

# Ultra Low Phase Noise Crystal Oscillator



## SOMC-330

### Feature

- Hermetically seam-sealed ceramic package:14.3×9.14×4.9mm
- Ultra Low Jitter Performance (Typical):35fs@49.152MHz
- Supply voltage: 1.8V, 2.5V, 3.3V
- Low current Consumption
- Pb-free/RoHS Compliant | MSL Level 1
- Tight frequency stability options available

### Applications

- Audio applications
- Network Communication

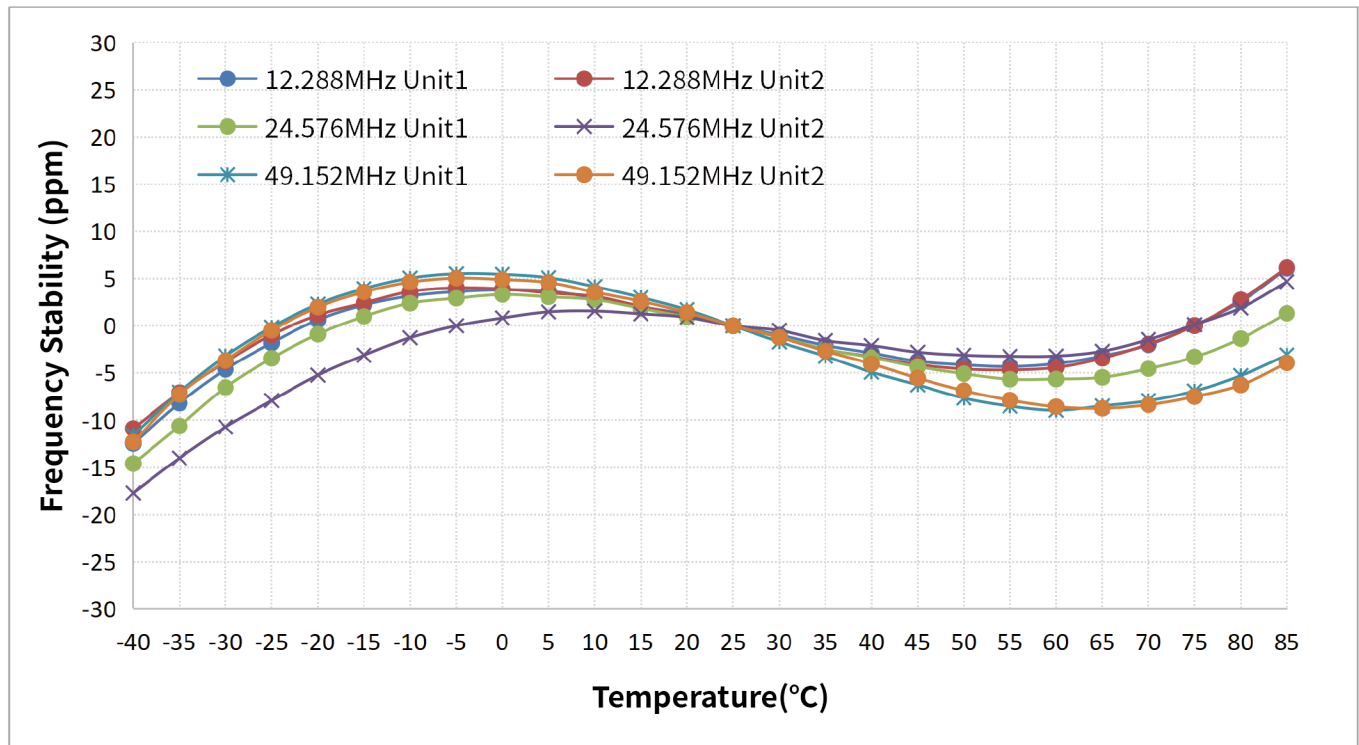


### Electrical Specifications

| Item                      | Symb.                           | Min.                    | Typ. | Max.               | Unit | Notes                                                                                       |
|---------------------------|---------------------------------|-------------------------|------|--------------------|------|---------------------------------------------------------------------------------------------|
| Frequency Range           | Freq.                           | 1                       | —    | 54                 | MHz  |                                                                                             |
| Operating Temperature     | T <sub>use</sub>                | -40                     | —    | +85                | °C   |                                                                                             |
| Storage Temperature Range | T <sub>stg</sub>                | -55                     | —    | +155               | °C   |                                                                                             |
| Supply Voltage            | V <sub>dd</sub>                 | 2.97                    | 3.3  | 3.63               | V    |                                                                                             |
|                           |                                 | 2.25                    | 2.5  | 2.75               | V    |                                                                                             |
|                           |                                 | 1.62                    | 1.8  | 1.98               | V    |                                                                                             |
| Output Load(CMOS)         | L <sub>CMOS</sub>               | 15                      |      |                    | pF   |                                                                                             |
| Current Consumption       | I <sub>cc</sub>                 | —                       | —    | 10                 | mA   | 1MHz ≤ Freq. < 40MHz, L <sub>CMOS</sub> = 15pF                                              |
|                           |                                 | —                       | —    | 20                 |      | 40MHz ≤ Freq. ≤ 54MHz, L <sub>CMOS</sub> = 15pF                                             |
| Duty Cycle                | SYM                             | 45                      | —    | 55                 | %    | 50% V <sub>dd</sub> level, L <sub>CMOS</sub> ≤ 15pF                                         |
| Output Voltage            | V <sub>OH</sub>                 | 0.9V <sub>dd</sub>      | —    | —                  | V    |                                                                                             |
|                           | V <sub>OL</sub>                 | —                       | —    | 0.1V <sub>dd</sub> |      |                                                                                             |
| Enable Voltage High       | V <sub>IH</sub>                 | 0.7V <sub>dd</sub>      | —    | —                  | V    | Output will be disable if OE is Logic"0"<br>Output will be enable if OE is Logic"1" or open |
| Disable Voltage Low       | V <sub>IL</sub>                 | —                       | —    | 0.3V <sub>dd</sub> |      |                                                                                             |
| Rise / Fall Time          | T <sub>R</sub> / T <sub>F</sub> | —                       | —    | 5                  | nS   | 10% V <sub>dd</sub> to 90% V <sub>dd</sub> level                                            |
| Start-up time             | T <sub>str</sub>                | —                       | —    | 5                  | mS   | To 90% of Final Amplitude                                                                   |
| RMS Phase Jitter          | PJ                              | Please see Table2 below |      |                    |      | Offset: 12kHz to 20MHz                                                                      |
| Aging                     | f <sub>age</sub>                | -3                      | —    | +3                 | ppm  | at 25°C ± 3°C. First Year                                                                   |

## Electrical Specifications Cont.

• Table 1: Frequency Stability VS. Temperature



• Table 2: RMS Phase Jitter (Offset: 12kHz to 20MHz)

| Frequency  | RMS Jitter (Typical) |                       |
|------------|----------------------|-----------------------|
|            | Supply Voltage =1.8V | Supply Voltage = 3.3V |
| 16.9344MHz | 115.297fs            | 58.248fs              |
| 22.5792MHz | 82.155fs             | 42.562fs              |
| 24.000MHz  | 81.626fs             | 38.42fs               |
| 24.576MHz  | 76.742fs             | 39.112fs              |
| 45.1584MHz | 94.777fs             | 37.804fs              |
| 49.152MHz  | 88.911fs             | 34.496fs              |
| 50.000MHz  | 89.53fs              | 35.572fs              |

# Ultra Low Phase Noise Crystal Oscillator

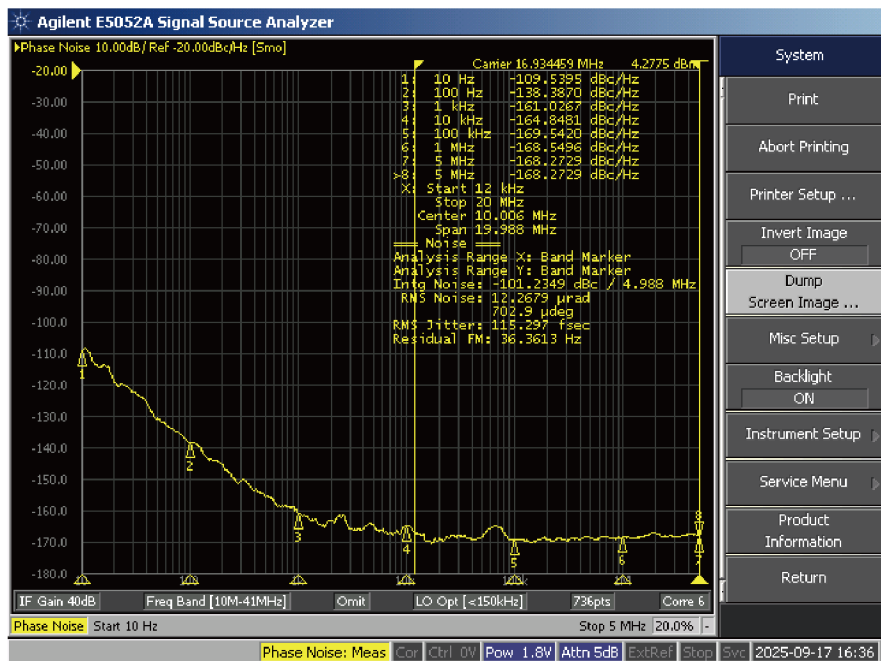


## SOMC-330

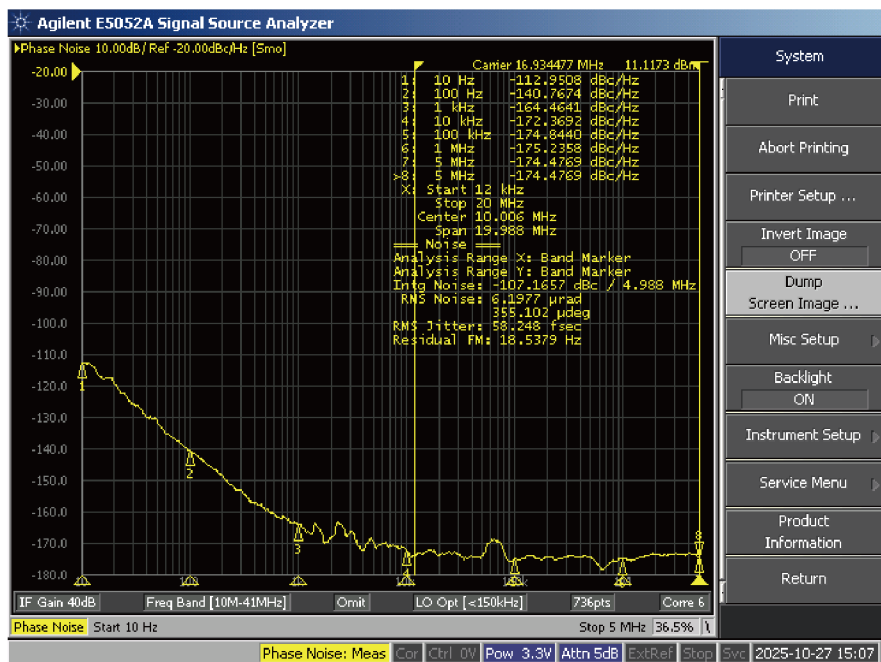
Table 3: Phase Noise Plots (Unit: dBc/Hz)

| Supply Voltage | Frequency (16.9344MHz) |           |           |           |           |           |           |
|----------------|------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
|                | 10Hz                   | 100Hz     | 1kHz      | 10kHz     | 100kHz    | 1MHz      | 5MHz      |
| 1.8V           | -109.5395              | -138.3870 | -161.0267 | -164.8481 | -169.5420 | -168.5496 | -168.2729 |
| 3.3V           | -112.9508              | -140.7674 | -164.4641 | -172.3692 | -174.8440 | -175.2358 | -174.4769 |

Frequency: 16.9344MHz Vdd=1.8V



Frequency: 16.9344MHz Vdd=3.3V



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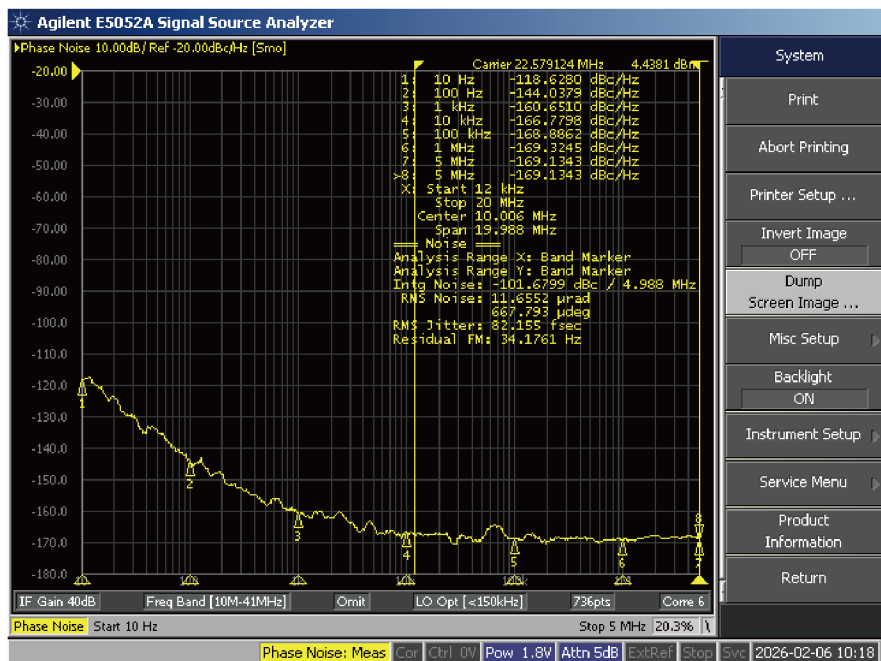


## SOMC-330

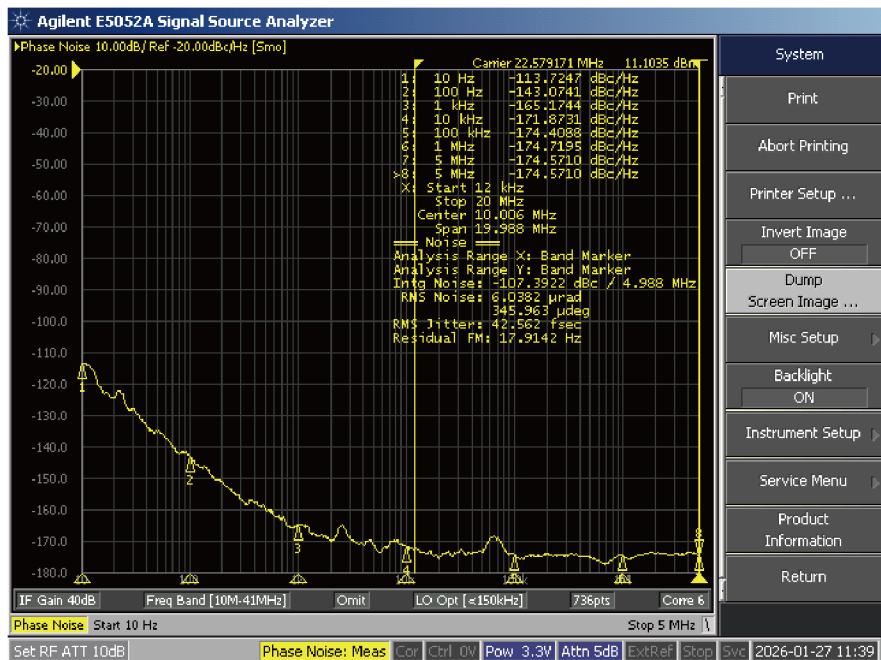
• Table 3: Phase Noise Plots (Unit: dBc/Hz)

| Supply Voltage | Frequency (22.5792MHz) |           |           |           |           |           |           |
|----------------|------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
|                | 10Hz                   | 100Hz     | 1kHz      | 10kHz     | 100kHz    | 1MHz      | 5MHz      |
| 1.8V           | -118.6280              | -144.0379 | -160.6510 | -166.7798 | -168.8862 | -169.3245 | -169.1343 |
| 3.3V           | -113.7247              | -143.0741 | -165.1744 | -171.8731 | -174.4088 | -174.7195 | -174.5710 |

Frequency: 22.5792MHz Vdd=1.8V



Frequency: 22.5792MHz Vdd=3.3V



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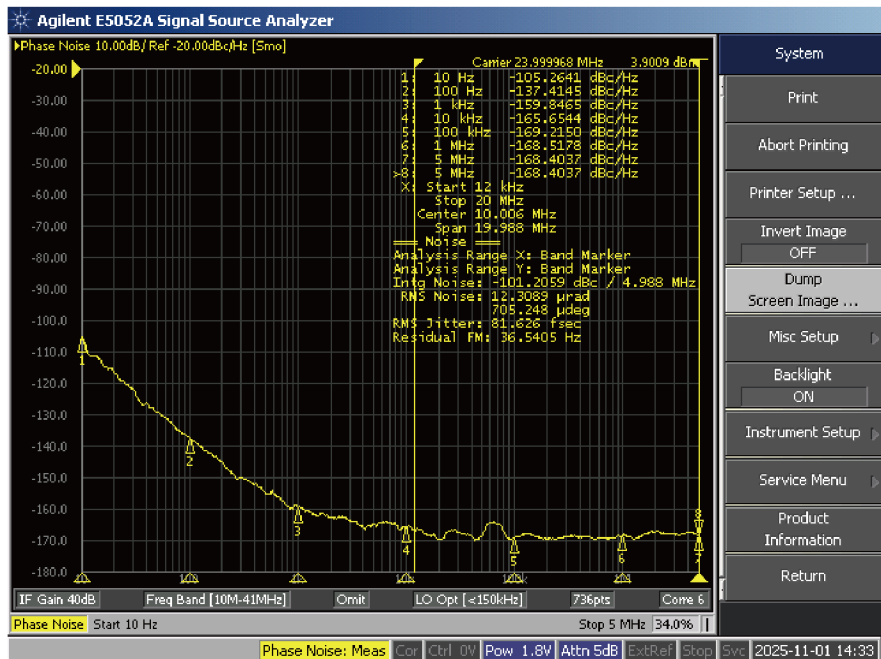


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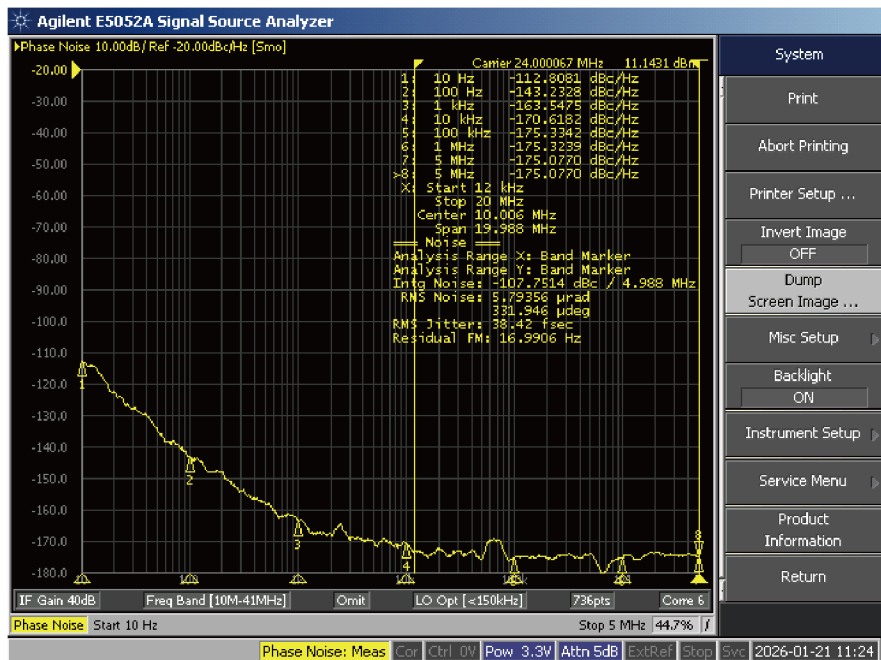
• Table 3: Phase Noise Plots (Unit: dBc/Hz)

| Supply Voltage | Frequency (24.000MHz) |           |           |           |           |           |           |
|----------------|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|
|                | 10Hz                  | 100Hz     | 1kHz      | 10kHz     | 100kHz    | 1MHz      | 5MHz      |
| 1.8V           | -105.2641             | -137.4145 | -159.8465 | -165.6544 | -169.2150 | -168.5178 | -168.4037 |
| 3.3V           | -112.8081             | -143.2328 | -163.5475 | -170.6182 | -175.3342 | -175.3239 | -175.0770 |

Frequency: 24.000MHz Vdd=1.8V



Frequency: 24.000MHz Vdd=3.3V



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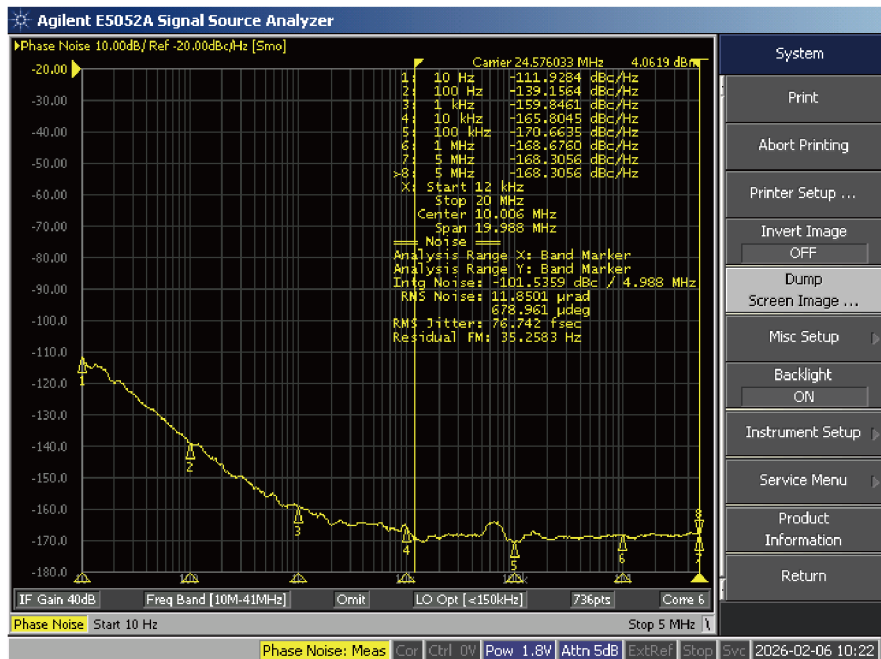


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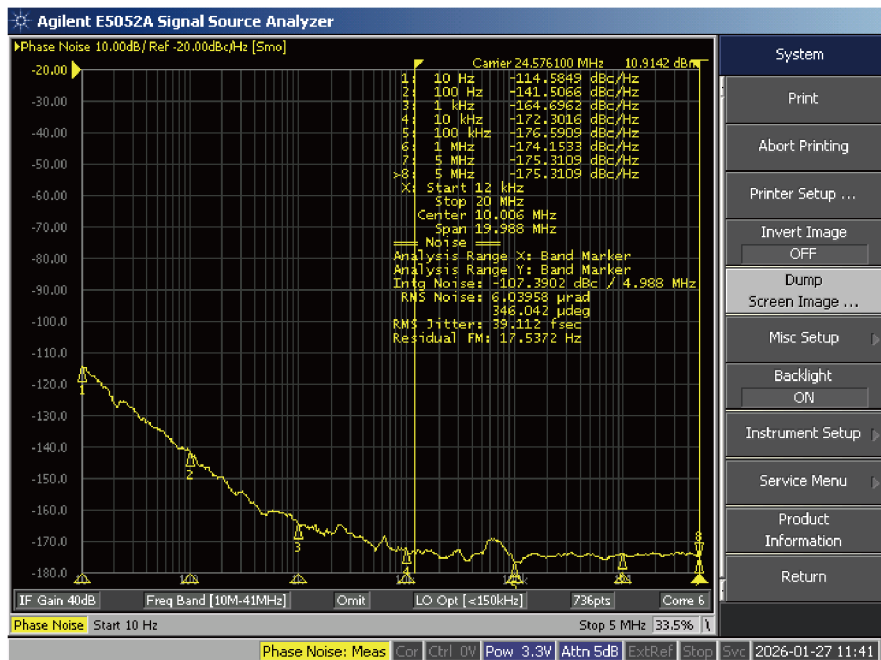
Table 3: Phase Noise Plots (Unit: dBc/Hz)

| Supply Voltage | Frequency (24.576MHz) |           |           |           |           |           |           |
|----------------|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|
|                | 10Hz                  | 100Hz     | 1kHz      | 10kHz     | 100kHz    | 1MHz      | 5MHz      |
| 1.8V           | -111.9284             | -139.1564 | -159.8461 | -165.8045 | -170.6635 | -168.6760 | -168.3056 |
| 3.3V           | -114.5849             | -141.5066 | -164.6962 | -172.3016 | -176.5909 | -174.1533 | -175.3109 |

Frequency: 24.576MHz Vdd=1.8V



Frequency: 24.576MHz Vdd=3.3V



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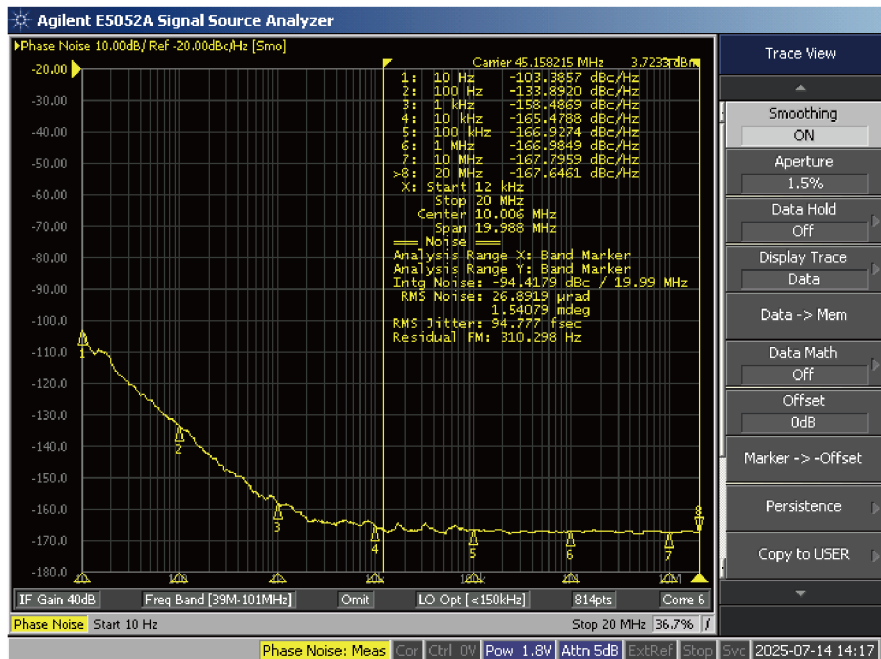


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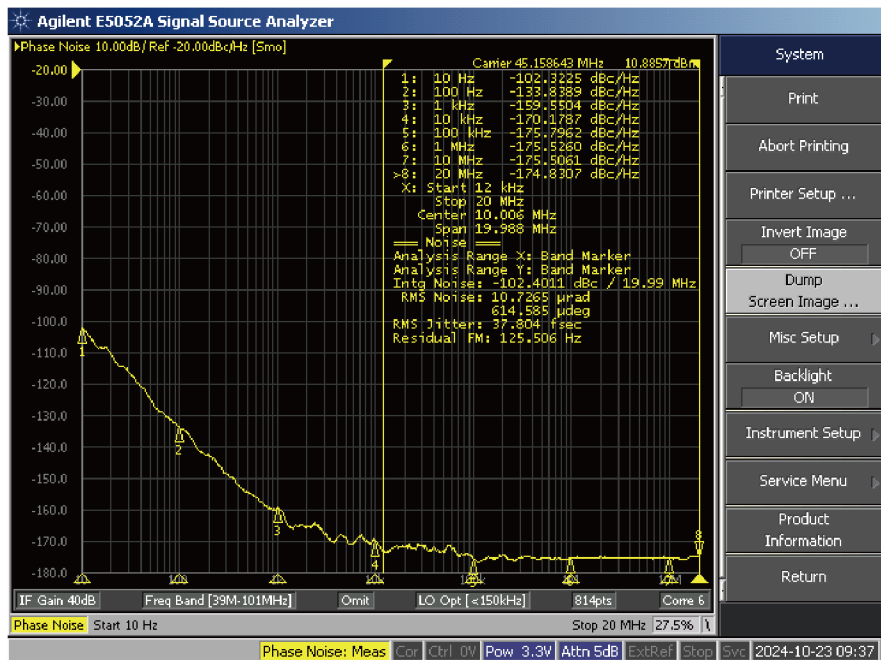
Table 3: Phase Noise Plots (Unit: dBc/Hz)

| Supply Voltage | Frequency (45.1584MHz) |           |           |           |           |           |           |           |
|----------------|------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                | 10Hz                   | 100Hz     | 1kHz      | 10kHz     | 100kHz    | 1MHz      | 10MHz     | 20MHz     |
| 1.8V           | -103.3857              | -133.8920 | -158.4869 | -165.4788 | -166.9274 | -166.9849 | -167.7959 | -167.6461 |
| 3.3V           | -102.3225              | -133.8389 | -159.5504 | -170.1787 | -175.7962 | -175.5260 | -175.5061 | -174.8307 |

Frequency: 45.1584MHz Vdd=1.8V



Frequency: 45.1584MHz Vdd=3.3V



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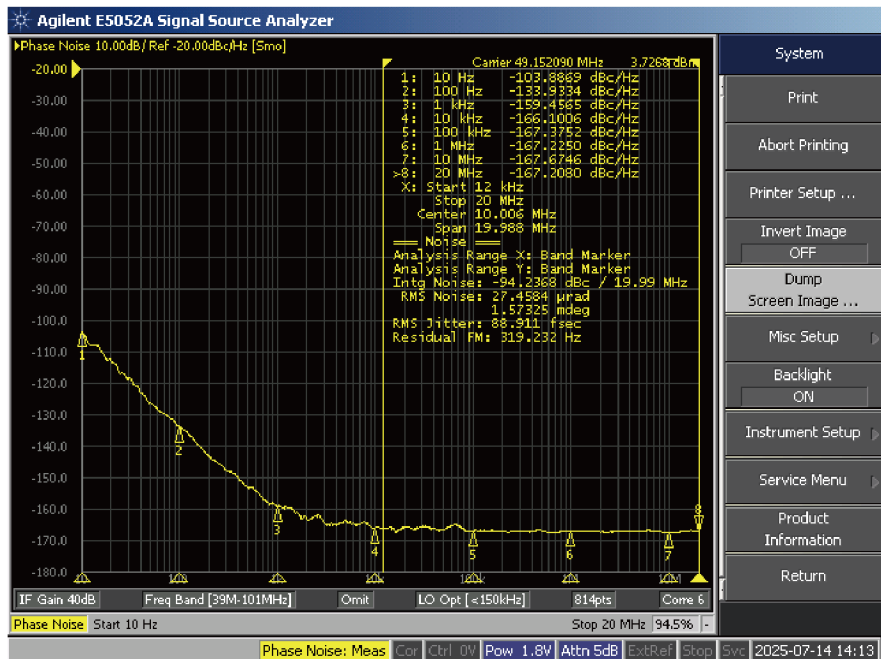


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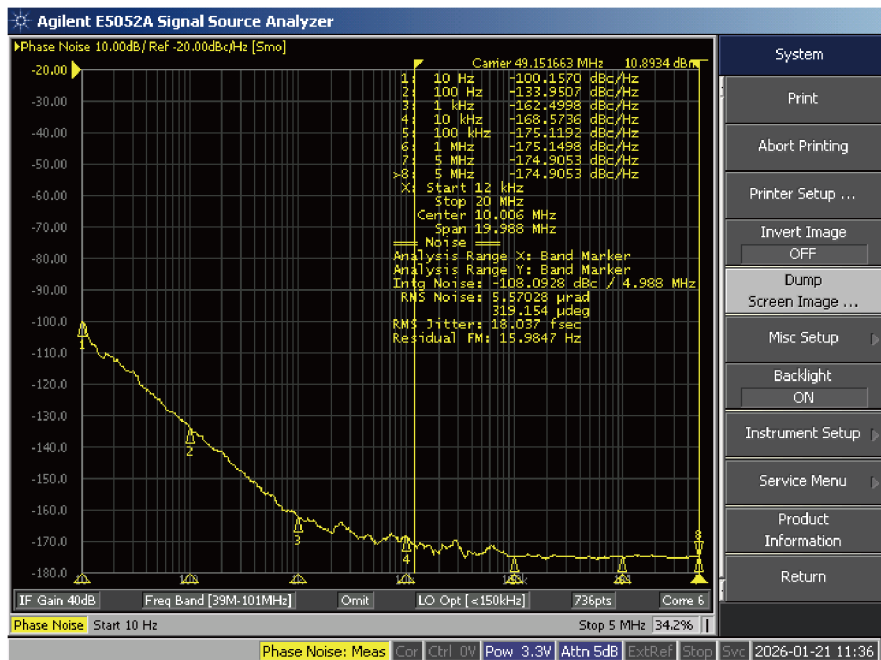
Table 3: Phase Noise Plots (Unit: dBc/Hz)

| Supply Voltage | Frequency (49.152MHz) |           |           |           |           |           |           |           |
|----------------|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                | 10Hz                  | 100Hz     | 1kHz      | 10kHz     | 100kHz    | 1MHz      | 10MHz     | 20MHz     |
| 1.8V           | -103.8869             | -133.9334 | -159.4565 | -166.1006 | -167.3752 | -167.2250 | -167.6746 | -167.2080 |
| 3.3V           | -100.1570             | -133.9507 | -162.4998 | -168.5736 | -175.1192 | -175.1498 | -174.9053 | -174.9053 |

Frequency: 49.152MHz Vdd=1.8V



Frequency: 49.152MHz Vdd=3.3V



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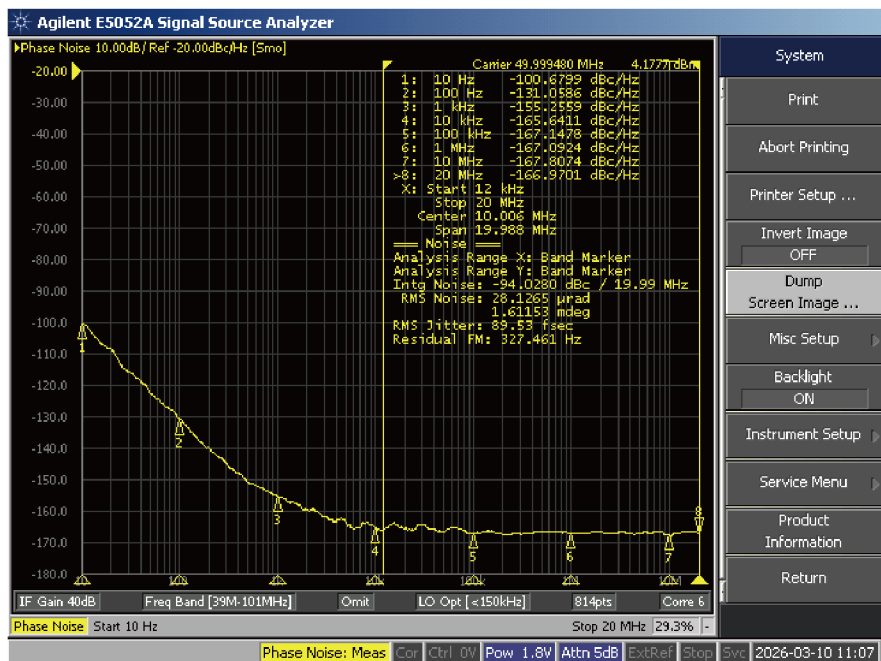


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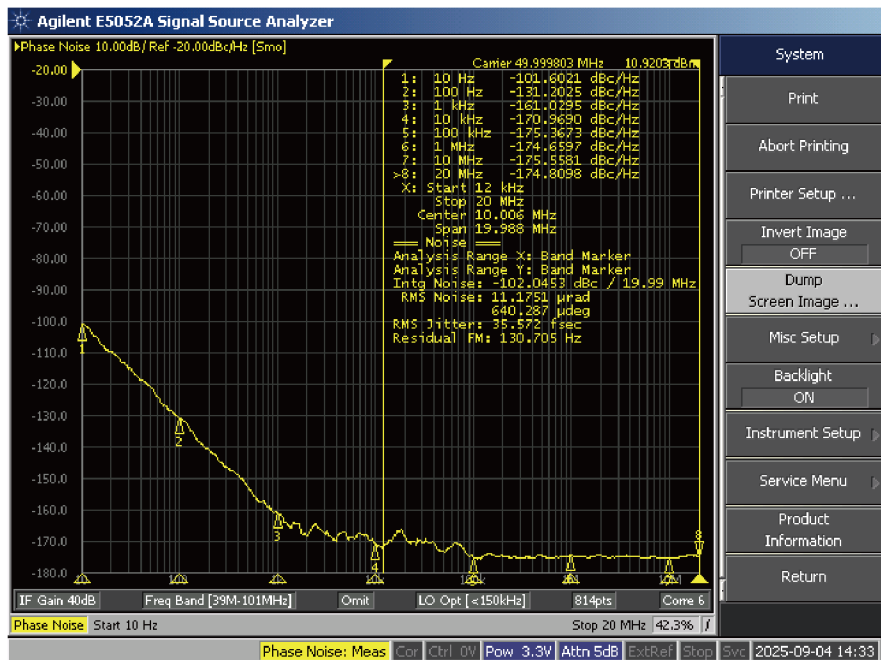
Table 3: Phase Noise Plots (Unit: dBc/Hz)

| Supply Voltage | Frequency (50.000MHz) |           |           |           |           |           |           |           |
|----------------|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                | 10Hz                  | 100Hz     | 1kHz      | 10kHz     | 100kHz    | 1MHz      | 10MHz     | 20MHz     |
| 1.8V           | -100.6799             | -131.0586 | -155.2559 | -165.6411 | -167.1478 | -167.0924 | -167.8074 | -166.9701 |
| 3.3V           | -101.6021             | -131.2025 | -161.0295 | -170.9690 | -175.3673 | -174.6597 | -175.5581 | -174.8098 |

Frequency: 50.000MHz Vdd=1.8V



Frequency: 50.000MHz Vdd=3.3V

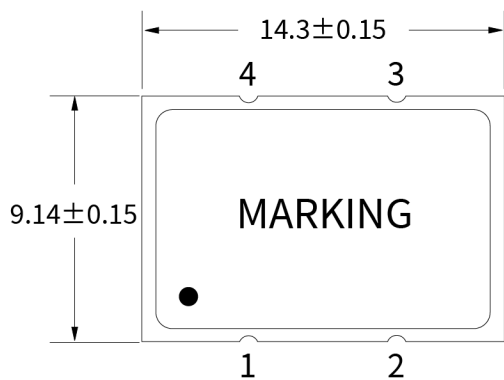


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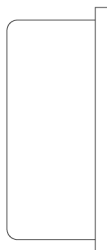


■ SOMC-330

## Dimensions (UNIT:mm)



• TOP VIEW



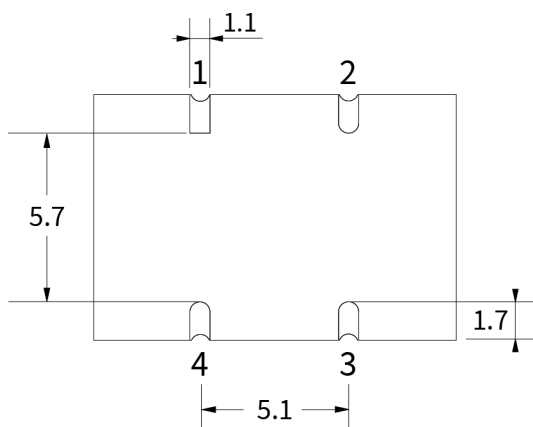
• SIDE VIEW

| Pin | Function       |
|-----|----------------|
| 1   | Enable Control |
| 2   | GND            |
| 3   | Output         |
| 4   | Vdd            |

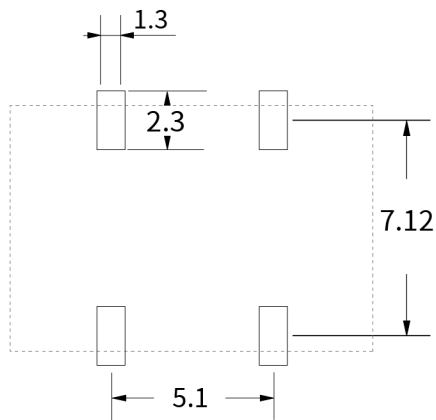


• SIDE VIEW

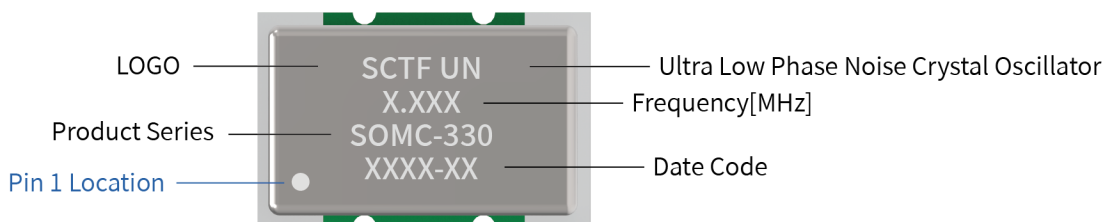
• SOLDER PAD LAYOUT



• BOTTOM VIEW



## Marking Information

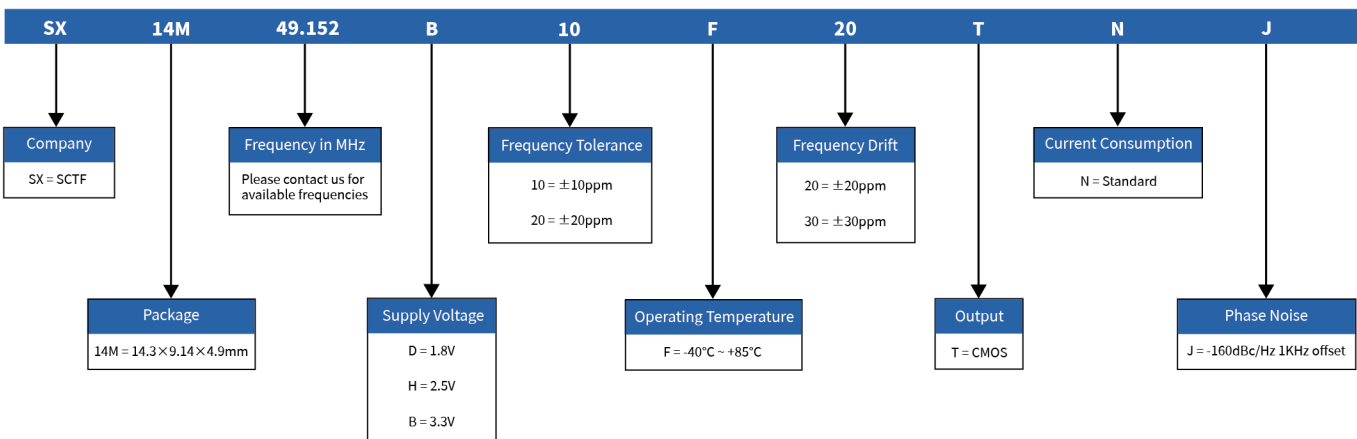


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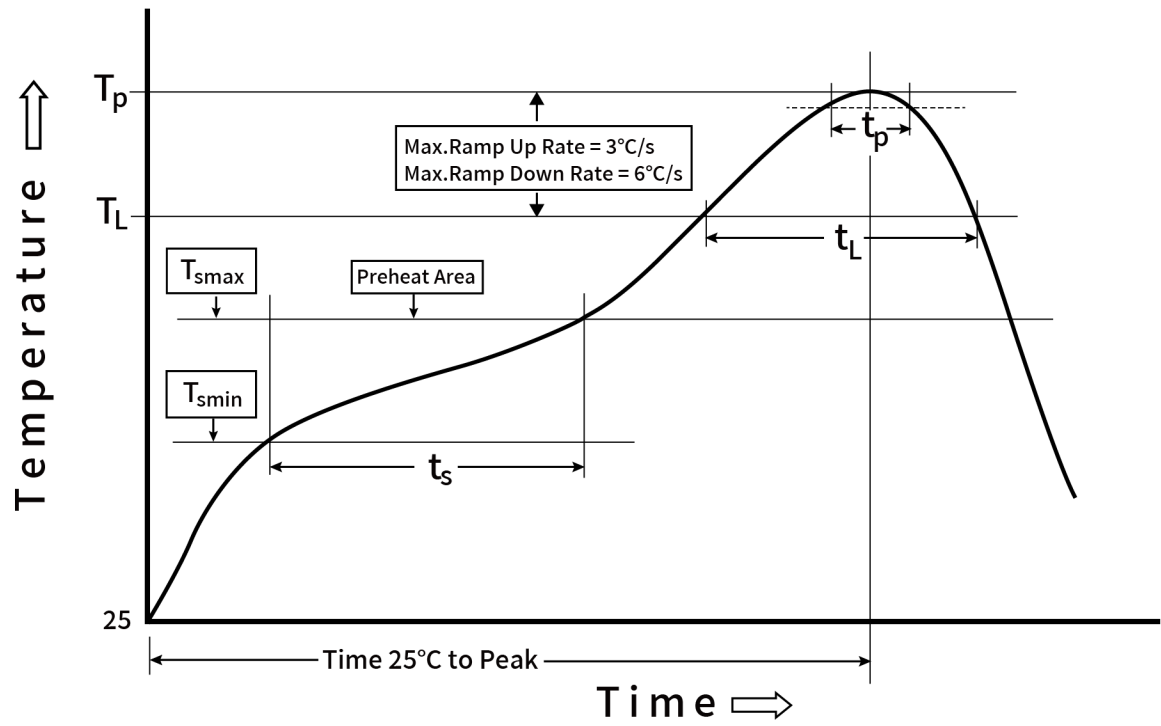
## Options and Part Identification



## List of available part numbers

| Part NO#              |                       |                      |                      |
|-----------------------|-----------------------|----------------------|----------------------|
| SX14M16.9344B10F20TNJ | SX14M22.5792B10F20TNJ | SX14M24.000B10F20TNJ | SX14M24.576B10F20TNJ |
| SX14M45.1584B10F20TNJ | SX14M49.152B10F20TNJ  | SX14M50.000B10F20TNJ |                      |

## Reflow Profile



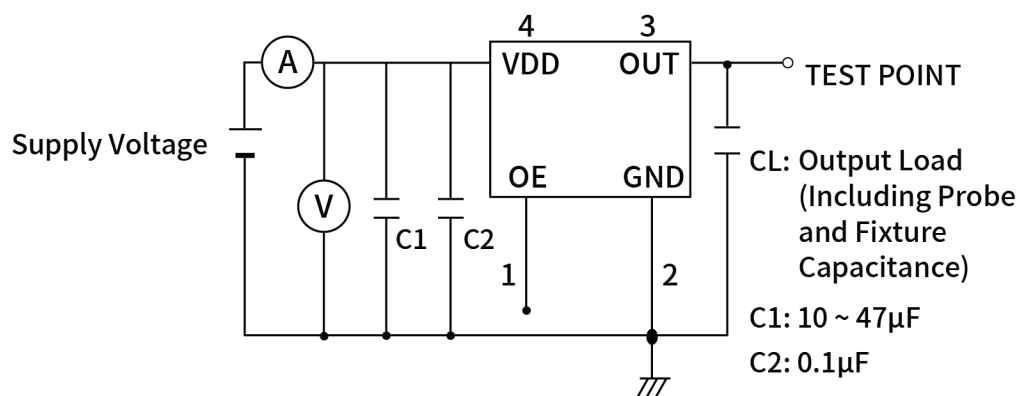
| Profile Feature                                                                                                                                                          | Sn - Pb Eutectic Assembly        | Preheat / Soak                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|
| Preheat / Soak <ul style="list-style-type: none"> <li>● Temperature Min ( Ts min )</li> <li>● Temperature Max ( Ts max )</li> <li>● Time ( Ts min to Ts max )</li> </ul> | 100°C<br>150°C<br>60-120 seconds | 150°C<br>200°C<br>60-120 seconds |
| Ramp - up rate ( TL to Tp )                                                                                                                                              | 3°C/ second max.                 | 3°C/ second max.                 |
| Time maintained above <ul style="list-style-type: none"> <li>● Liquidous temperature ( TL )</li> <li>● Time ( tL ) maintained above TL</li> </ul>                        | 183°C<br>60-150 seconds          | 217°C<br>60-150 seconds          |
| Peak package body temperature ( Tp )                                                                                                                                     | 235°C                            | 260°C                            |
| Time within 5° C of the specified classification temperature ( Tp )                                                                                                      | 20 seconds                       | 30 seconds                       |
| Ramp - down rate ( Tp to TL )                                                                                                                                            | 6°C/ second max.                 | 6°C/ second max.                 |
| Time 25° C to peak temperature                                                                                                                                           | 6 minutes max.                   | 8 minutes max.                   |
| <b>Suggest reflow times</b>                                                                                                                                              | <b>2 Times max.</b>              |                                  |

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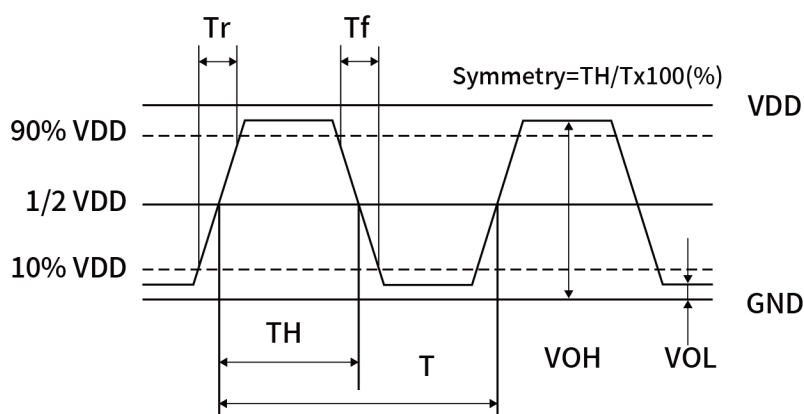
**SCTF**<sup>®</sup>

## Testing Circuit



Notes: PIN 1 connected to Vdd or floating, the product is working properly; connected to GND, stops working.

## Waveform Conditions



Waveform measurement system should have a min. bandwidth of 5 times the frequency being tested.

### Reliability Specification

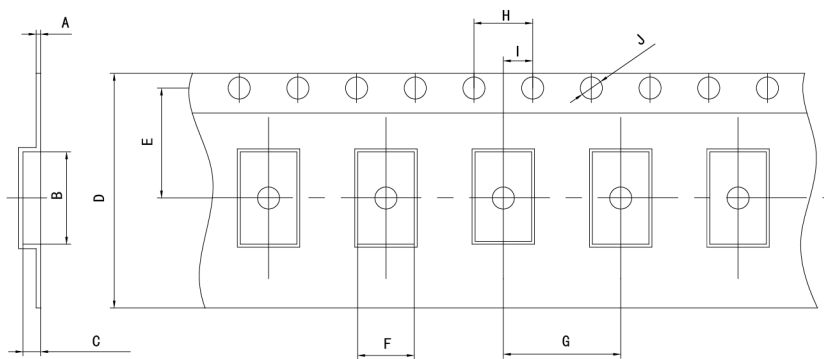
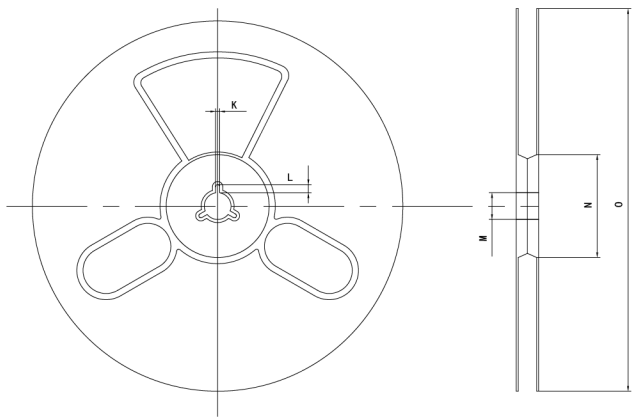
| NO. | Item                         | Conditions                                                                                                                                                          | Basis of Verdict                     |
|-----|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| 1   | Drop                         | High:100cm;Thickness:3cm;3 times.                                                                                                                                   | $\triangle FL \leq \pm 5 \text{ppm}$ |
| 2   | Vibration                    | Frequency:10~500HZ<br>speed:11min/cycle<br>Amplitude:1.5mm(10~55Hz)<br>acceleration rate:200m/s <sup>2</sup> (55~500Hz)<br>Direction:X,Y,Z                          | $\triangle FL \leq \pm 5 \text{ppm}$ |
| 3   | Low Temperature Storage      | Temp:-40°C $\pm$ 2°C;Times:96h                                                                                                                                      | $\triangle FL \leq \pm 5 \text{ppm}$ |
| 4   | High Temperature Storage     | Temp:125°C $\pm$ 2°C;Times:96h                                                                                                                                      | $\triangle FL \leq \pm 5 \text{ppm}$ |
| 5   | High Temp.&Humidity          | Temp:80°C $\pm$ 2°C;<br>Humidity:85% $\pm$ 5%;Times:1000h                                                                                                           | $\triangle FL \leq \pm 5 \text{ppm}$ |
| 6   | Thermal Shock                | -40°C $\pm$ 2°C (30min) $\longleftrightarrow$ 85°C $\pm$ 2°C (30min) ;<br>For 100 cycles                                                                            | $\triangle FL \leq \pm 5 \text{ppm}$ |
| 7   | Resistance to Soldering Heat | Keep 150 °C $\pm$ 5 °C 120s and then rose to 265 °C $\pm$ 5 °C for 10s,warming and holding time is less than the 200s, placed at room temperature 1 ~ 2h after test | $\triangle FL \leq \pm 5 \text{ppm}$ |
| 8   | Aging                        | Temp:85°C;Times:30days                                                                                                                                              | $\triangle FL \leq \pm 5 \text{ppm}$ |
| 9   | Soldering Test               | Dipping in solder bath at 245deg.C $\pm$ 5deg.C for 3 $\pm$ 0.5 sec.                                                                                                | Soldering tin rate greater than 95%  |

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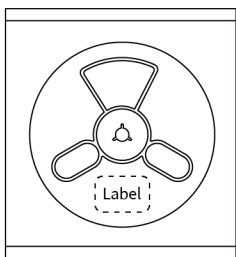
## Taping Specifications



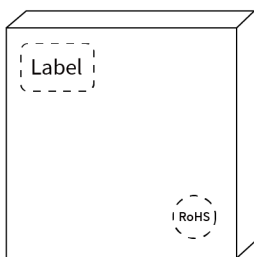
Pocket Tape Dimensions(mm)

| Series   | A    | B     | C    | D     | E     | F    | G     | H    | I    | J    | K    | L    | M     | N     | O      |
|----------|------|-------|------|-------|-------|------|-------|------|------|------|------|------|-------|-------|--------|
| SOMC-330 | 0.35 | 14.35 | 4.90 | 24.00 | 11.50 | 9.35 | 16.00 | 4.00 | 2.00 | 1.50 | 2.00 | 4.00 | 13.00 | 60.00 | 180.00 |

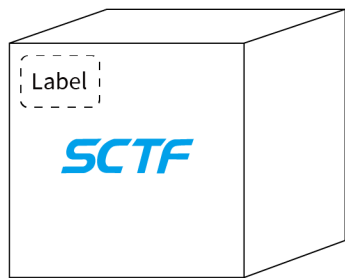
## Packaging specifications



■ 800 pcs/reel



■ 1 reel/box



■ 10 box/carton