

Sampling Phase Detectors

MSPD1011,MSPD1012,MSPD1013 Series

Data Sheet

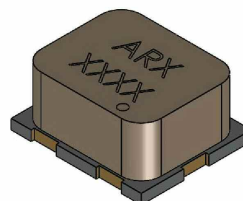


Features

- Operating Frequency: 10 MHz to 20 GHz
- Surface mount package: 3.3 mm (L) x 2.8 mm (W) x 1.5 mm (H)
- RoHS Compliant

Applications

- Phase locked loops
- High frequency sampling



Description

The products of the MSPD101x-121 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 Aeroflex/Metelics proven diode fabrication and assembly processes which optimize diode characteristics for optimal electrical performance and excellent reliability.

These low profile, compact (3.3 mm L x 2.8 mm W x 1.5 mm H) 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. The MSPD101x-121 family of devices is RoHS compliant.

Environmental Capabilities

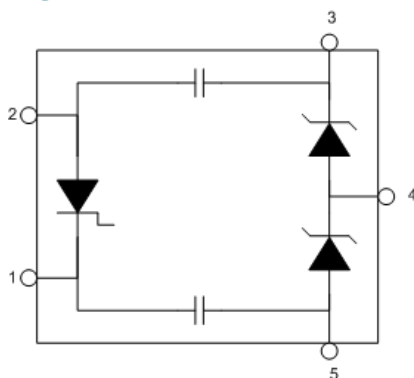
The MSPD101x-121 sampling phase detectors are capable of meeting the environmental requirements of MIL-STD-750 and MIL-STD-883.

ESD and Moisture Sensitivity Level Rating

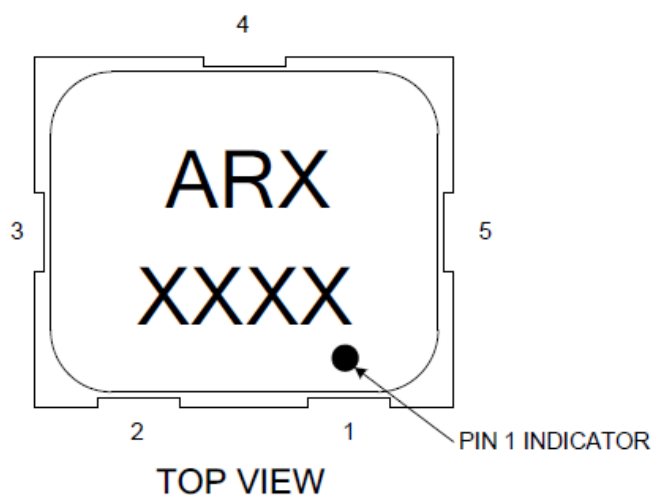
As are all semiconductors, the MSPD101x-121 sampling phase detectors are susceptible to damage from ESD events. Proper ESD prevention procedures should be followed. The ESD rating for these devices is Class 0 (HBM). The moisture sensitivity level rating is MSL 1.



Sampling Phase Detector Schematic



CS121 Pinout



Pin Description

Pin Number	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

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Electrical Specifications

$T_A = 25^\circ\text{C}$ (Unless otherwise Defined)

Parameter	Condition	MSPD1011			MSPD1012			MSPD1013			Unit
		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			Med.			High		
Forward voltage	$I_F = 1\text{ mA}$	270		350	370		550	600		700	mV
Junction capacitance	$V_R = 0\text{ V}, f = 1\text{ MHz}$			0.1			0.1			0.1	pF
Total resistance	$I_F = 5\text{ mA}$			24			24			24	
Step recovery diode											
Breakdown voltage	$I_R = 10\text{ }\mu\text{A}$		20	30		20	30		20	30	V
Carrier life time	$I_F = 10\text{ mA}, I_R = 6\text{ mA}$		10			10			10		ns
Transition time	$I_F = 10\text{ mA}, V_R = 10\text{ V}$		70			70			70		ps
Junction capacitance	$V_R = 0\text{ V}, f = 1\text{ MHz}$			0.25			0.25			0.25	pF
DC block capacitor											
Capacitance	$f = 1\text{ MHz}$		0.5	1		0.5	1		0.5	1	pF

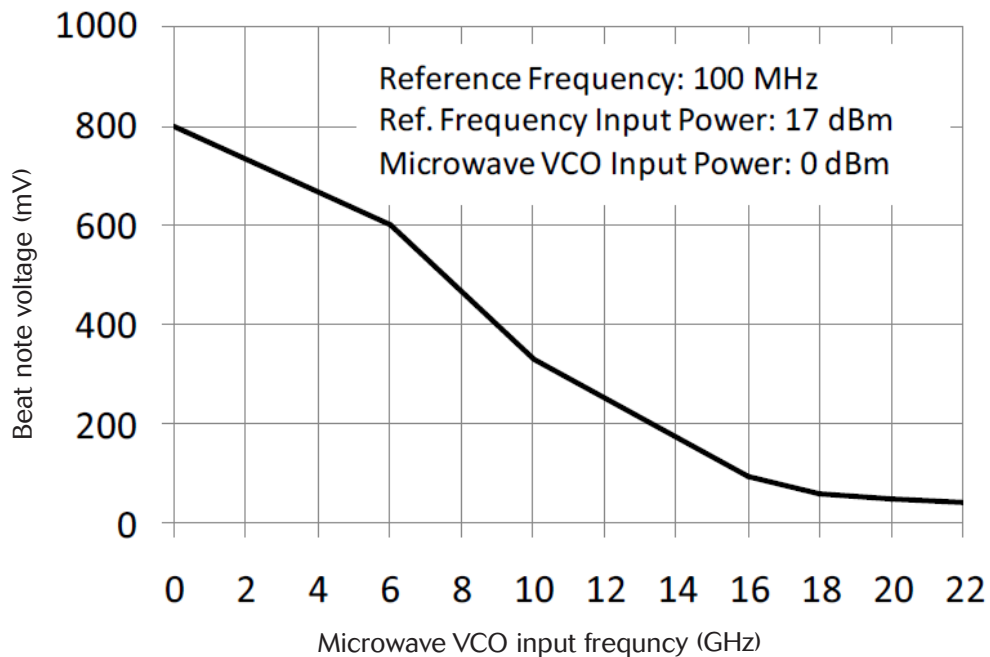
Absolute Maximum Ratings

$T_A = +25^\circ\text{C}$ (Unless Otherwise Defined)

Parameter	Conditions	Absolute Maximum Value
RF Incident Power	Applied to step recovery diode (pin 1 to pin 2)	27 dBm
	Applied to microwave input (pin 4)	20 dBm
Operating Temperature		-55 °C to 125 °C
Storage Temperature		-65 °C to 150 °C
Junction Temperature		150 °C
Total Dissipated Power	Infinite heat sink, $T_{case} = 25^\circ\text{C}$. Derate power linearly from 100 mW @ 85 °C to 0 W @ 125 °C	100 mW

Typical Performance

$Z_0 = 50 \Omega$, $T_{CASE} = 25^\circ\text{C}$, (Unless Otherwise Defined)



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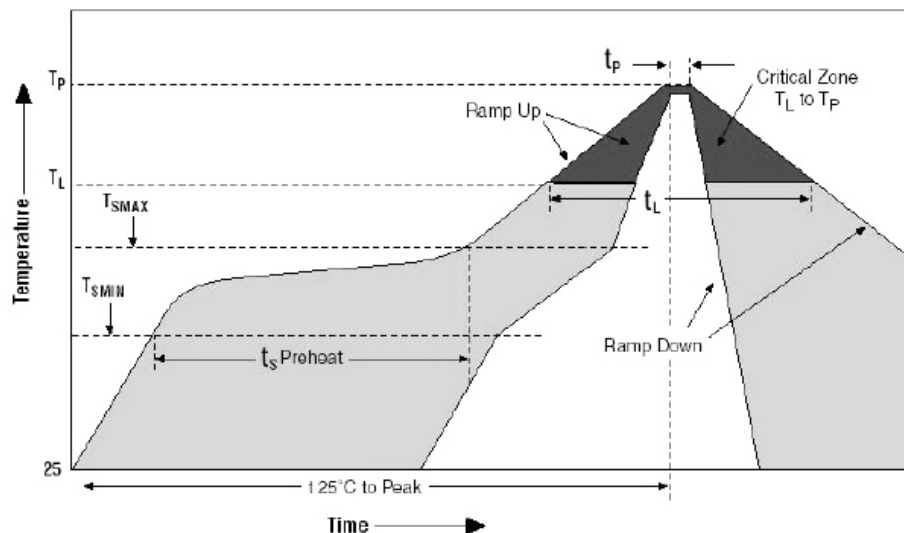
Assembly Instructions

The MSPD101x family of sampling phase detectors may be soldered to a printed circuit using conventional solder re-flow or wave soldering procedures with RoHS type or Sn 60/Pb 40 type solders per the recommended time-temperature profile described in Table I and Figure 1.

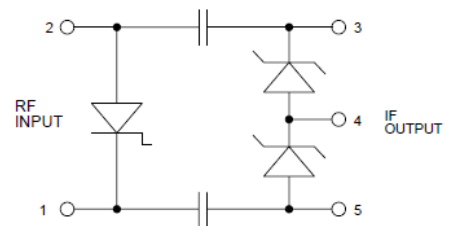
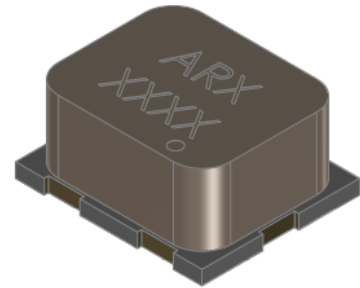
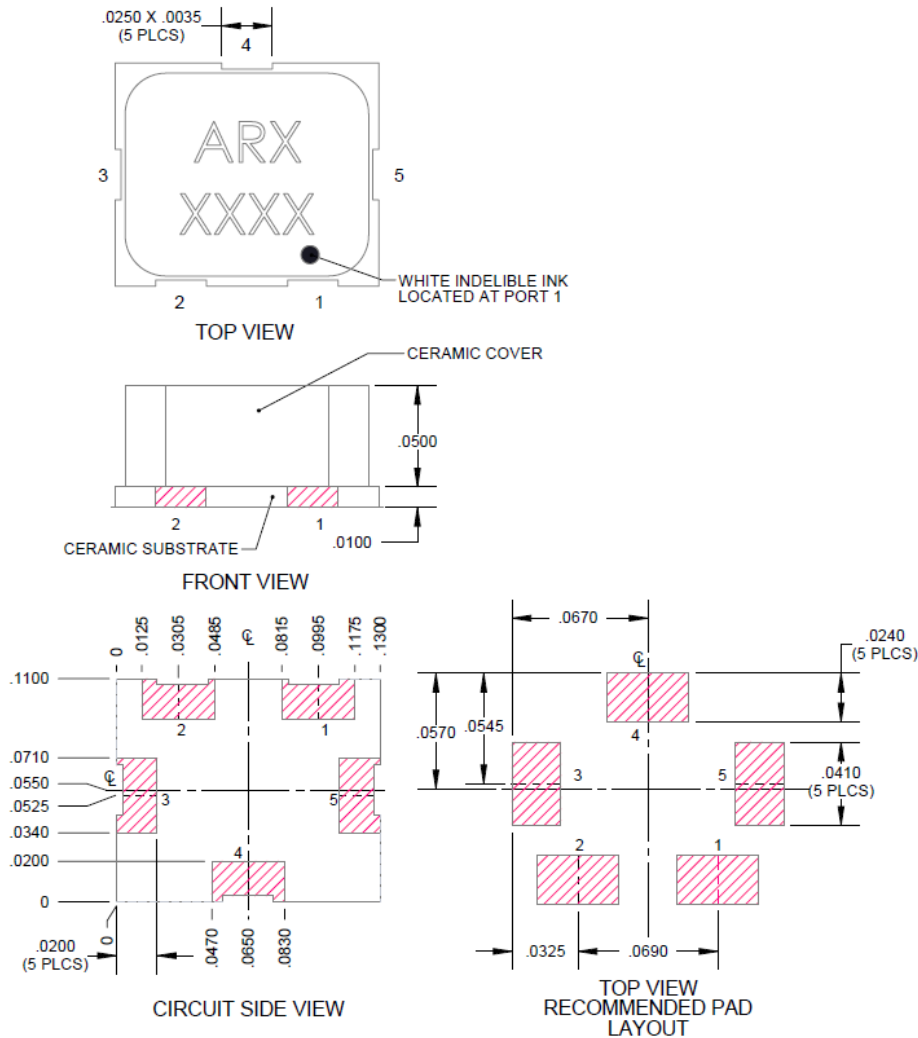
Table 1. Time-Temperature Profile for Sn60/Pb40 or RoHS Type Solders

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: - Temperature Min (T_{SMIN}) - Temperature Max (T_{SMAX}) - Time (min to max)(t_s)	100°C 150°C 60-120 s	150°C 200°C 60-180 s
T_{SMAX} to T_L - Ramp-Up Rate		3°C/s maximum
Time Maintained Above: - Temperature (T_L) - Time (t_L)	183°C 60-150 s	217°C 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



Outline (CS121)



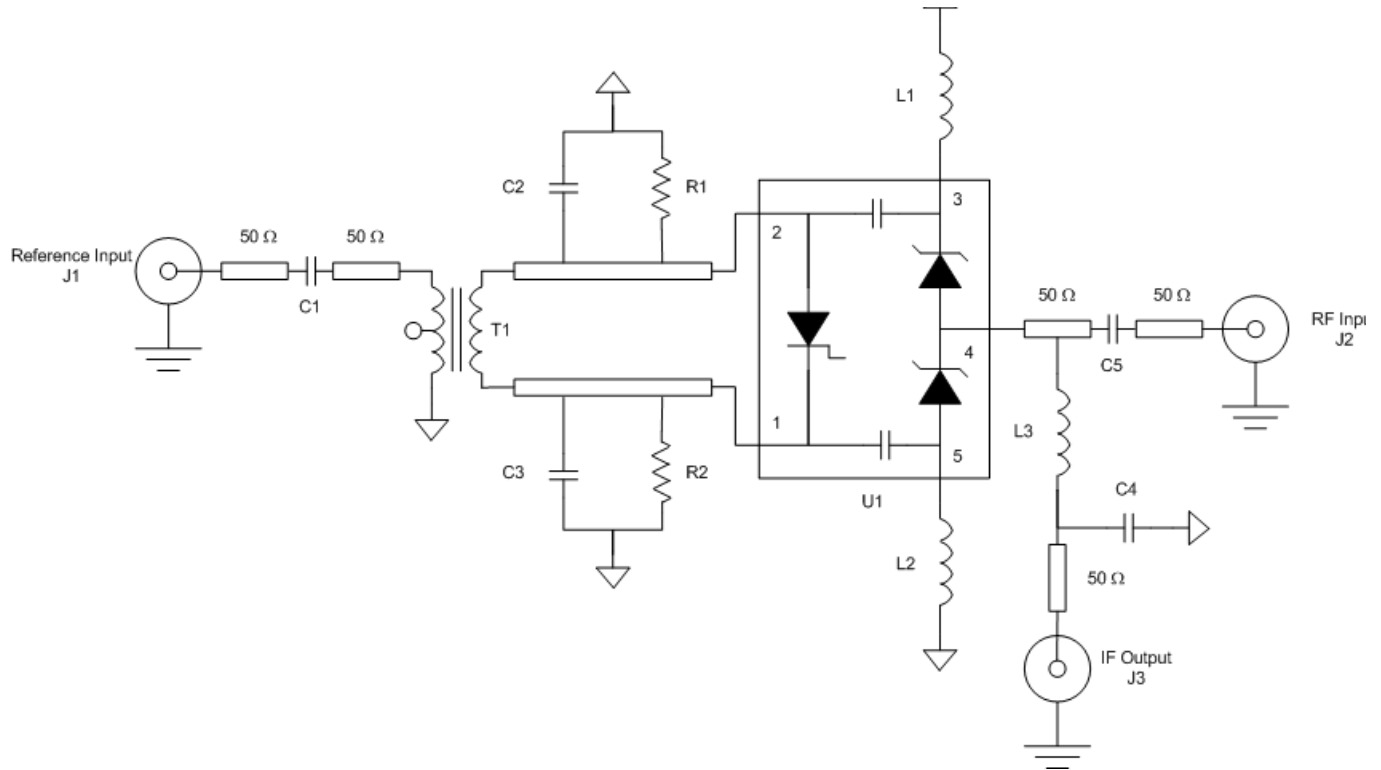
- NOTES:
1. SUBSTRATE MATERIAL: 10 MIL THICK 99.6% ALUMINA.
2. COVER: BLACK CERAMIC.
3. TOP SIDE AND BACKSIDE METALLIZATION: 500a TiW 3000A Au PLATING: 60u" ETCHABLE ELECTROLYTIC Ni/40u Au MIN
4. PACKAGE INTERNAL VOLUME: 0.002151294 CC
5. PHYSICAL INTERNAL VOLUME DEPENDENT UPON DIE SELECTION AND ATTACHMENT MATERIALS

All Dimensions in Inches

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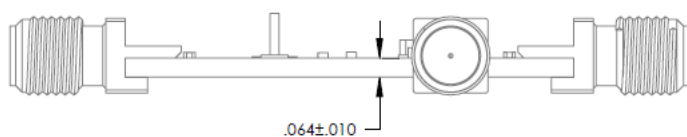
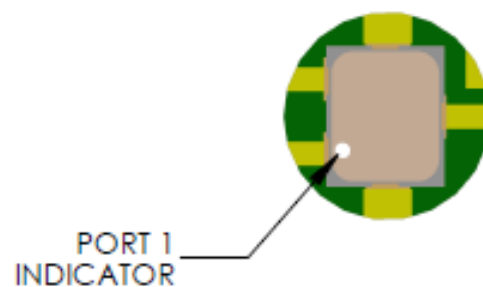
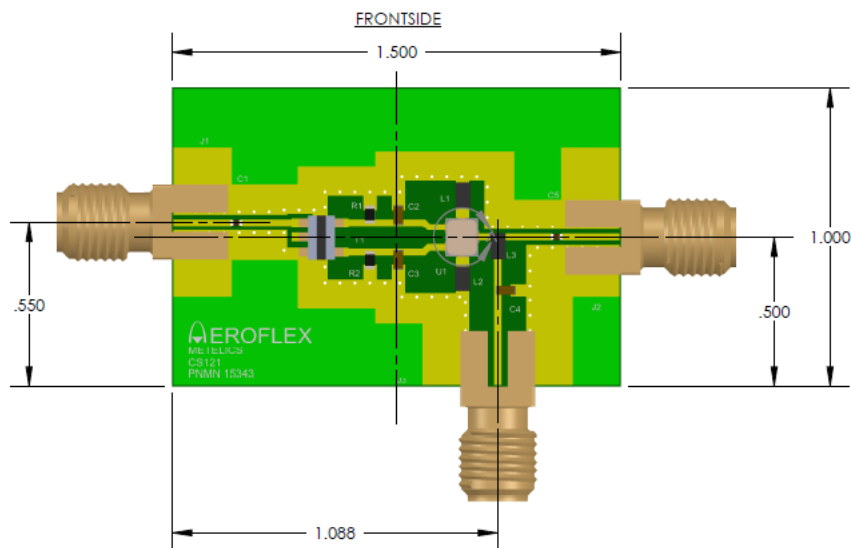
Recommended Circuit



Bill of Materials

Component	Reference Designator	Manufacturer	Manufacturer's Part Number	Quantity
Capacitor , 47 pF, 2%, 0603 pkg	C2,C3	Johanson Technology Inc	251R14S470JV4T	2
Capacitor , 22 pF, 2%, 0402 pkg	C5	Johanson Technology Inc	500R07S220GV4T	1
Capacitor , 10 pF, 2%, 0402 pkg	C1	Johanson Technology Inc	250R05L100GV4T	1
Capacitor , 39 pF, 2%, 0603 pkg	C4	Johanson Technology Inc	251R14S390GV4T	1
Inductor, 100 nH , 0603	L1,L2,L3	Coilcraft	0603CS-R10X-J-EU	3
Resistor, 100 Ω , 5%, 0.1 W, 0603	R1,R2	Panasonic Electronic Components	ERJ-3GEYJ101V	2
Sampling Phase Detector	U1	Aeroflex Metelics	MSPD101x-121	1
Connector, SMA Jack	J1,J2,J3	Cinch Connectivity Solutions Johnson	142-0761-871 (Digikey Part # J806-ND)	3
Transformer , 4:1 Balun,SM-22	T1	M/A COM	MABAES0061	1

Sampling Phase Detector Evaluation Board



Note

1. All dimensions in inches.
2. Circuit board material Rogers 4350B.

Part Number Ordering Information

Part Number	Description	Packaging
MSPD1011-121-T	Sampling Phase Detector, Low Barrier	Tube Packaging
MSPD1012-121-T	Sampling Phase Detector, Medium Barrier	
MSPD1013-121-T	Sampling Phase Detector, High Barrier	
MSPD1011-121-R	Sampling Phase Detector, Low Barrier	Tape & Reel Packaging Qty : 250 or 500 per reel
MSPD1012-121-R	Sampling Phase Detector, Medium Barrier	
MSPD1013-121-R	Sampling Phase Detector, High Barrier	
MSPD1011-121-W	Sampling Phase Detector, Low Barrier	Waffle Pack Packaging
MSPD1012-121-W	Sampling Phase Detector, Medium Barrier	
MSPD1013-121-W	Sampling Phase Detector, High Barrier	
MSPD1011-121-E	Sampling Phase Detector, Low Barrier Evaluation Board	Evaluation Board
MSPD1012-121-E	Sampling Phase Detector, Medium Barrier Evaluation Board	
MSPD1013-121-E	Sampling Phase Detector, High Barrier Evaluation Board	

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