   |           | ms                               |      |

**Note 1:** default

**Note 2:** VDD +/- 5%

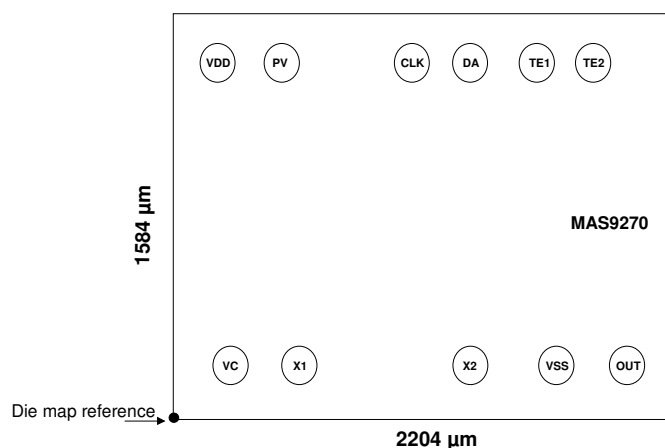
**Note 3:** R=10 kohm +/- 10%, C=10 pF +/- 10%

**Note 4:** MAS9270Cxx3

**Note 5:** typ C10 = 13 pF

**Note 6:** typ C20 = 6 pF (varactor capacitance at 1.8 V 12 pF)

## IC OUTLINES



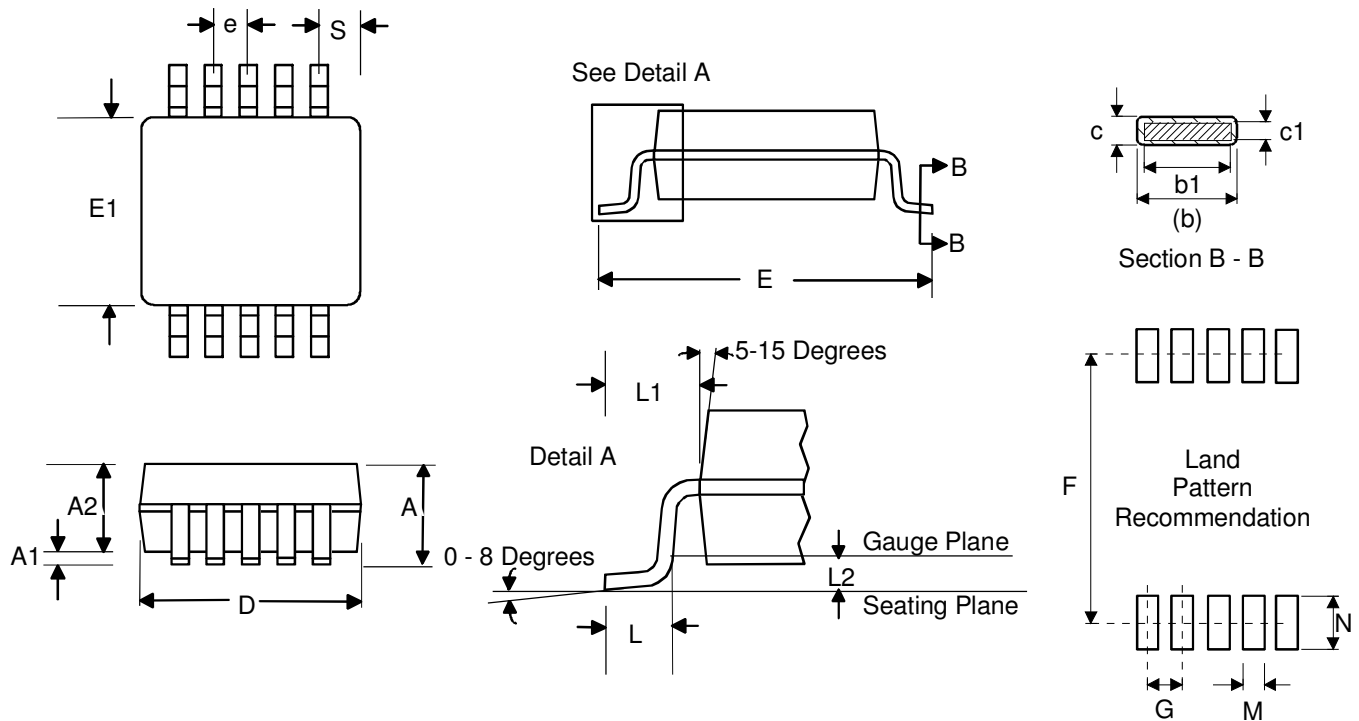
**Note 1:** MAS9270 pads are round with 80  $\mu m$  diameter at opening.

**Note 2:** Pins CLK and DA can either be connected to VSS or left floating, pin PV can either be connected to VDD or left floating and pin TE1 must be left floating in VCTCXO module end-user application.

**Note 3:** Die map reference is the actual left bottom corner of the sawn chip.



## PACKAGE (MSOP-10) OUTLINE



| Symbol                               | Min  | Nom      | Max  | Unit |
|--------------------------------------|------|----------|------|------|
| A                                    | --   | --       | 1.10 | mm   |
| A1                                   | 0.00 | --       | 0.15 | mm   |
| A2                                   | 0.75 | 0.85     | 0.95 | mm   |
| b                                    | 0.15 | --       | 0.30 | mm   |
| b1                                   | 0.15 | ---      | 0.25 | mm   |
| c                                    | 0.08 |          | 0.23 | mm   |
| c1                                   | 0.08 |          | 0.18 | mm   |
| D                                    |      | 3.00 BSC |      | mm   |
| E                                    |      | 4.90 BSC |      | mm   |
| E1                                   |      | 3.00 BSC |      | mm   |
| e                                    |      | 0.50 BSC |      | mm   |
| F                                    |      | 4.8      |      | mm   |
| G                                    |      | 0.50     |      | mm   |
| L<br>(Terminal length for soldering) | 0.40 | 0.60     | 0.80 | mm   |
| L1                                   |      | 0.95 REF |      |      |
| L2                                   |      | 0.25 BSC |      | mm   |
| M                                    |      | 0.41     |      | mm   |
| N                                    |      | 1.02     |      | mm   |
| S                                    |      | 0.50     |      | Mm   |

Dimensions do not include mold or interlead flash, protrusions or gate burrs.  
Reference Standard : JEDEC MO-187 BA.

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## SOLDERING INFORMATION

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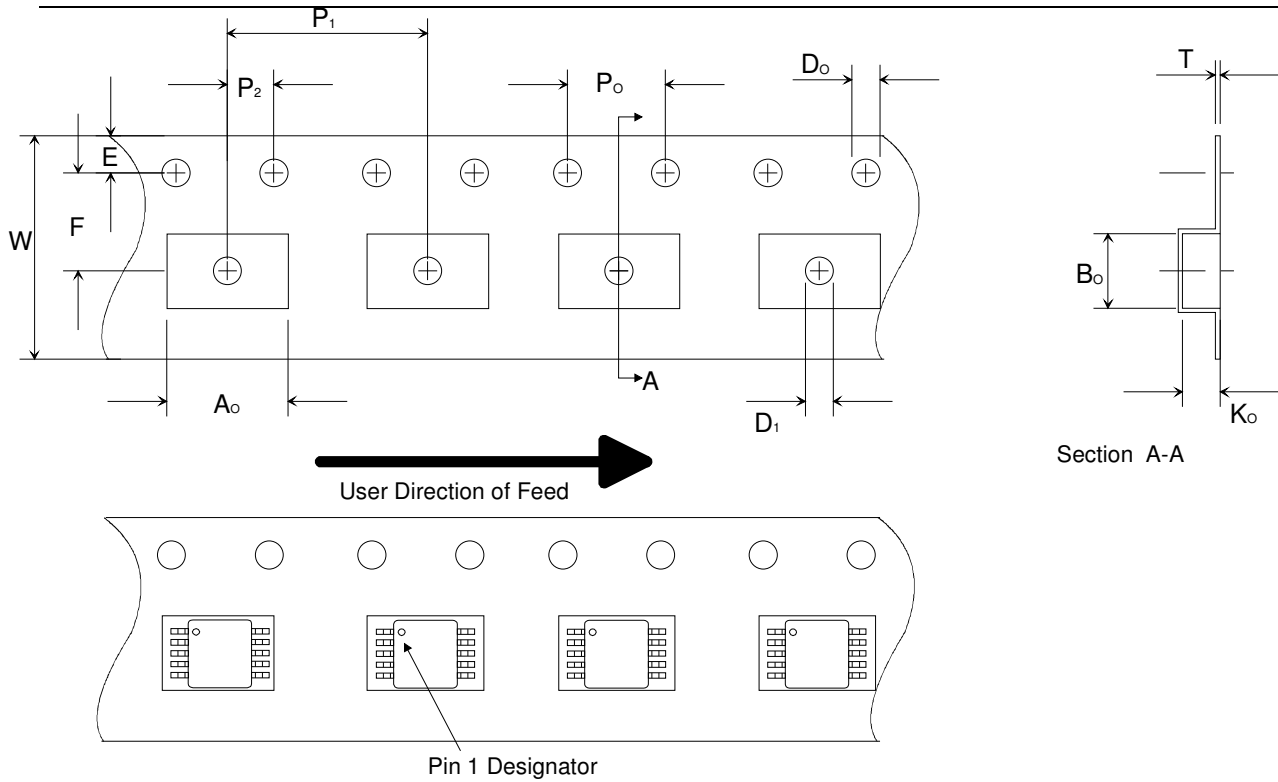
◆ For Sn/Pb MSOP-10

|                                 |  |
|---------------------------------|--|
| Resistance to Soldering Heat    | According to RSH test IEC 68-2-58/20 2*220°C   |
| Maximum Temperature             | 240°C  |
| Maximum Number of Reflow Cycles | 2  |
| Reflow profile                  | Thermal profile parameters stated in JESD22-A113 should not be exceeded. <a href="http://www.jedec.org">http://www.jedec.org</a> |
| Seating Plane Co-planarity      | max 0.08 mm  |
| Lead Finish                     | Solder plate 7.62 - 25.4 µm, material Sn 85% Pb 15%  |

◆ For Pb Free, RoHS Compliant MSOP-10

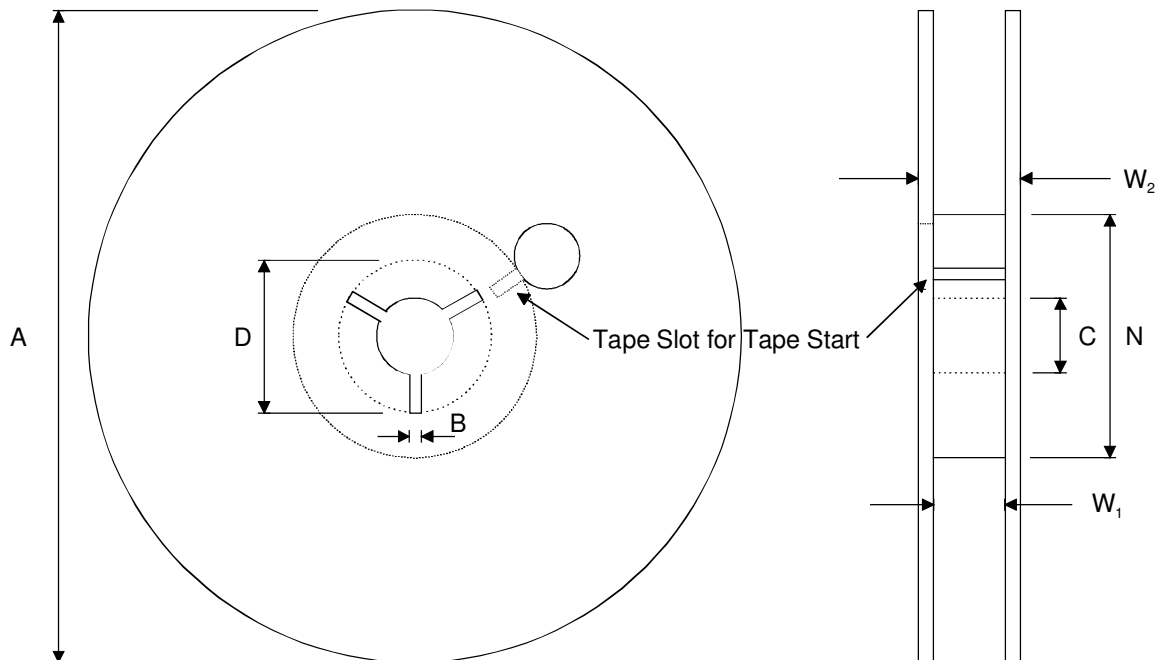
|                                 |  |
|---------------------------------|--|
| Resistance to Soldering Heat    | According to RSH test IEC 68-2-58/20   |
| Maximum Temperature             | 260°C  |
| Maximum Number of Reflow Cycles | 3  |
| Reflow profile                  | Thermal profile parameters stated in IPC/JEDEC J-STD-020 should not be exceeded. <a href="http://www.jedec.org">http://www.jedec.org</a> |
| Lead Finish                     | Solder plate 7.62 - 25.4 µm, material Matte Tin  |

## EMBOSSED TAPE SPECIFICATIONS

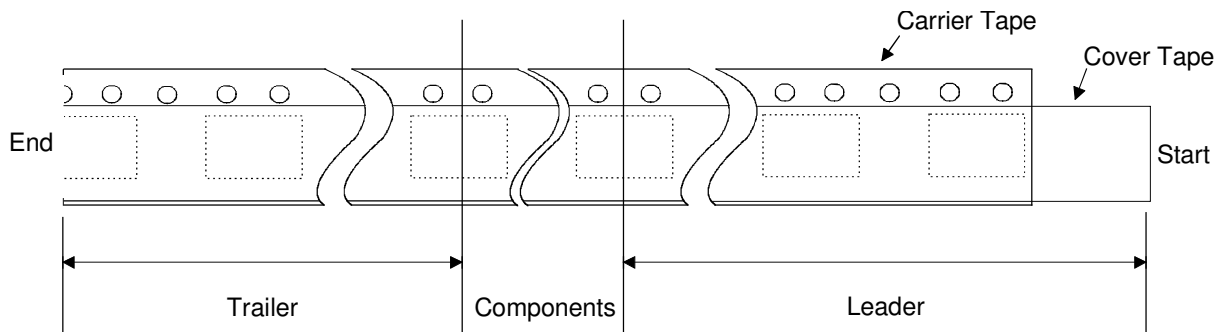


| Dimension | Min/Max             | Unit |
|-----------|---------------------|------|
| $A_0$     | 5.00 $\pm 0.10$     | mm   |
| $B_0$     | 3.20 $\pm 0.10$     | mm   |
| $D_0$     | 1.50 $+0.1/-0.0$    | mm   |
| $D_1$     | 1.50 min            | mm   |
| $E$       | 1.75                | mm   |
| $F$       | 5.50 $\pm 0.05$     | mm   |
| $K_0$     | 1.45 $\pm 0.10$     | mm   |
| $P_0$     | 4.0                 | mm   |
| $P_1$     | 8.0 $\pm 0.10$      | mm   |
| $P_2$     | 2.0 $\pm 0.05$      | mm   |
| $T$       | 0.3 $\pm 0.05$      | mm   |
| $W$       | 12.00 $+0.30/-0.10$ | mm   |

## REEL SPECIFICATIONS



5000 Components on Each Reel  
 Reel Material: Conductive, Plastic Antistatic or Static Dissipative  
 Carrier Tape Material: Conductive  
 Cover Tape Material: Static Dissipative



| Dimension               | Min  | Max   | Unit |
|-------------------------|--|-------|------|
| A                       |  | 330   | mm   |
| B                       | 1.5  |       | mm   |
| C                       | 12.80  | 13.50 | mm   |
| D                       | 20.2   |       | mm   |
| N                       | 50   |       | mm   |
| $W_1$ (measured at hub) | 12.4   | 14.4  | mm   |
| $W_2$ (measured at hub) |  | 18.4  | mm   |
| Trailer                 | 160  |       | mm   |
| Leader                  | 390,<br>of which minimum 160<br>mm of empty carrier tape<br>sealed with cover tape |       | mm   |
| Weight                  |  | 1500  | g    |



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**ORDERING INFORMATION**


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| Product Code  | Product          | Package   | Comments                    |
|---------------|------------------|---|-----------------------------|
| MAS9270CTB1   | VCTCXO IC 2.7 V  | EWS Tested wafers 480 µm                                  | Die Size 2.204 x 1.584 mm   |
| MAS9270CTG1   | VCTCXO IC 2.7 V  | EWS Tested wafers 215 µm                                  | Die Size 2.204 x 1.584 mm   |
| MAS9270CASN06 | VCTCXO IC 2.7 V  | Green MSOP-10, Pb Free,<br>RoHS Compliant/Top Marking CA  | Tape & Reel, 5.000 pcs/reel |
| MAS9270CTB2   | VCTCXO IC 2.6 V  | EWS Tested wafers 480 µm                                  | Die Size 2.204 x 1.584 mm   |
| MAS9270CTG2   | VCTCXO IC 2.6 V  | EWS Tested wafers 215 µm                                  | Die Size 2.204 x 1.584 mm   |
| MAS9270C2SN06 | VCTCXO IC 2.6 V  | Green MSOP-10, Pb Free,<br>RoHS Compliant /Top Marking C2 | Tape & Reel, 5.000 pcs/reel |
| MAS9270CTB3   | VCTCXO IC -40 °C | EWS Tested wafers 480 µm                                  | Die Size 2.204 x 1.584 mm   |
| MAS9270CTG3   | VCTCXO IC -40 °C | EWS Tested wafers 215 µm                                  | Die Size 2.204 x 1.584 mm   |
| MAS9270C3SN06 | VCTCXO IC -40 °C | Green MSOP-10, Pb Free,<br>RoHS Compliant /Top Marking C3 | Tape & Reel, 5.000 pcs/reel |

Please contact Micro Analog Systems Oy for other wafer thickness options.

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