320 MHz Ultra - Low Phase Noise VCSO

101765-320-A

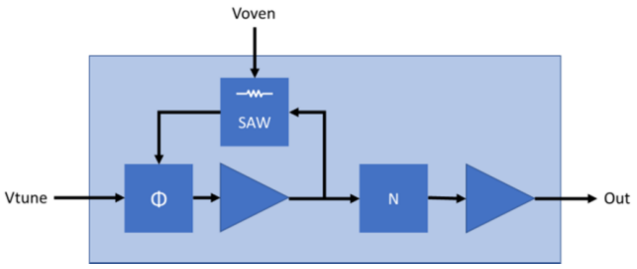
Product Overview

The 101765–320–A is an Oven Controlled Voltage Controlled SAW Oscillator that operates at 320 MHz. The SAW resonator is a high-Q quartz device that enables the circuit to achieve ultra-low phase noise while our patented micro–oven technology stabilizes performance over the operating temperature range and consumes minimal power. The oscillator is hermetically sealed in a Kovar package suitable for surface mount installation. The 101765 family is not RoHS compliant as Sn63Pb eutectic solder is used in assembly for tin whisker mitigation. The 101765–320–A is export controlled per EAR 3a001.b.10.

Key Features

- Ultra–Low phase noise:
  - –166 dBc/Hz at 10 kHZ
  - –182 dBc/Hz floor
- High RF output power: +18.5 dBm
- Single ended sinewave output
- Wide supply voltage range: 5V – 15V
- Hermetic 1 in. ×1 in. × 0.2 in.^{3} package
- –40 °C to +85 °C
- 2 ppb/g vibration sensitivity

Functional Block Diagram



Applications

- Radar:
  - Clock
  - Coherent local oscillator
- Test and Measurement Systems
- High Reliability Applications
  - Optional Mil–Prf–38534 screening

Overall Performance

Parameters	Value	Units
Frequency	320	MHz
Supply voltage	4.75 –15.75	V
Supply current	111	mA
Control voltage	0 – 4.5	V
Output power	17 – 20	dBm

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1. Electrical Specifications

1.1 Typical Electrical Performance

Table 1-1. Electrical Specifications at T_{case} = 25 °C, V_{CC} = 5V, V_{oven} = 12V, unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
Frequency	f_n		320		MHz	1
Frequency variation over temperature			20		ppm	2
Supply voltage sensitivity			0.1		ppm	3
Loadpull			6		ppm	4
Frequency aging				30	ppm	5
Vibration sensitivity	Γ		2		ppb/g	
Supply voltage	V_{cc}	4.75	5	15.75	V	6
Supply current	I_{cc}		111		mA	
Control current	I_c		0		mA	
Oven voltage	V_{oven}	9	12	15.75	V	
Oven current – steady state	I_{oven}		25		mA	
Control voltage	V_c	0	2.2	4.5	V	
Tuning Range			107		ppm	
Tuning sensitivity	K_v		23.8		ppm/V	
Linearity			2.5		%	
Modulation bandwidth	BW		50		kHz	
Output power	P_{out}	17	18.5	20	dBm	7
Output power variation over temperature			1		dBm	2
Second harmonic suppression			–57	–50	dBc	
Third harmonic suppression			–58	–50	dBc	
Non–harmonic spurious			–94	–90	dBc	
Phase noise at 100 Hz			–106	–104	dBc/Hz	
Phase noise at 1 kHz			–138	–136	dBc/Hz	
Phase Noise at 10 kHz			–166	–164	dBc/Hz	
Phase noise at 100 kHz			–180	–178	dBc/Hz	
Phase noise at 1 MHz			–182	–180	dBc/Hz	
Phase noise at 10 MHz			–182	–180	dBc/Hz	
Operating case temperature	T_{case}	–40	25	85	°C	
Package size		1 x 1 x 0.2			in^3	
Mass		11			g	

Notes:

1. Unit will tune to nominal frequency at end of life under any combination of supply variation, load pull, case temperature, and vibration.
2. Over operating case temperature range –40 °C to +85 °C
3. Supply voltage variation ± 5%
4. Load variation 2:1 VSWR, any angle
5. 20 years
6. Adequate heat sinking must be implemented to meet operating case temperature requirements. Recommended operating condition is V_{cc} = 5V.
7. Single ended into 50Ω load at 320 MHz.

1.2 Typical Performance Curves

The following graphs show the typical performance curves of 101765–320–A.

Figure 1-1. Typical Phase Noise Performance

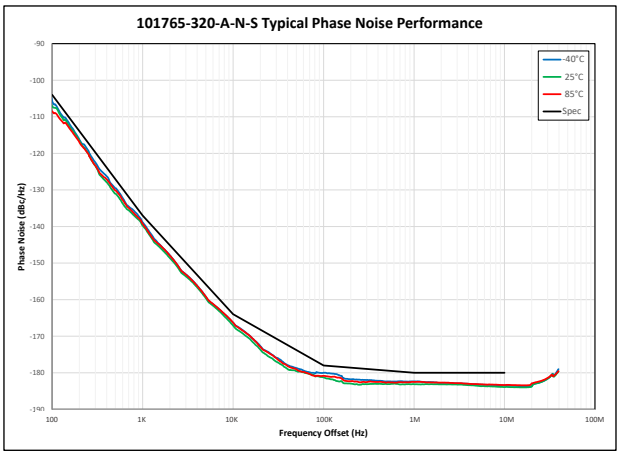
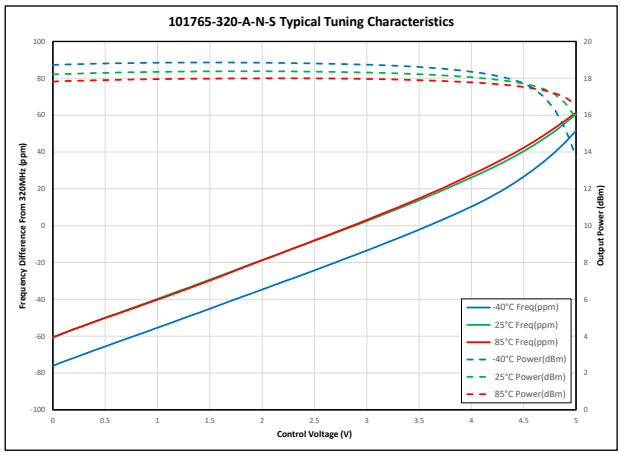


Figure 1-2. Typical Tuning Characteristics



1.3 Absolute Maximum Ratings

Stress exceeding the absolute maximum ratings can permanently damage the device. Also, exposure to these absolute maximum ratings for extended periods may adversely affect device reliability. Functional operation is not implied at these or any other conditions exceeding those represented in the operational sections of this data sheet.

The following table shows the absolute maximum ratings, for T_{case} from –40 °C to +85 °C.

Table 1-2. Absolute Maximum Ratings

Parameters	Symbol	Min	Max	Units
Supply voltage	V_{cc}	–0.3	22	V
Supply current	I_{cc}	N/A	120	mA
Oven voltage	V_{oven}	0	40	V
Oven current	I_{oven}	N/A	800	mA
Control voltage	V_c	–10	30	V
Operating case temperature	T_{case}	–40	85	°C
Storage temperature	T_{stg}	–55	125	°C

1.3.1 Reliability

Qualification included MIL–STD –883 tests per MIL–PRF–38534 Table C–Xc, Class K, QML Level, Sub–groups 1, 2, 3 and 4. Standard Screening includes pre–seal burn –in, non –destructive bond pull, temperature cycling and seal tests. Mil screening includes tests per MIL–PRF–38534 Table C–IX, Class H. Custom screening is available. Consult factory.

2. Outline Drawing

Figure 2-1. Outline Drawing

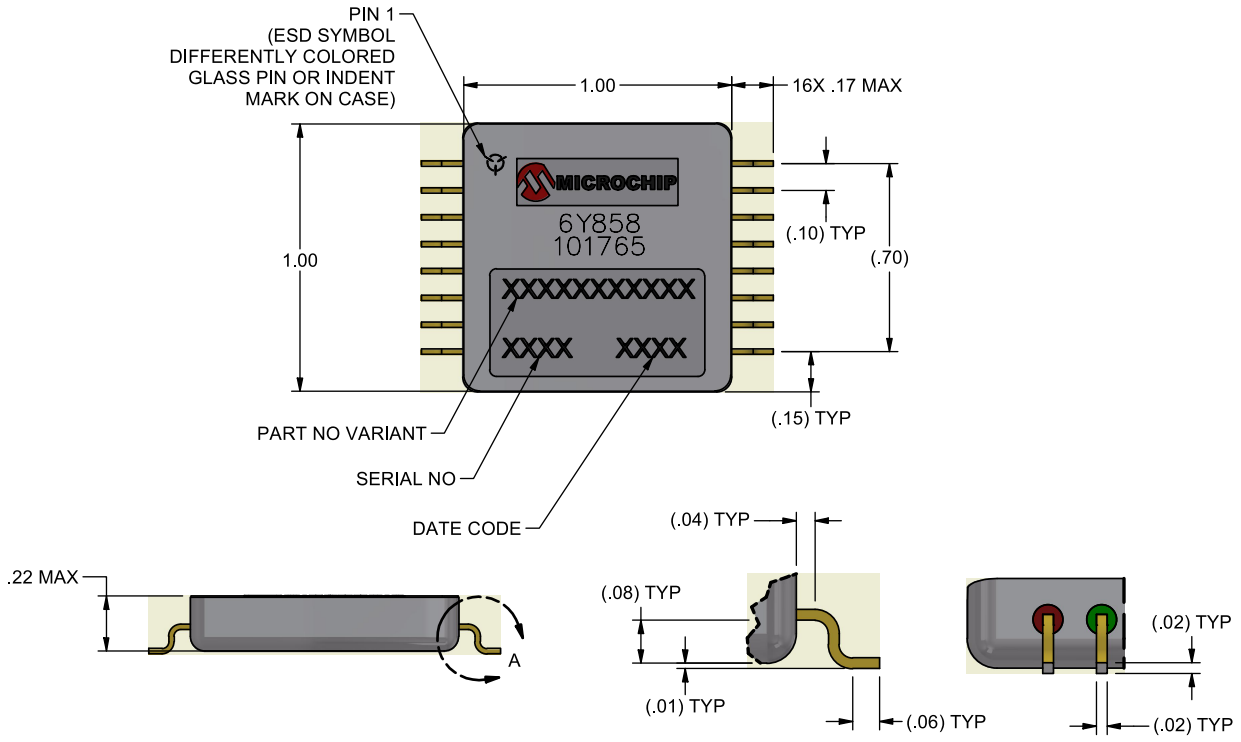


Table 2-1. Pin Outs

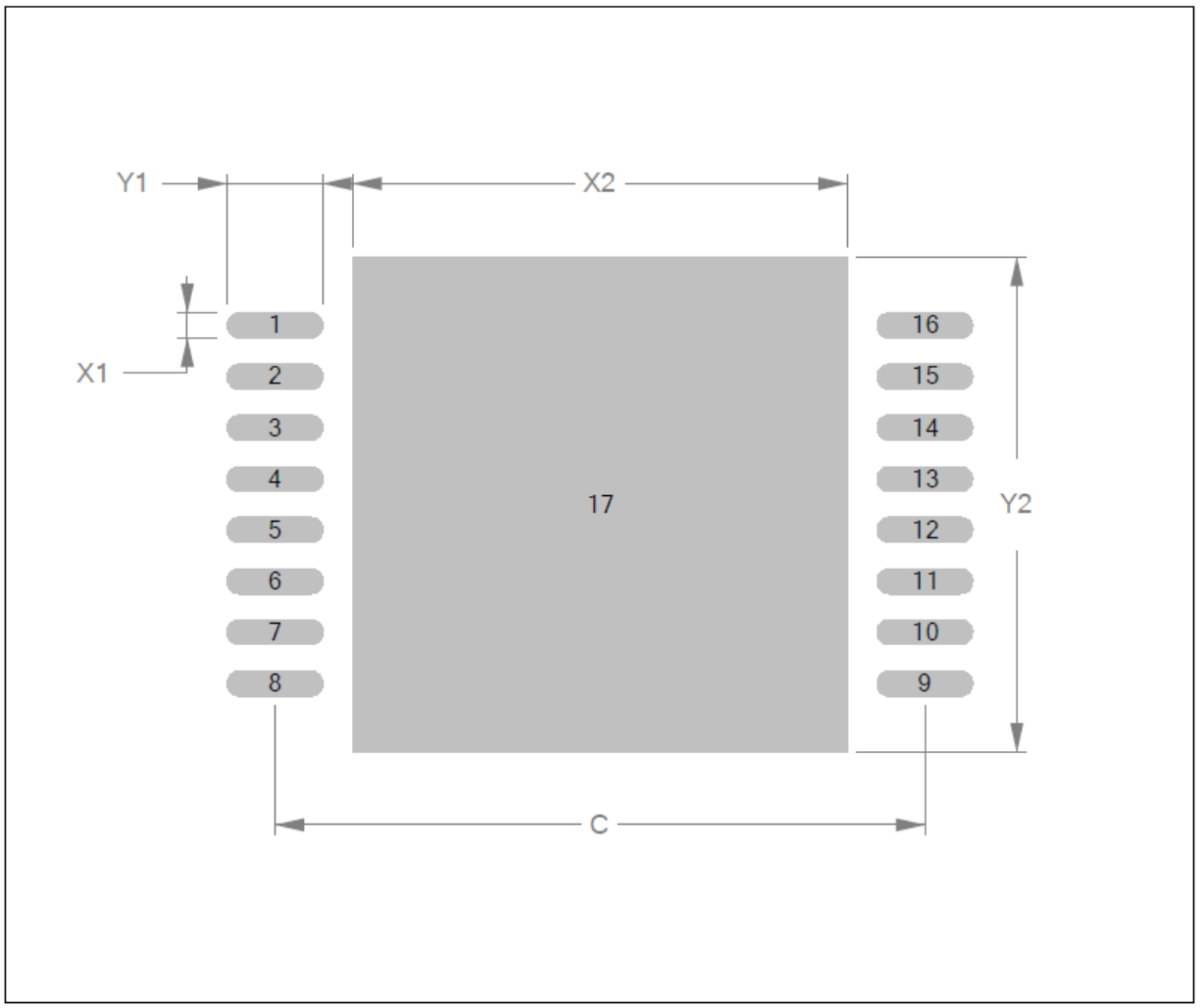
Pin No.	Function
1	$V_{control}$
2	NC
3	GND
4	NC
5	NC
6	NC
7	GND
8	V_{oven}
9	OUTPUT
10	GND
11	NC
12	NC
13	NC
14	NC
15	GND
16	V_{CC}

Notes:

1. Microchip recommends grounding NC Pins in application.
2. Part marking may be implemented with laser etch and/or printed label at Microchip`s discretion.

2.1 Recommended Land Pattern

Figure 2-2. Recommended Land Pattern



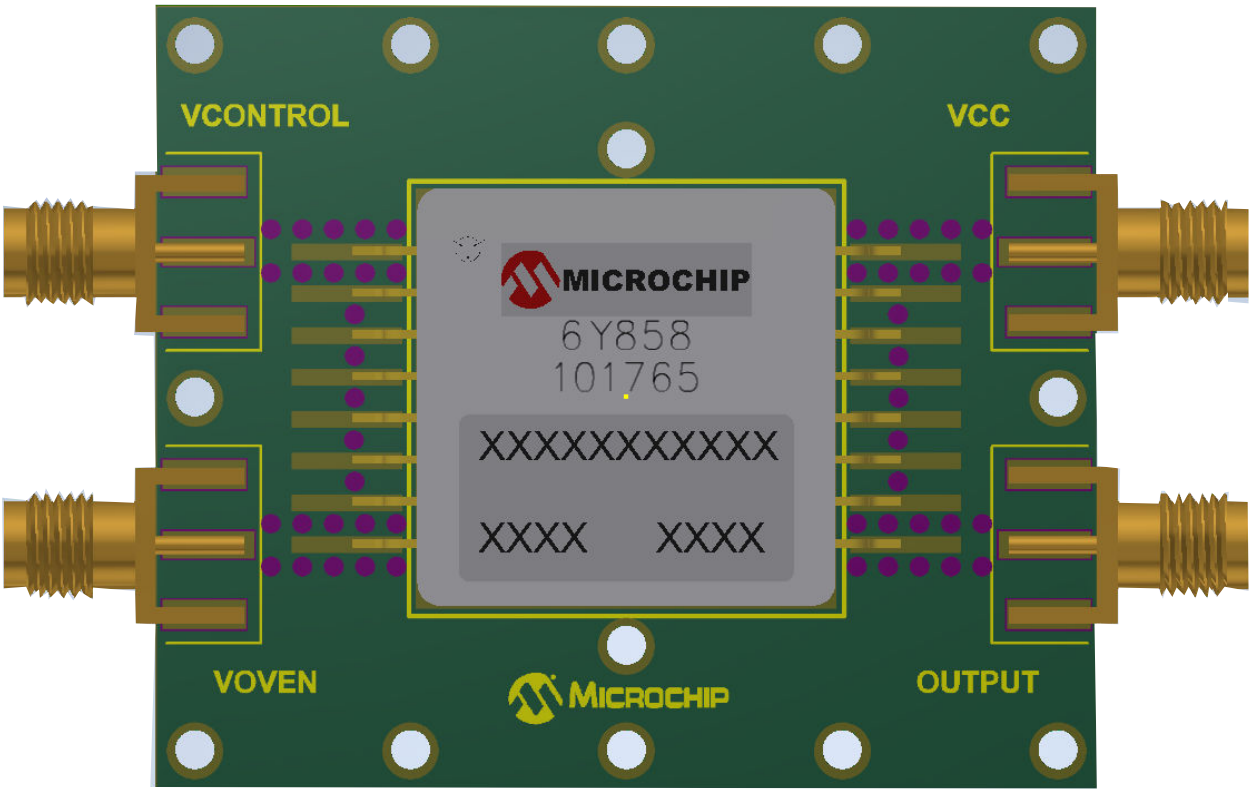
Symbol	Dimension (in)
C	1.272
Y1	0.187
X1	0.049
Y2	0.969
X2	0.969

Notes:

1. Microchip recommends placing an array of vias in the ground plane (17) beneath the device body for RF performance and thermal conduction.

2.2 Test Board

Figure 2-3. Test Board

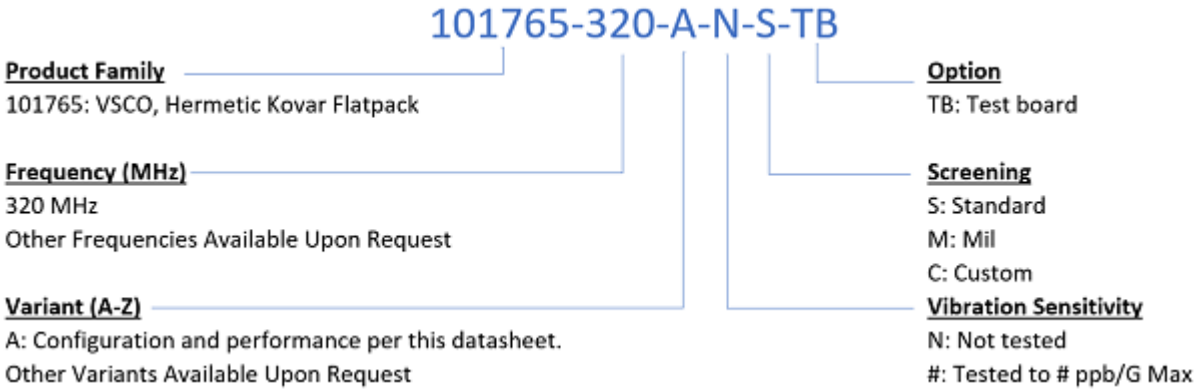


Notes:

1. SMA female connectors
2. PCB material: FR4 or equivalent
3. PCB dimensions: 2.250 in. × 1.875 in. × 0.062 in.[3]
4. When ordering the – TB option, the VCSO is mounted on the test board as recommended in the datasheet.

3. Ordering Information, and Handling Recommendations

3.1 Ordering Information



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3.2 Handling Recommendations

The 101765 family of VCSO are susceptible to electrostatic discharge. Proper precautions should be taken when handling and mounting.

Mounting

Microchip recommends thermally and electrically attaching the body of the 101765 to the substrate ground or chassis on which it is mounted (e.g., with epoxy) and selectively soldering the leads (e.g., with solder iron or hot air pencil). The end user is responsible for implementing a compatible process.

ESD Sensitive Device

4. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Description
A	02/2024	Document created.

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