

Low-Jitter Precision CMOS Oscillator for Automotive

Features

- Automotive AEC-Q100 Qualified
- Two Rise/Fall Time Options for EMI Reduction
- Low RMS Phase Jitter: <1 ps (typ.)
- High Stability: ± 20 ppm, ± 25 ppm, ± 50 ppm
- Wide Temperature Range:
 - Automotive Grade 1: -40°C to $+125^{\circ}\text{C}$
 - Automotive Grade 2: -40°C to $+105^{\circ}\text{C}$
 - Automotive Grade 3: -40°C to $+85^{\circ}\text{C}$
- High Supply Noise Rejection: -50 dBc
- Wide Freq. Range: 2.3 MHz to 170 MHz
- Small Industry Standard Footprints
 - 2.5 mm x 2.0 mm
 - 3.2 mm x 2.5 mm
 - 5.0 mm x 3.2 mm
- Excellent Shock and Vibration Immunity
 - Qualified to MIL-STD-883
- High Reliability
 - 20x Better MTF than Quartz Oscillators
- Low Current Consumption
- Supply Range of 2.25 to 3.63V
- Standby and Output Enable Function
- Lead-Free and RoHS Compliant

Applications

- Automotive Infotainment
- Automotive ADAS
- Automotive Camera Module
- Automotive LIDAR and RADAR

Benefits

- Replace High Temperature Crystals and Quartz Oscillators

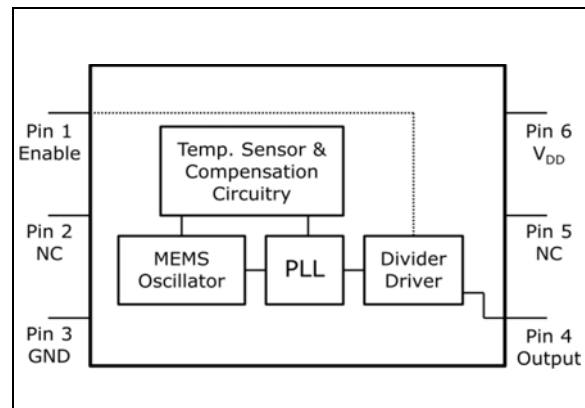
General Description

The DSA1101 and DSA1121 series of high performance oscillators utilize a proven silicon MEMS technology to provide excellent jitter and stability over a wide range of supply voltages and temperatures. By eliminating the need for quartz or SAW technology, MEMS oscillators significantly enhance reliability and accelerate product development, while meeting stringent clock performance criteria for a variety of communications, storage, and networking applications.

DSA1101 has a standby feature that allows it to completely power-down when EN pin is pulled low. For DSA1121, only the outputs are disabled when EN is low. Both oscillators are available in industry standard packages, including the small 2.5 mm x 2.0 mm, and are “drop-in” replacements for standard 4-pin and 6-pin CMOS quartz crystal oscillators.

The DSA1105/25 is functionally equivalent to the DSA1101/21, but it has lower drive strength for EMI reduction.

Functional Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

| | |
|----------------------------------|-----------------------------|
| Input Voltage, V_{IN} | -0.3V to V_{DD} +0.3V |
| Supply Voltage | -0.3V to + 4.0V |
| ESD Protection On All Pins | 4000V HBM, 1500V CDM (max.) |

† **Notice:** Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

TABLE 1-1: ELECTRICAL CHARACTERISTICS

| Parameter | Symbol | Min. | Typ. | Max. | Units | Conditions |
|--|------------|----------------------|------|---------------------|-------------------|--|
| Supply Voltage (Note 1) | V_{DD} | 2.25 | — | 3.63 | V | — |
| Supply Current | I_{DD} | — | — | 0.095 | mA | DSA1101/05, EN pin low. Output is disabled and device is in standby |
| | | — | 20 | 22 | | DSA1121/25, EN pin low, output is disabled |
| | | — | 21 | 35 | | EN pin high, output is enabled $C_L = 15\text{ pF}$, $F_O = 100\text{ MHz}$ |
| Frequency Stability (Including frequency variations due to initial tolerance, temp. and power supply voltage) | Δf | — | — | ± 20 | ppm | All temp ranges |
| | | — | — | ± 25 | | |
| | | — | — | ± 50 | | |
| Aging | Δf | — | — | ± 5 | ppm | 1 year @ 25°C |
| Startup Time (Note 2) | t_{SU} | — | — | 5 | ms | T = 25°C |
| Input Logic Levels | | | | | | |
| Input Logic High | V_{IH} | $0.75 \times V_{DD}$ | — | — | V | — |
| Input Logic Low | V_{IL} | — | — | $0.1 \times V_{DD}$ | V | — |
| Output Disable Time (Note 3) | t_{DS} | — | — | 5 | ns | — |
| Output Enable Time | t_{EN} | — | — | 5 | ms | DSA1101/05 |
| | | | | 20 | ns | DSA1121/25 |
| Enable Pull-Up Resistor (Note 4) | — | — | 40 | — | k Ω | Internally pulled-up |
| CMOS Output | | | | | | |
| Output Logic Level High | V_{OH} | $0.9 \times V_{DD}$ | — | — | V | I = $\pm 6\text{ mA}$ |
| Output Logic Level Low | V_{OL} | — | — | $0.1 \times V_{DD}$ | V | |
| Output Transition Rise Time | t_R | — | 1.1 | 2 | ns | DSA1101/21, 20% to 80%, $C_L = 15\text{ pF}$ |
| | | | 4 | 5 | | DSA1105/25, 20% to 80%, $C_L = 15\text{ pF}$ |
| Output Transition Fall Time | t_F | — | 1.3 | 2 | ns | DSA1101/21, 20% to 80%, $C_L = 15\text{ pF}$ |
| | | | 4.7 | 6 | | DSA1105/25, 20% to 80%, $C_L = 15\text{ pF}$ |
| Frequency | f_O | — | 2.3 | 170 | MHz | $C_L = 15\text{ pF}$ and -40°C to $+85^\circ\text{C}$ |
| | | | 3.3 | 170 | | $C_L = 15\text{ pF}$, -40°C to $+105^\circ\text{C}$ and -40°C to $+125^\circ\text{C}$ |
| Output Duty Cycle | SYM | 45 | — | 55 | % | — |
| Period Jitter | J_{PER} | — | 3 | — | ps _{RMS} | $F_{OUT} = 125\text{ MHz}$ |
| Integrated Phase Noise | J_{PH} | — | 0.3 | — | ps _{RMS} | 200 kHz to 20 MHz @ 125 MHz |
| | | | 0.38 | — | | 100 kHz to 20 MHz @ 125 MHz |
| | | | 1.7 | 2 | | 12 kHz to 20 MHz @ 125 MHz |

Note 1: Pin 6 V_{DD} should be filtered with 0.1 μF capacitor.

2: t_{SU} is time to 100 ppm of output frequency after V_{DD} is applied and outputs are enabled.

3: Output Waveform and Test Circuit figures define the parameters.

4: Output is enabled if pad is floated or not connected.

TEMPERATURE SPECIFICATIONS (Note 1)

| Parameters | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---------------------------------|----------------|------|------|------|-------|-------------------|
| Temperature Ranges | | | | | | |
| Operating Temperature Range (T) | T _A | -40 | — | +85 | °C | Ordering Option I |
| | T _A | -40 | — | +105 | °C | Ordering Option L |
| | T _A | -40 | — | +125 | °C | Ordering Option A |
| Junction Operating Temperature | T _J | — | — | +150 | °C | — |
| Storage Temperature Range | T _A | -40 | — | +150 | °C | — |
| Soldering Temperature Range | T _S | — | — | +260 | °C | Soldering, 40s |

Note 1: The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air (i.e., T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature to exceed the maximum +150°C rating. Sustained junction temperatures above +150°C can impact the device reliability.

2.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in [Table 2-1](#).

TABLE 2-1: DSA1101/21/05/25 PIN FUNCTION TABLE

| Pin Number 5x3.2 | Pin Number 3.2x2.5 | Pin Number 2x2.5 | Pin Name | Description |
|---------------------|-----------------------|---------------------|----------|-----------------|
| 1 | 1 | 1 | EN | Enable. |
| 2 | 2 | 2 | NC | Do not connect. |
| 3 | 3 | 3 | GND | Ground. |
| 4 | 4 | 4 | OUT | Output. |
| 5 | 5 | 5 | NC | Do not connect. |
| 6 | 6 | 6 | VDD | Supply voltage. |

TABLE 2-2: OUTPUT ENABLE MODES

| EN Pin | DSA1101/05 | DSA1121/25 |
|--------|---------------|-----------------|
| High | Output Active | Output Active |
| NC | Output Active | Output Active |
| Low | Standby | Output Disabled |

3.0 NOMINAL PERFORMANCE CHARACTERISTICS

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

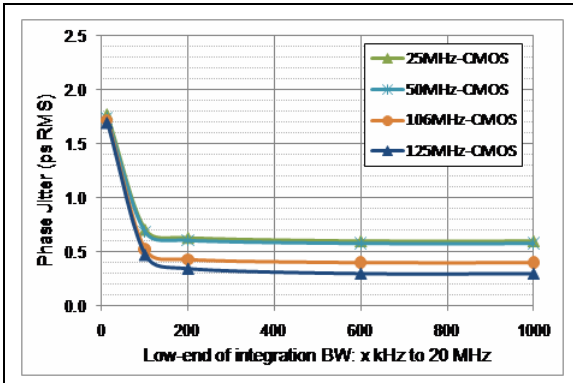


FIGURE 3-1: Phase Jitter (Integrated Phase Noise).

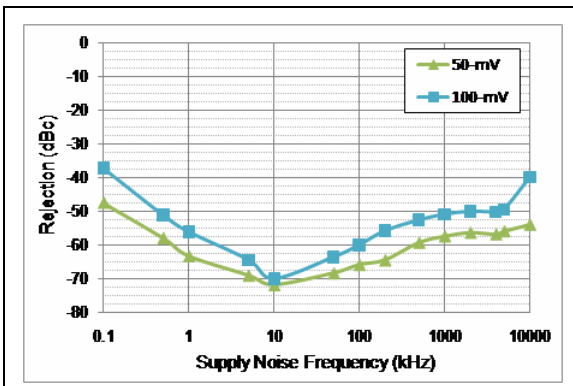


FIGURE 3-2: Power Supply Rejection Ratio.

4.0 OUTPUT WAVEFORM

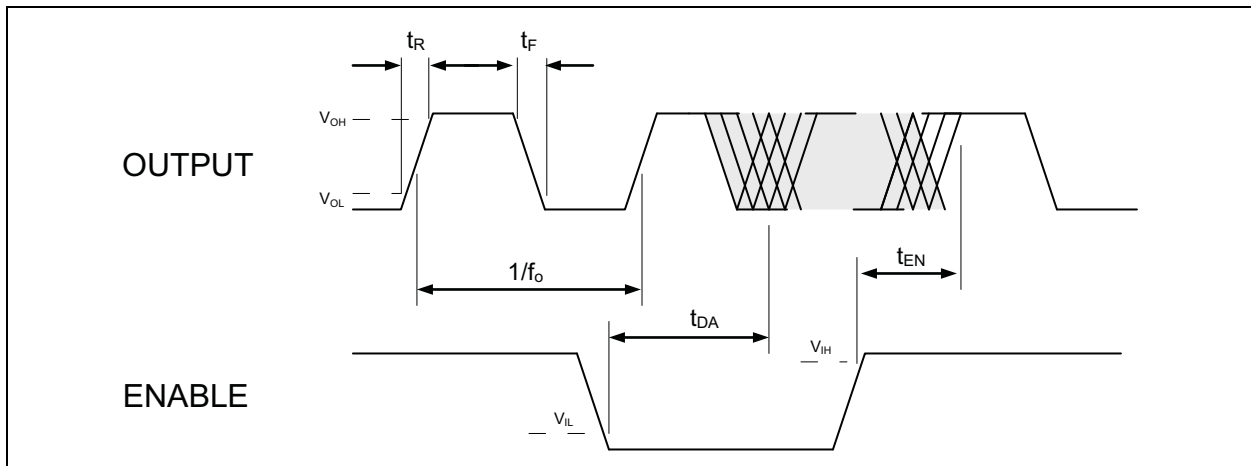


FIGURE 4-1: DSA1101/21/05/25 Output Waveform.

5.0 TYPICAL TERMINATION SCHEME

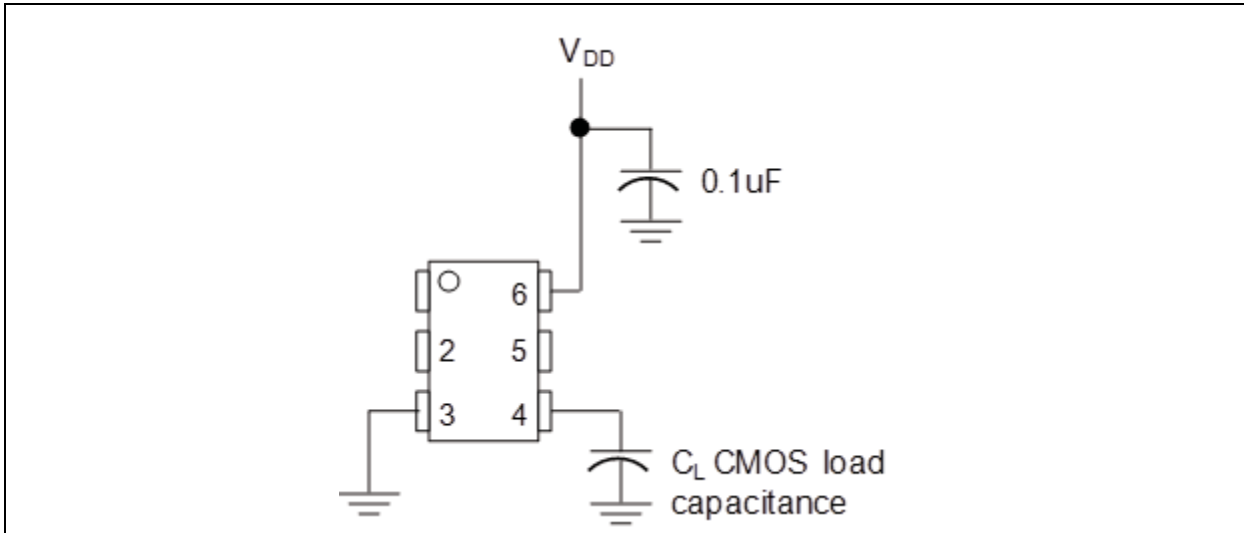


FIGURE 5-1: Typical Termination Scheme for DSA1101/21/05/25.

6.0 BOARD LAYOUT (RECOMMENDED)

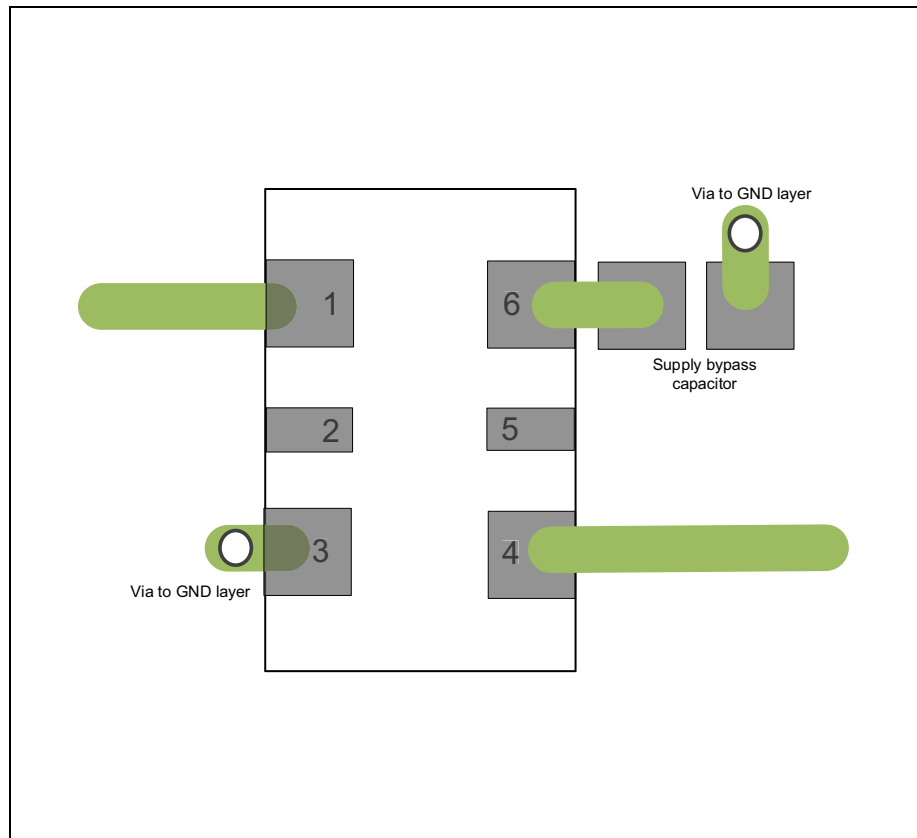


FIGURE 6-1: DSA1101/21/05/25 Recommended Board Layout.

7.0 SOLDER REFLOW PROFILE

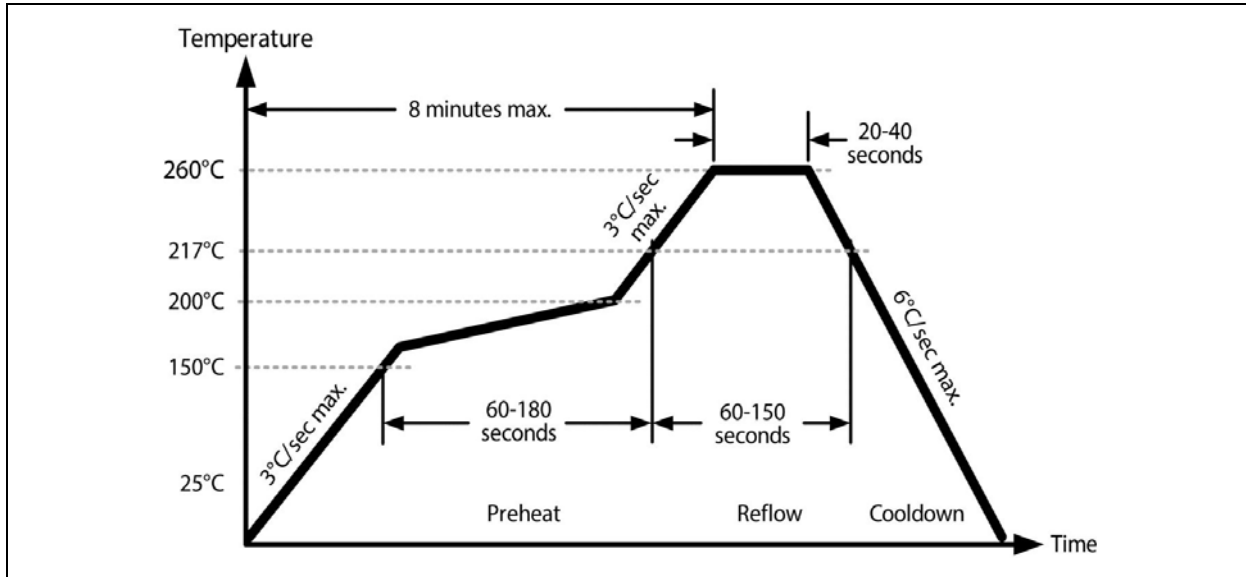


FIGURE 7-1: Solder Reflow Profile.

TABLE 7-1: SOLDER REFLOW

| MSL 1 @ 260°C Refer to JSTD-020C | |
|------------------------------------|----------------|
| Ramp-Up Rate (200°C to Peak Temp.) | 3°C/sec. max. |
| Preheat Time 150°C to 200°C | 60 to 180 sec. |
| Time Maintained above 217°C | 60 to 150 sec. |
| Peak Temperature | 255°C to 260°C |
| Time within 5°C of Actual Peak | 20 to 40 sec. |
| Ramp-Down Rate | 6°C/sec. max. |
| Time 25°C to Peak Temperature | 8 minutes max. |

8.0 PACKAGING INFORMATION

8.1 Package Marking Information

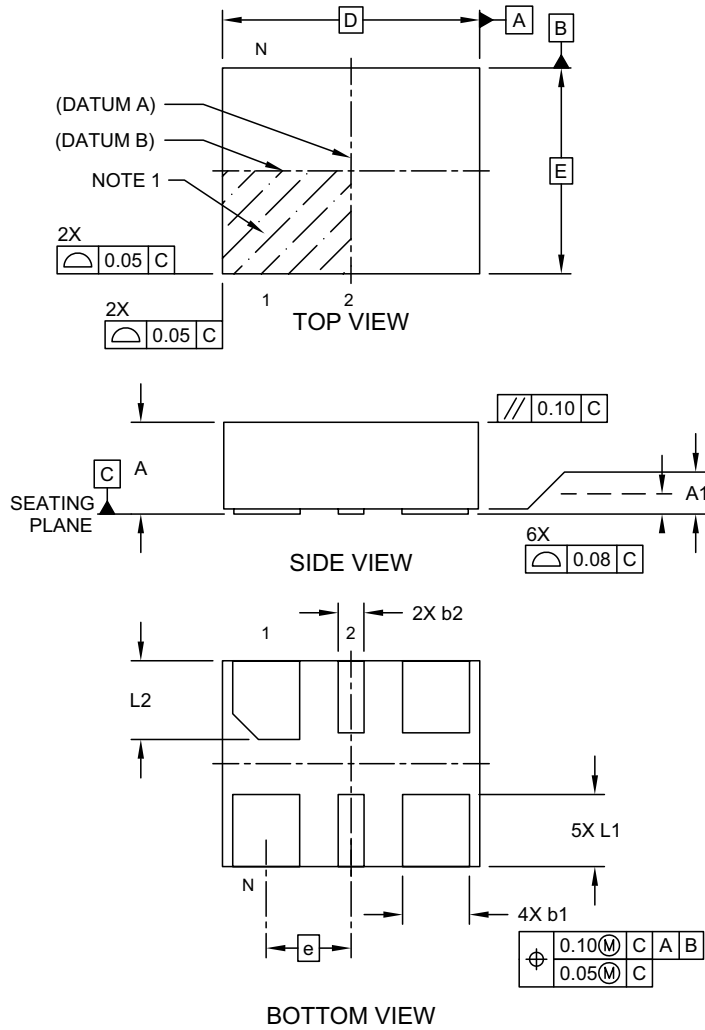


| | |
|--|---|
| <p>Legend:</p> <p>XX...X Product code, customer-specific information, or frequency in MHz without printed decimal point</p> <p>Y Year code (last digit of calendar year)</p> <p>YY Year code (last 2 digits of calendar year)</p> <p>WW Week code (week of January 1 is week '01')</p> <p>NNN Alphanumeric traceability code</p> <p>(e3) Pb-free JEDEC® designator for Matte Tin (Sn)</p> <p>* This package is Pb-free. The Pb-free JEDEC designator (e3) can be found on the outer packaging for this package.</p> <p>●, ▲, ▼ Pin one index is identified by a dot, delta up, or delta down (triangle mark).</p> | <p>Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.</p> <p>Underbar (_) and/or Overbar (¯) symbol may not be to scale.</p> |
|--|---|

6-Lead VDFN 2.5 mm x 2.0 mm Package Outline and Recommended Land Pattern

6-Lead Very Thin Dual Flatpack No-Leads (J7A) - 2.5x2.0 mm Body [VDFN]

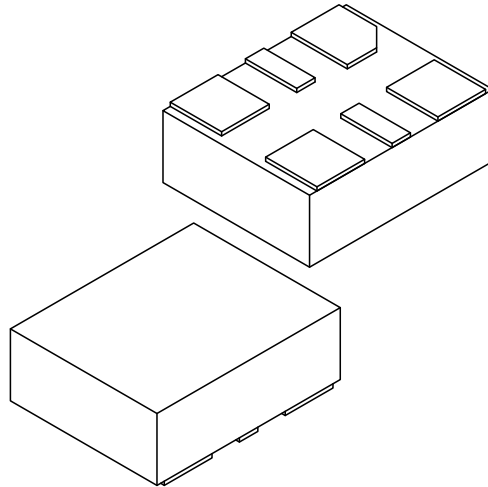
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-1005A Sheet 1 of 2

6-Lead Very Thin Dual Flatpack No-Leads (J7A) - 2.5x2.0 mm Body [VDFN]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



| Dimension Limits | Units | MILLIMETERS | | |
|---------------------|-------|-------------|-------|-------|
| | | MIN | NOM | MAX |
| Number of Terminals | N | 6 | | |
| Pitch | e | 0.825 BSC | | |
| Overall Height | A | 0.80 | 0.85 | 0.90 |
| Standoff | A1 | 0.00 | 0.02 | 0.05 |
| Overall Length | D | 2.50 BSC | | |
| Overall Width | E | 2.00 BSC | | |
| Terminal Width | b1 | 0.60 | 0.65 | 0.70 |
| Terminal Width | b2 | 0.20 | 0.25 | 0.30 |
| Terminal Length | L1 | 0.60 | 0.70 | 0.80 |
| Terminal Length | L2 | 0.665 | 0.765 | 0.865 |

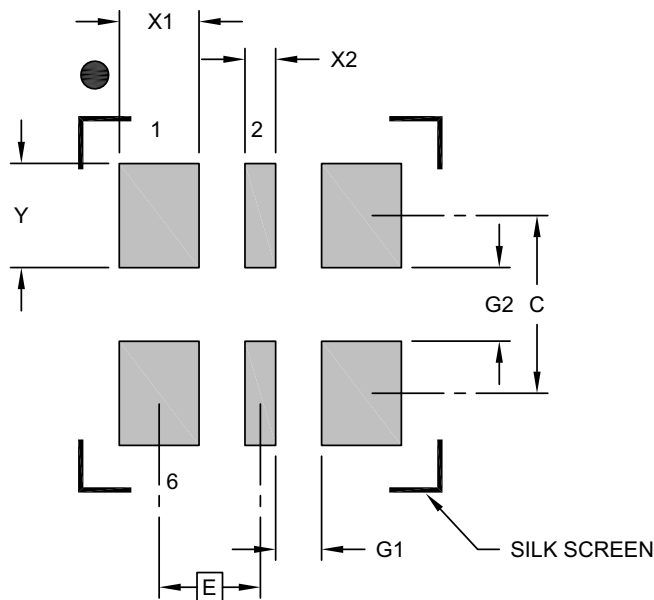
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package is saw singulated
3. Dimensioning and tolerancing per ASME Y14.5M
 - BSC: Basic Dimension. Theoretically exact value shown without tolerances.
 - REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1005A Sheet 2 of 2

6-Lead Very Thin Dual Flatpack No-Leads (J7A) - 2.5x2.0 mm Body [VDFN]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



RECOMMENDED LAND PATTERN

| Dimension Limits | Units | MILLIMETERS | | |
|-----------------------------|-------|-------------|------|------|
| | | MIN | NOM | MAX |
| Contact Pitch | E | 0.825 BSC | | |
| Contact Pad Width (X4) | X1 | | | 0.65 |
| Contact Pad Width (X2) | X2 | | | 0.25 |
| Contact Pad Length (X6) | Y | | | 0.85 |
| Contact Pad Spacing | C | | 1.45 | |
| Space Between Contacts (X4) | G1 | 0.38 | | |
| Space Between Contacts (X3) | G2 | 0.60 | | |

Notes:

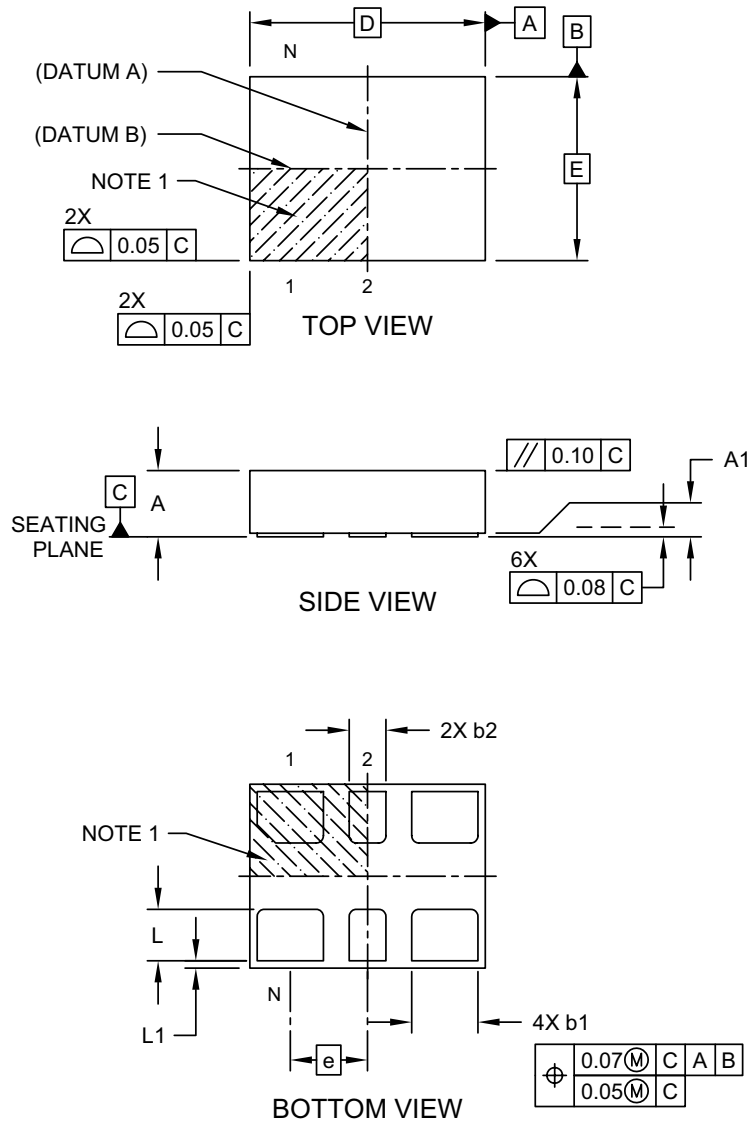
- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-3005A

6-Lead VDFN 3.2 mm x 2.5 mm Package Outline and Recommended Land Pattern

6-Lead Very Thin Plastic Dual Flatpack No-Lead (H5A) - 3.2x2.5 mm Body [VDFN]

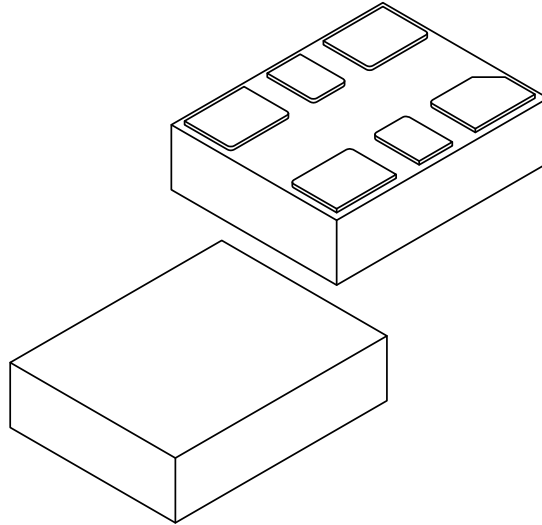
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-1007A Sheet 1 of 2

6-Lead Very Thin Plastic Dual Flatpack No-Lead (H5A) - 3.2x2.5 mm Body [VDFN]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



| Units | | MILLIMETERS | | |
|---------------------|----|-------------|------|------|
| Dimension Limits | | MIN | NOM | MAX |
| Number of Terminals | N | 6 | | |
| Pitch | e | 1.05 BSC | | |
| Overall Height | A | 0.80 | 0.85 | 0.90 |
| Standoff | A1 | 0.00 | 0.02 | 0.05 |
| Overall Length | D | 3.20 BSC | | |
| Overall Width | E | 2.50 BSC | | |
| Terminal Width | b1 | 0.85 | 0.90 | 0.95 |
| Terminal Width | b2 | 0.45 | 0.50 | 0.55 |
| Terminal Length | L | 0.65 | 0.70 | 0.75 |
| Terminal Pullback | L1 | 0.10 REF | | |

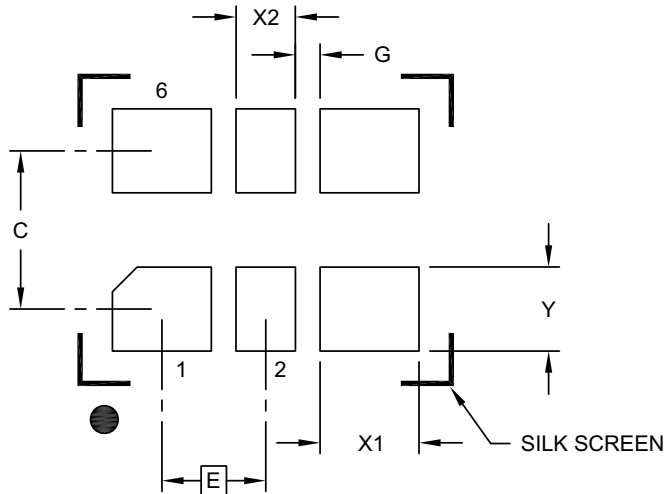
Notes:

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Package is saw singulated
- Dimensioning and tolerancing per ASME Y14.5M
 - BSC: Basic Dimension. Theoretically exact value shown without tolerances.
 - REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1007A Sheet 2 of 2

6-Lead Very Thin Plastic Dual Flatpack No-Lead (H5A) - 3.2x2.5 mm Body [VDFN]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



RECOMMENDED LAND PATTERN

| Dimension Limits | Units | MILLIMETERS | | |
|-----------------------------|-------|-------------|------|------|
| | | MIN | NOM | MAX |
| Contact Pitch | E | 1.05 BSC | | |
| Contact Pad Spacing | C | | 1.60 | |
| Contact Pad Width (X4) | X1 | | | 1.00 |
| Contact Pad Width (X2) | X2 | | | 0.60 |
| Contact Pad Length (X6) | Y | | | 0.85 |
| Space Between Contacts (X4) | G1 | 0.25 | | |

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

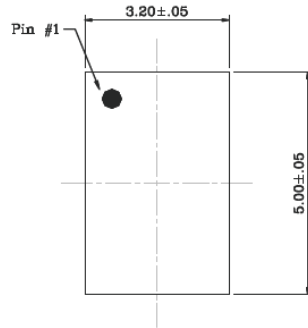
Microchip Technology Drawing C04-3007A

6-Lead CDFN 5.0 mm x 3.2 mm Package Outline and Recommended Land Pattern

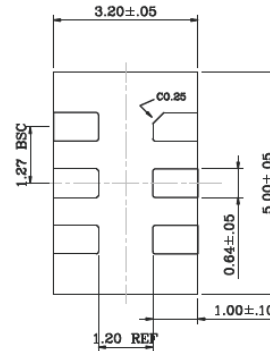
TITLE

6 LEAD CDFN 5.0x3.2mm COL PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

| DRAWING # | CDFN5032-6LD-PL-1 | UNIT | MM |
|-----------|-------------------|------|----|
|-----------|-------------------|------|----|



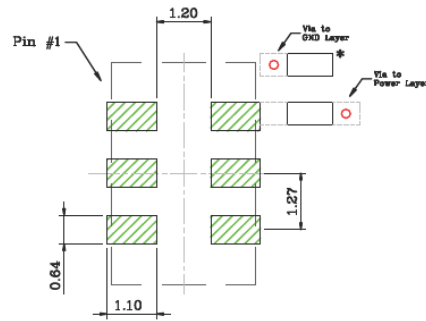
Top View



Bottom View



Side View



Recommended Land Pattern

NOTE:

- * Power Supply Decoupling Capacitor is required in Recommended Land Pattern.
- Green shaded rectangles in Recommended Land Pattern are solder stencil opening.
- Red circles in Recommended Land Pattern are thermal VIA.

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>.

APPENDIX A: REVISION HISTORY

Revision A (March 2018)

- Initial release of DSA1101/21/05/25 as Microchip data sheet DS20005890B.

Revision B (May 2018)

- Typographical errors were changed in the last paragraph of the General Description and in the CMOS Output section of the Electrical Characteristics Table under the Conditions column that corrects the part numbers from DSC1105/25 and DSC1101/21 to DSA1105/25 and DSA1101/21.
- Added the Automotive Suffix to the Product Identification System.

NOTES:

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

| PART NO. | X | X | X | -XXX.XXXX | X | VXX |
|--|---------|-------------|-----------|-----------|----------------|-------------------|
| Device | Package | Temp. Range | Stability | Frequency | Packing Option | Automotive Suffix |
| <p>Device: DSA1101/21: Low-Power Precision CMOS Oscillator for Automotive with Standby DSA1105/25: Low-Power Precision CMOS Oscillator for Automotive</p> <p>Package: B = 6-Lead 5.0 mm x 3.2 mm CDFN C = 6-Lead 3.2 mm x 2.5 mm VDFN D = 6-Lead 2.5 mm x 2.0 mm VDFN</p> <p>Temperature Range: I = -40°C to +85°C (Grade 3) L = -40°C to +105°C (Grade 2) A = -40°C to +125°C (Grade 1)</p> <p>Stability: 1 = ±50 ppm 2 = ±25 ppm 3 = ±20 ppm</p> <p>Frequency: xxx.xxxx = 2.3 MHz to 170 MHz (user-defined)</p> <p>Packing Option: <blank> = 110/Tube T = 1,000/Reel</p> <p>Automotive Suffix: Vxx = Automotive Suffix in which "xx" is assigned by Microchip</p> | | | | | | |
| <p>Please use the Microchip Clockworks to check AEC-Q100 compliance status and build the exact part number.</p> | | | | | | |
| <p>Examples:</p> <p>a) DSA1101CL3-030.0000VAO: Low-Power Precision CMOS Oscillator for Automotive with Standby, 6-LD 3.2x2.5 VDFN, Grade 2 Temperature Range, ±20 ppm, 30 MHz Output Frequency, 110/Tube, Automotive Suffix</p> <p>b) DSA1121DI1-075.0000TVAO: Low-Power Precision CMOS Oscillator for Automotive with Standby, 6-LD 2.5x2.0 VDFN, Grade 3 Temperature Range, ±50 ppm, 75 MHz Output Frequency, 1,000/Reel, Automotive Suffix</p> <p>c) DSA1105BL2-027.0000VAO: Low-Power Precision CMOS Oscillator for Automotive, 6-LD 5.0x3.2 CDFN, Grade 2 Temperature Range, ±25 ppm, 27 MHz Output Frequency, 110/Tube, Automotive Suffix</p> <p>d) DSA1125CA3-033.0000TVAO: Low-Power Precision CMOS Oscillator for Automotive, 6-LD 3.2x2.5 VDFN, Grade 1 Temperature Range, ±20 ppm, 33 MHz Output Frequency, 1000/Reel, Automotive Suffix</p> | | | | | | |
| <p>Note 1: Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.</p> | | | | | | |

NOTES:

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