

# MSPD101x-xxx Series



## Sampling Phase Detectors 10 MHz - 20 GHz

Rev. V1

### Features

- Surface Mount Package:  
3.3 mm (L) x 2.8 mm (W) x 1.5 mm (H)
- RoHS\* Compliant

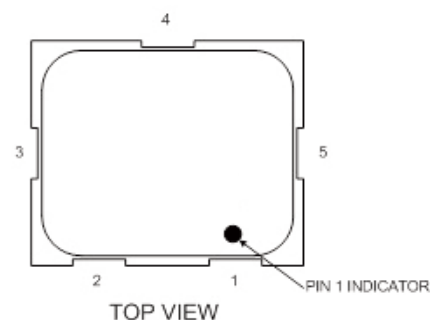
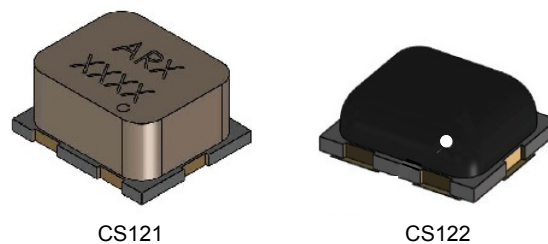
### Applications

- Phase Lock Loops
- High Frequency Sampling

### Description

The products of the MSPD101x-x series are fully-contained sampling phase detectors, each comprising a beam lead silicon step recovery diode, beam lead DC blocking capacitors and a beam lead series-tee pair of low-barrier silicon Schottky diodes mounted on a ceramic substrate. The semiconductors and chip capacitors are protected with an epoxy encapsulation on the top side of the ceramic substrate. These products are manufactured using a proven diode fabrication and assembly processes which optimize diode characteristics for optimal electrical performance and excellent reliability.

These low profile, compact surface mount components offer RF and microwave signal performance superior to comparable chip-and-wire discrete devices in leaded packages. These rugged devices are capable of reliable operation in all military, commercial and industrial applications.



### Pin Configuration

| Pin # | Description                                     |
|-------|---|
| 1     | Cathode terminal of step recovery diode         |
| 2     | Anode terminal of step recovery diode           |
| 3     | Cathode connection of Schottky diode series tee |
| 4     | Center node of Schottky diode series tee        |
| 5     | Anode connection of Schottky diode series tee   |

### Ordering Information

| Part #                       | Description    | Packaging             |
|------------------------------|----------------|-----------------------|
| MSPD1011-xxx <sup>1</sup> -T | Low Barrier    | Tube                  |
| MSPD1012-xxx <sup>1</sup> -T | Medium Barrier |                       |
| MSPD1013-xxx <sup>1</sup> -T | High Barrier   |                       |
| MSPD1011-xxx <sup>1</sup> -R | Low Barrier    | 250 or 500 piece reel |
| MSPD1012-xxx <sup>1</sup> -R | Medium Barrier |                       |
| MSPD1013-xxx <sup>1</sup> -R | High Barrier   |                       |
| MSPD1011-xxx <sup>1</sup> -W | Low Barrier    | Waffle Pack           |
| MSPD1012-xxx <sup>1</sup> -W | Medium Barrier |                       |
| MSPD1013-xxx <sup>1</sup> -W | High Barrier   |                       |

1. Insert 121 for ceramic or 122 for epoxy.

1 \* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

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DC-0012374

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### Electrical Specifications: $T_A = +25^\circ\text{C}$

| Parameter              | Conditions                                 | MSPD1011 |         |      | MSPD1012 |        |      | MSPD1013 |         |      | Units    |
|------------------------|--|----------|---------|------|----------|--------|------|----------|---------|------|----------|
|                        |  | Min.     | Typ.    | Max. | Min.     | Typ.   | Max. | Min.     | Typ.    | Max. |          |
| Microwave Signal Level | —  |          | -3 to 0 |      |          | 0 to 3 |      |          | 0 to 13 |      | dBm      |
| Schottky Diode         |  |          |         |      |          |        |      |          |         |      |          |
| Barrier Height         |  | Low      |         |      | Medium   |        |      | High     |         |      |          |
| Forward Voltage        | $I_F = 1\text{ mA}$                        | 270      | —       | 350  | 370      | —      | 550  | 600      | —       | 700  | mV       |
| Junction Capacitance   | $V_R = 0\text{ V}$ , 1 MHz                 | —        | —       | 0.1  | —        | —      | 0.1  | —        | —       | 0.1  | pF       |
| Total Resistance       | $I_F = 5\text{ mA}$                        | —        | —       | 24   | —        | —      | 24   | —        | —       | 24   | $\Omega$ |
| Step Recovery Diode    |  |          |         |      |          |        |      |          |         |      |          |
| Breakdown Voltage      | $I_R = 10\text{ }\mu\text{A}$              | —        | 20      | 30   | —        | 20     | 30   | —        | 20      | 30   | V        |
| Carrier Lifetime       | $I_F = 10\text{ mA}$ , $I_R = 6\text{ mA}$ | —        | 10      | —    | —        | 10     | —    | —        | 10      | —    | ns       |
| Transition Time        | $I_F = 10\text{ mA}$ , $V_R = 10\text{ V}$ | —        | 70      | —    | —        | 70     | —    | —        | 70      | —    | ps       |
| Junction Capacitance   | $V_R = 0\text{ V}$ , 1 MHz                 | —        | —       | 0.25 | —        | —      | 0.25 | —        | —       | 0.25 | pF       |
| DC Block Capacitance   |  |          |         |      |          |        |      |          |         |      |          |
| Capacitance            | 1 MHz                                      | —        | 0.5     | 1.0  | —        | 0.5    | 1.0  | —        | 0.5     | 1.0  | pF       |

### Absolute Maximum Ratings @ $T_A = 25^\circ\text{C}$ (Unless otherwise noted)

| Parameter              | Conditions  | Absolute Maximum                            |
|------------------------|---|---|
| RF Incident Power      | Applied to step recovery diode (pin 1 to pin2)<br>Applied to microwave input (pin 4)  | 27 dBm<br>20 dBm                            |
| Total Dissipated Power | Infinite heat sink, $T_C = 25^\circ\text{C}$ .<br>Derate power linearly from 100 mW @ $85^\circ\text{C}$ to 0 W @ $125^\circ\text{C}$ | 100 mW                                      |
| Junction Temperature   | —   | $150^\circ\text{C}$                         |
| Operating Temperature  | —   | $-55^\circ\text{C}$ to $+125^\circ\text{C}$ |
| Storage Temperature    | —   | $-65^\circ\text{C}$ to $+150^\circ\text{C}$ |

### Handling Procedures

Please observe the following precautions to avoid damage:

### Static Sensitivity

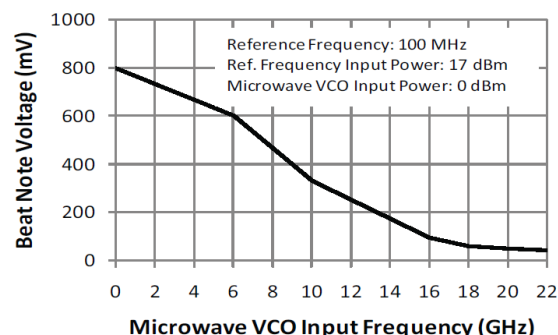
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices. The moisture sensitivity level (MSL) rating is 1.

### Environmental Capabilities

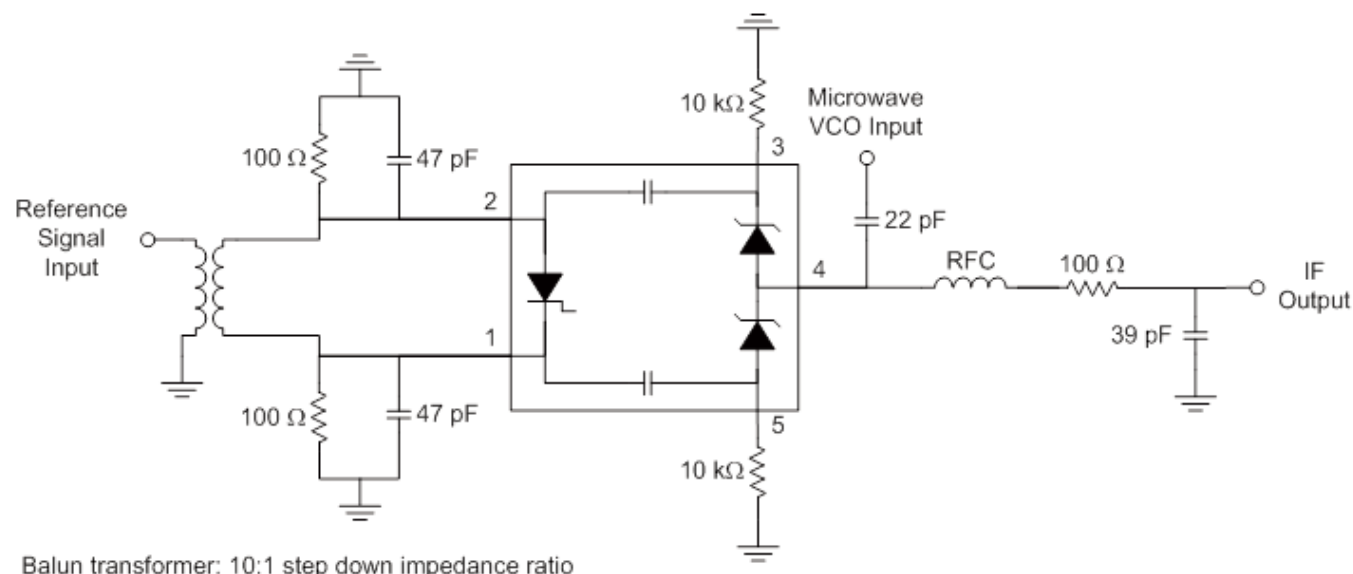
The MSPD101x-121 sampling phase detectors are capable of meeting the environmental requirements of MIL-STD-750 and MIL-STD-883.

### Typical Performance:

$T_A = +25^\circ\text{C}$ ,  $Z_0 = 50\ \Omega$



### Recommended Circuit



## Sampling Phase Detectors

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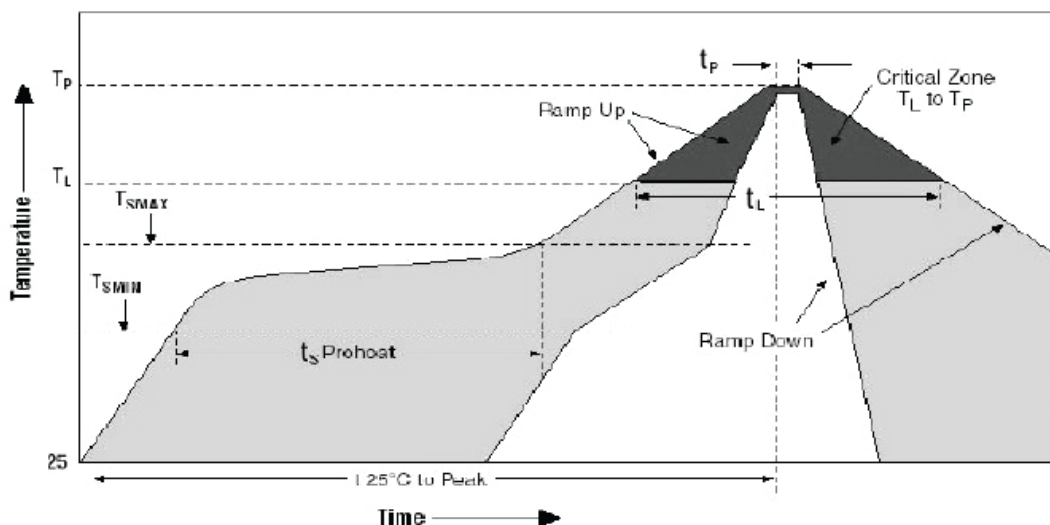
## Assembly Instructions

The MSPD101x family of sampling phase detectors may be soldered to a printed circuit using conventional solder reflow or wave soldering procedures with RoHS type or Sn60/Pb40 type solders per the recommended time temperature profile described in Table I and Figure I.

*Table 1. Time-Temperature Profile for Sn60/Pb40 or RoHS Type Solders*

| Profile Feature  | SnPb Solder Assembly       | Pb-Free Solder Assembly    |
|--|----------------------------|----------------------------|
| Average Ramp-Up Rate ( $T_L$ to $T_p$ )  | 3°C /second maximum        | 3°C /second maximum        |
| Preheat: <ul style="list-style-type: none"> <li>- Temperature Min (<math>T_{SMIN}</math>)</li> <li>- Temperature Max (<math>T_{SMAX}</math>)</li> <li>- Time (min to max)(<math>t_s</math>)</li> </ul> | 100°C<br>150°C<br>60-120 s | 150°C<br>200°C<br>60-180 s |
| $T_{SMAX}$ to $T_L$ <ul style="list-style-type: none"> <li>- Ramp-Up Rate</li> </ul>   |                            | 3°C/s maximum              |
| Time Maintained Above: <ul style="list-style-type: none"> <li>- Temperature (<math>T_L</math>)</li> <li>- Time (<math>t_L</math>)</li> </ul>   | 183°C<br>60-150 s          | 217°C<br>60-150 s          |
| Peak temperature ( $T_p$ )   | 225 +0/-5°C                | 260 +0/-5°C                |
| Time Within 5°C of Actual Peak Temperature ( $t_p$ )   | 10 – 30 s                  | 20 – 40 s                  |
| Ramp-Down Rate   | 6°C /s maximum             | 6°C /s maximum             |
| Time 25°C to Peak Temperature  | 6 minutes maximum          | 8 minutes maximum          |

Figure 1. Solder Re-Flow Time-Temperature Profile



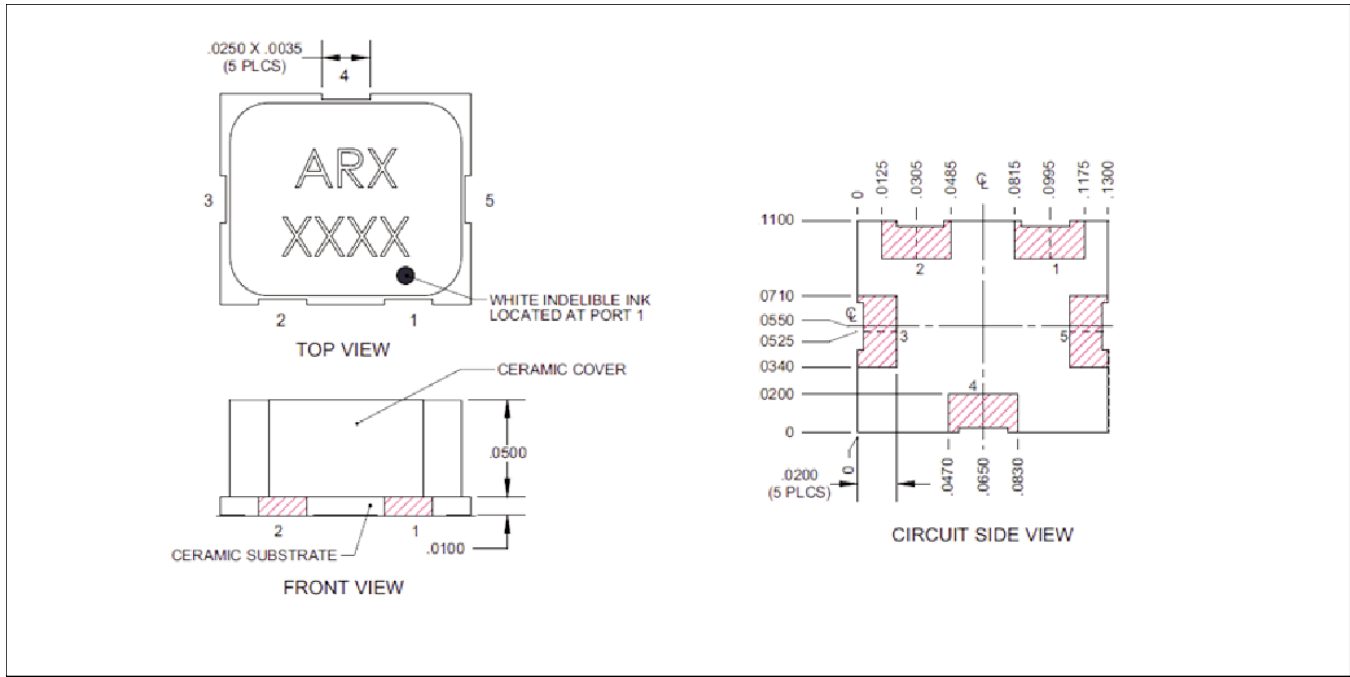
# MSPD101x-xxx Series



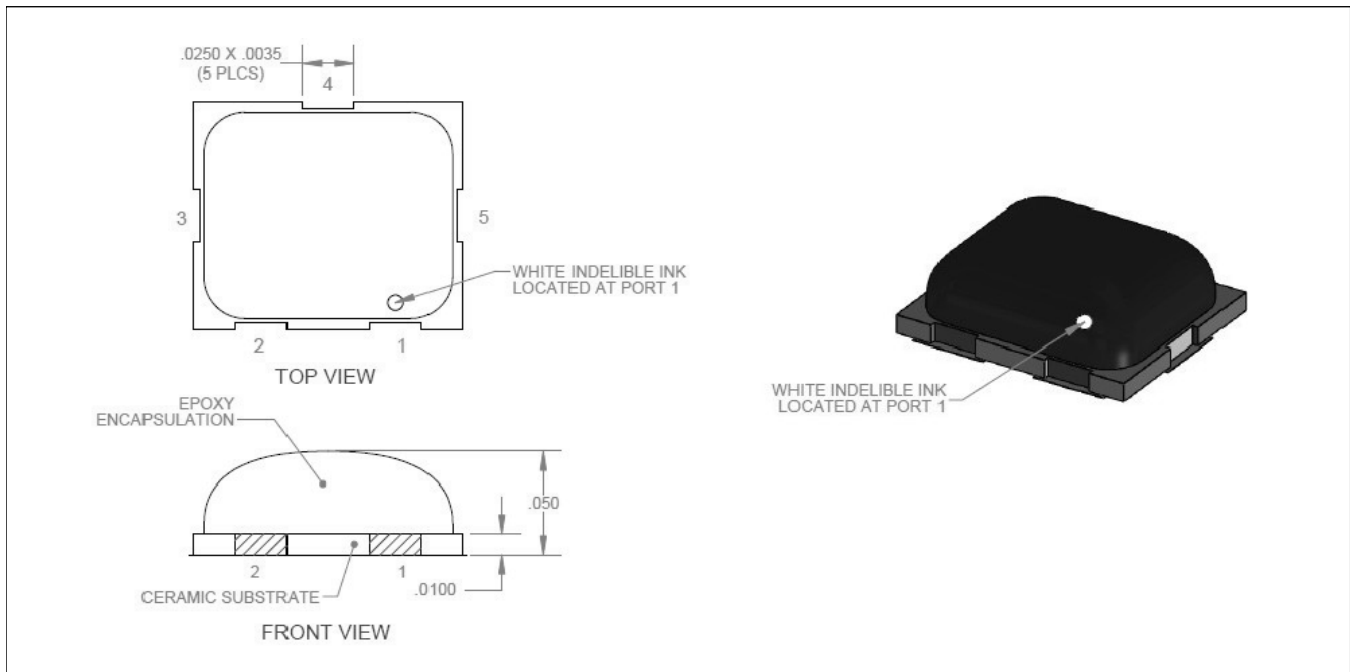
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10 MHz - 20 GHz

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## Outline Drawing (CS121)



## Outline Drawing (CS122)



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